GENESYS AEROSYSTEMS
a Moog Company

IDU-680 EFIS Software Version 9.0B (Fixed Wing)

Pilot Operating Guide and Reference

(Fixed Wing)

EFIS Software Version 9.0B

Document 64-000099-090B

This pilot guide must be carried in the aircraft and made available to the pilot at all times. It can only be used in conjunction with the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM). Refer to the applicable AFM or Aircraft Flight Manual Supplement (AFMS) for aircraft specific information, such as unique ground tests, limitations, and emergency procedures.

Cover Image: Turnagain Arm, Anchorage, Alaska

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Revision Record

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Section 1 Introduction

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 maneuvers. Instead of overloading the pilot with information and options, the Genesys Aerosystems EFIS presents only necessary information to reduce workload, decrease task complexity, and minimize confusion, which results in safer flying with less stress and fatigue.

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 USB memory 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 USB drive must be inserted before power-up.

1.3. About This Guide

The operation of the Genesys Aerosystems EFIS is described in detail and divided into sections as follows:

TABLE OF CONTENTS: Locate areas by topic

INTRODUCTION (Section 1): Basic explanation of the pilot guide.

SYSTEM OVERVIEW (Section 2): Description of system and hardware; IDU behavior during initialization, warning alerts, time-critical warning alerts, master visual and aural alerts, caution alerts, and advisory alerts with conditions; coloring conventions; abbreviations and acronyms; and database update procedures.

DISPLAY SYMBOLOGY (Section 3): Identification of each screen element of the primary flight display (PFD) and multi-function display (MFD), and explanation of symbology.

REVERSIONARY MODES (Section 4): Views of displays with various sensor failed conditions and resulting symbology, as well as examples of various configurations and display formats used with specific tables showing affected functions. Explanation of what to expect when a particular sensor fails and what changes on the display immediately or after a specified amount of time.

MENU FUNCTIONS AND STEP-BY-STEP PROCEDURES (Section 5): Menu structure of each feature and step-by-step procedures for each task. Basic description of all knob and button functions with menu definitions.

QUICK START TUTORIAL (Section 6): Basics necessary for flying a flight with this system. Includes simple steps to manage displays for existing flight conditions to quickly gain familiarity with where to locate controls to manipulate the system for each operation.

IFR PROCEDURES (Section 7): Detailed information and instruction about selecting and flying instrument procedures with examples of the most popular published procedures. Includes descriptions of a selection of departure, published instrument approach, standard terminal arrival procedures, and how the active flight plan quickly reflects changes to ATC clearances.

TERRAIN AWARENESS WARNING SYSTEM (Section 8): Description of the TAWS (all classes) functionality for this fixed-wing aircraft with all configurations. Defines the various parameters, which automatically apply to each mode of flight.

APPENDIX (Section 9): Contains support material and other helpful information about system operation, guidance from Jeppesen, and supplemental information such as flight planning; magnetic vs. true north modes; airspeed/altitude miscompare thresholds; VFR Flight planning; and downloading/uploading routes and user waypoints.

APPENDICES: Traffic, Remote Bugs Panel, WX-500 Lightning Strikes, Datalink, Video, Weather Radar, Round Dials, Search and Rescue Patterns, and Electronic Circuit Breaker Unit. Sections on equipment and features not installed in every aircraft may be removed at the discretion of the end-user.

INDEX: Alphabetical listing of terms or keywords with corresponding page numbers.

GLOSSARY: Alphabetical listing of definitions for terms.

Section 2 System Overview

2.1. Abbreviations and Acronyms

µm Hg	Micrometer of Mercury
0R	No Radius
3D	Three-Dimensional
AC	Advisory Circular
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
ALT SEL	Altitude Selection
AMLCD	Active Matrix Liquid Crystal Display
ANP	Actual Navigation Performance
ANT	Antenna
AOA	Angle of Attack
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
AS	SAE Aerospace Standard

ASEL	Aircraft Selected Altitude
ATC	Air Traffic Control
ATT	Attitude
Baro	Barometric setting
Baro-VNAV	Barometric Vertical Navigation
BC	Backcourse navigation
BFO	Beat Frequency Oscillator
BIT	Built-in-test
B-RNAV	European Basic RNAV
BRT	Brightness
BTM	Bottom
C	Celsius
CA	Course to Altitude (ARINC-424 Leg)
CALC	as in RAIM (R2)
CAS	Crew Alerting System
CD	Course to DME Distance (ARINC-424 Leg)
CCW	Counter Clockwise
CDA	Continuous Descent Approach
CDI	Course Deviation Indicator
CF	Course to Fix (ARINC-424 Leg)
CI	Course to Intercept (ARINC-424 Leg)
CLR	Clear
CNX	Cancel
COM	Communication
CONT	Continue
CPLT	Co-Pilot
CPM	Computer Processor Module
CPU	Central Processing Unit
CR	Course to Radial Termination (ARINC-424 Leg)
CRC	Cyclic Redundancy Check
CRS	Course
CSA	Conflict Situation Awareness (ADS-B)
CTRST	Contrast
CW	Clockwise

DA	Decision Altitude
dB	Decibel
dB/dBZ	Decibel (dB) relative to radar reflectivity (Z)
DCLTR	Declutter
DCND	Descend
DEC HT	Decision Height Bug
DEL	Delete
DESIG	Designate
DF	Direct to Fix (ARINC-424 Leg)
DFCS	Digital Flight Control System
DFLT	Default
DG	Directional Gyro
DH	Decision Height
DLNK	Datalink
DME	Distance Measuring Equipment
DO	RTCA Document
DOD	Department of Defense
DP	Departure Procedure
DR	Dead Reckoning
DTG	Distance to Go
ECBU	Electronic Circuit Breaker Unit
EFIS	Electronic Flight Instrument System
EGM	Earth Gravity Model
EGNOS	European Geostationary Navigation Overlay Service
EGPWS	Enhanced Ground Proximity Warning System
EQPMNT	Equipment
ESSNTL	Essential
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
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)
FC	Course Fix to along Track Distance (ARINC-424 Leg)
FD	Course from a Fix to DME Distance (ARINC-424 Leg); Flight Director
FDE	Fault Detection and Exclusion
FG	Fixed Gear
FG + F	Fixed Gear with Defined Landing Flaps Position
FIS	Flight Information Service
FIS-B	Flight Information Service-Broadcast
FL	Flight Level
FLTA	Forward Looking Terrain Awareness
FM	Course from Fix to Manual termination (ARINC-424 Leg)
FMS	Flight Management System
FOV	Field of View
FPAP	Flight Path Alignment Point
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	GNSS 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
GNSS	Global Navigation Satellite System
GPI	Glide Path Intercept
GPIP	Glide Path Intercept Point
GPS	Global Positioning System
GPSV	Global Positioning System Vertical Navigation
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
HAT	Height Above Threshold
HDG	Heading
HFOM	Horizontal Figure of Merit
hh:mm:ss	Hours: Minutes: Seconds
HITS	Highway in the Sky
HLTH	Health
HORIZ	Horizontal
HOTAS	Hands on Throttle and Stick
hPa	Hectopascal
HPL	Horizontal Protection Level
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
KTAS	Knots True Airspeed
LAT	Latitude
lbs	Pounds
LCD	Liquid Crystal Display
LCL	Local
LDA	Localizer-type Directional Aid
LED	Light Emitting Diode
LGND	Legend
LIFR	Low IFR conditions (Ceiling < 100’ or visibility < 1 mile)
LIN	Linear
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 (same as MAHP)
MAN	Manual
MAP	Missed Approach Point; Missed Approach Procedure
MASPS	Minimum Aviation System Performance Standard
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
MOT	Mark On Target
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
nT	Nanoteslas (ref. World magnetic Model)
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
PI	Procedure Turn (ARINC-424 Leg)
PLI	Pitch Limit Indicator
PLT	Pilot
PM	Personality Module
PN	Part Number, Pan
PPOS	Present Position
PROC	Procedure
PRN	Pseudo-Random-Noise (Satellite communications)
PRS	Press
PRV	Previous
PSH	Push
PTK	Parallel offset (Parallel Track)
PTRS	Pointers
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
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 AR-APCH	RNP approach procedure that requires special aircraft and aircrew authorization.
RTC	Required Terrain clearance
RTCA	Radio Technical Commission for Aeronautics
RTD	Resistive Thermal Detector
RW	Runway
SAE	Society of Automotive Engineers
SAR	Search and Rescue
SAT	Saturation
SATLT	Satellite
SBAS	Satellite-Based Augmentation System
SCC	System Configuration Card (personality module)
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 (Tapes configuration in PFI area)
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
TF	Track to a Fix; Track from Fix to New Fix (ARINC-424 Leg)
TFR	Temporary Flight Restriction
TGT	Target
TIS	Traffic Information Service
TIS-B	Traffic information Service-Broadcast
TOAC	Time Of Arrival Control
TLT	Tilt (WX-RDR)
TRANS	Transition
TRK	Track
TRNDO	Tornadic
TSO	Technical Standard Order
TTA	Time to Alert
TTG	Time to Go
TURB	Turbulence

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
VD	Heading to DME Distance (ARINC-424 Leg)
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
VR	Heading to Radial Termination (ARINC-424 Leg)
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
WGS84	World Geodetic System 1984
WOG	Weight on Ground
WOW	Weight on Wheels
WPT	Waypoint
WX	Weather
WXA	Weather-alert (RDR-2100)
XFILL	Crossfill

2.2. System Overview

The IDU-680 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, only has 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 2-1: 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
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."

Table 2-2 describes the EFIS limits set for all screen captured views for this pilot guide development except where different settings are noted.

Table 2-2: Pertinent EFIS Limits Settings

Category	Setting
Screen Position Settings:	
Screen Number	#1 or #2 as specified
Aircraft Type	Generic
Speed Settings:	
Airspeed Scale Type	FAR 23.1545 with V_{MO}/M_{MO} (or V_{NE} where depicted)
Airspeed Units	Knots
Pilot-side analog configuration	Tapes
Digital configuration	Rolling (or Pure Digital where depicted)
Optional Sensor Settings:	
Datalink Receiver	ADS-B
TAWS Type	Class A (RG + Flaps)
Traffic Sensor	ADS-B (or as depicted)
WX-500 (STRIKES)	Installed
SAR Patterns	Enabled
NAV Preview	Disabled
ADF Navigation	Disabled
TACAN Navigation	Disabled
Aircraft S/N	GENESYS
Airframe Settings:	
External Lights on Critical Alerts	Enabled
Always show CAS in ESSENTIAL Mode	Enabled
Glide Ratio	10
Landing Gear Configuration	Retractable
Temperature Units	°C
Same *** CAS Caution Enable	Disabled (If enabled "CAUTIONS")
Mach Display enable	Enabled
Map Knob Rotation	CW increase Range (MAPs/WX RDR)
Maximum AGL Display	2500'
Minimum Obstacle Height	50'
PLI Display	Enabled

Table 2-2: Pertinent EFIS Limits Settings	
Category	**Setting**
Roll Indicator Type	Sky Pointer
Slip-Skid Display	Enabled
Minimum Runway length	2500’
Positive G-Limit	6.0
Negative G-Limit	-4.0
Show Full MFD Status	Enabled
Show MFD Density Alt	Enabled
Show MFD IS Tem Deviation	Enabled
Show MFD True Airspeed	Enabled
Autopilot Settings:	
Autopilot Type	Analog
Flight Director	Enabled
Flight Director on Side-in-Command	Disabled
Minimum IAS Bug	60
Basic Sensor Settings:	
Remote Tuning	Cobham CD/Honeywell…
ADF System	Dual
ADC System	Dual
Baro Autosetting on Startup	Enabled
Synch pilot/Copilot Baro	Disabled
AHRS System	Dual
Analog interface unit	Not Installed
DME System	Dual HW KDM706A
EFIS System	Dual (Pilot-Side defaults to #1 Sensors)
Cockpit Arrangement	Side-by-Side
Pilot Position	Left
GPS System	Dual
Radar Altimeter	Dual
Dual DH	Disabled
Baro Agl	Enabled
VOR System	Dual
TACAN System	Dual
VIDEO Input Settings:	
VIDEO-1 Force NTSC	Label= FLIR
VIDEO-2 Force NTSC	Label= TAC MAP
DVI Button Label	To DVI
Weather Radar Settings:	
WX RDR Enable Screen #1	Enabled
WX RDR Enable Screen#2	Enabled
WX RDR Enable Screen#3	Disabled
WX RDR Enable Screen #4	Disabled

Table 2-2: Pertinent EFIS Limits Settings	
Category	**Setting**
WX RDR Type External Radar Control Panel Radar Scan Width	Honeywell RDR-2100 Not Installed 120° (± 60°)
Discrete Input Settings: GPI# 1 GPI# 2 GPI# 3 GPI# 4 GPI# 5 AIU# 3	 All Landing Gear Down TAWS Landing Flaps TAWS Glideslope Inhibit TAWS Inhibit No Function Weight On Ground/Wheels
Aircraft Fuel Settings: Fuel Totalizer Fuel Tank Count Fuel Flow Count Unmonitored Fuel Volume Units Aircraft Total Fuel QTY Aircraft Main Fuel Quantity Totalizer Fuel Increments Aircraft low Fuel Caution Aircraft Low Fuel Alarm Wing Tank Split Caution Totalizer Mismatch Caution Fuel Tank #1 Settings: Tank Type Fuel Tank QTY Fuel Tank Caution Fuel Tank Alarm Fuel Tank #2 Settings: Tank Type Fuel Tank QTY Fuel Tank Caution Fuel Tank Alarm	 Enabled 2 2 N/A Lbs. (Jet Fuel) 2000 1000 50 200 100 Disabled Disabled Left Wing Tank 1000 LBS 200 LBS 100 LBS Right Wing Tank 1000 LBS 200 LBS 100 LBS

In an IFR installation, the primary IDU-680 is configured so only the primary flight information (PFI) in top area and multi-function display (MFD) page in bottom area are displayed.

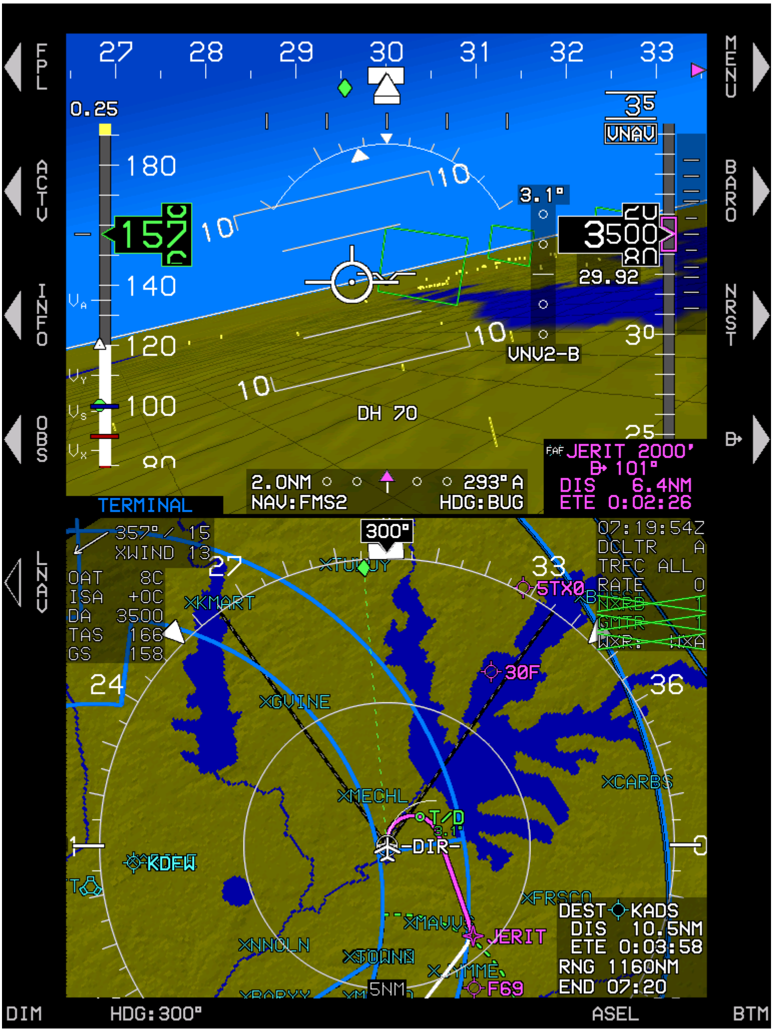


Figure 2-1: IDU-680 Primary Flight Display (PFD) with PFI and Map Page

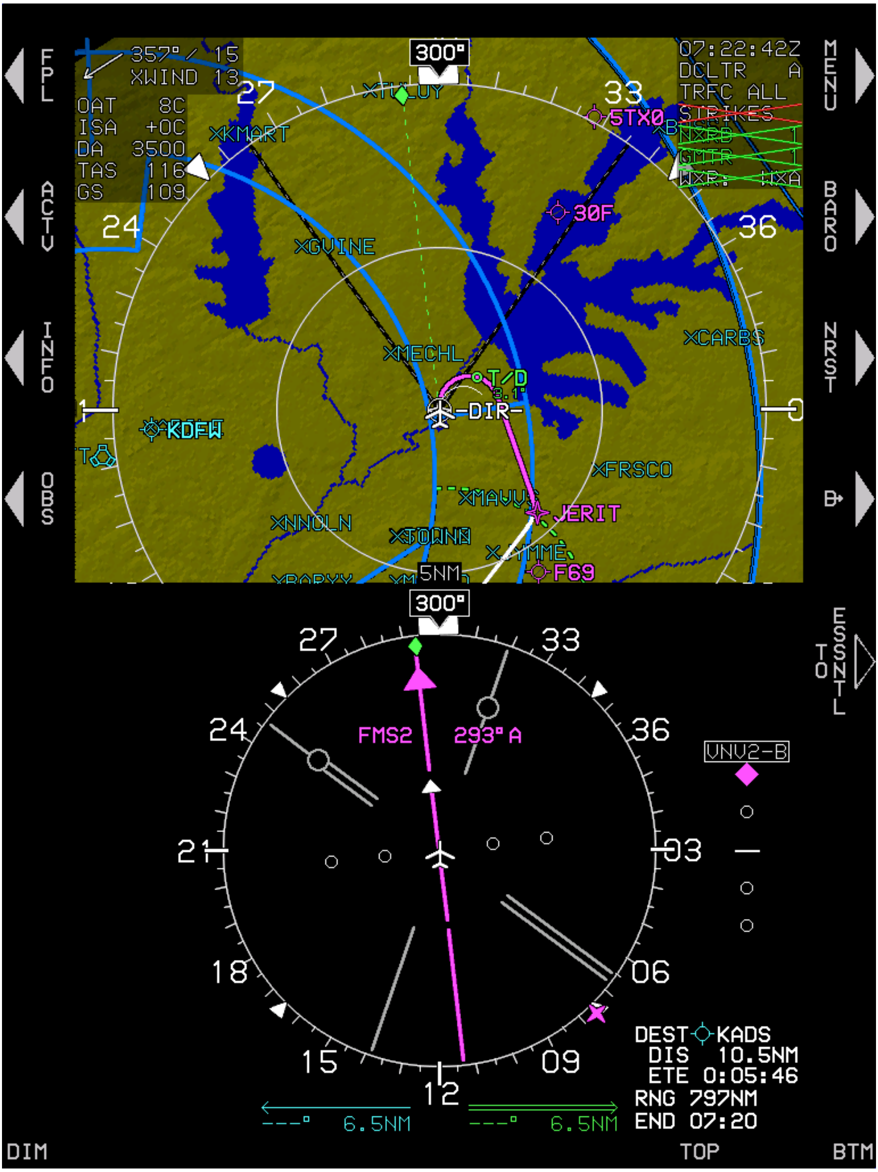


Figure 2-2: IDU-680 Multifunction Display (MFD)

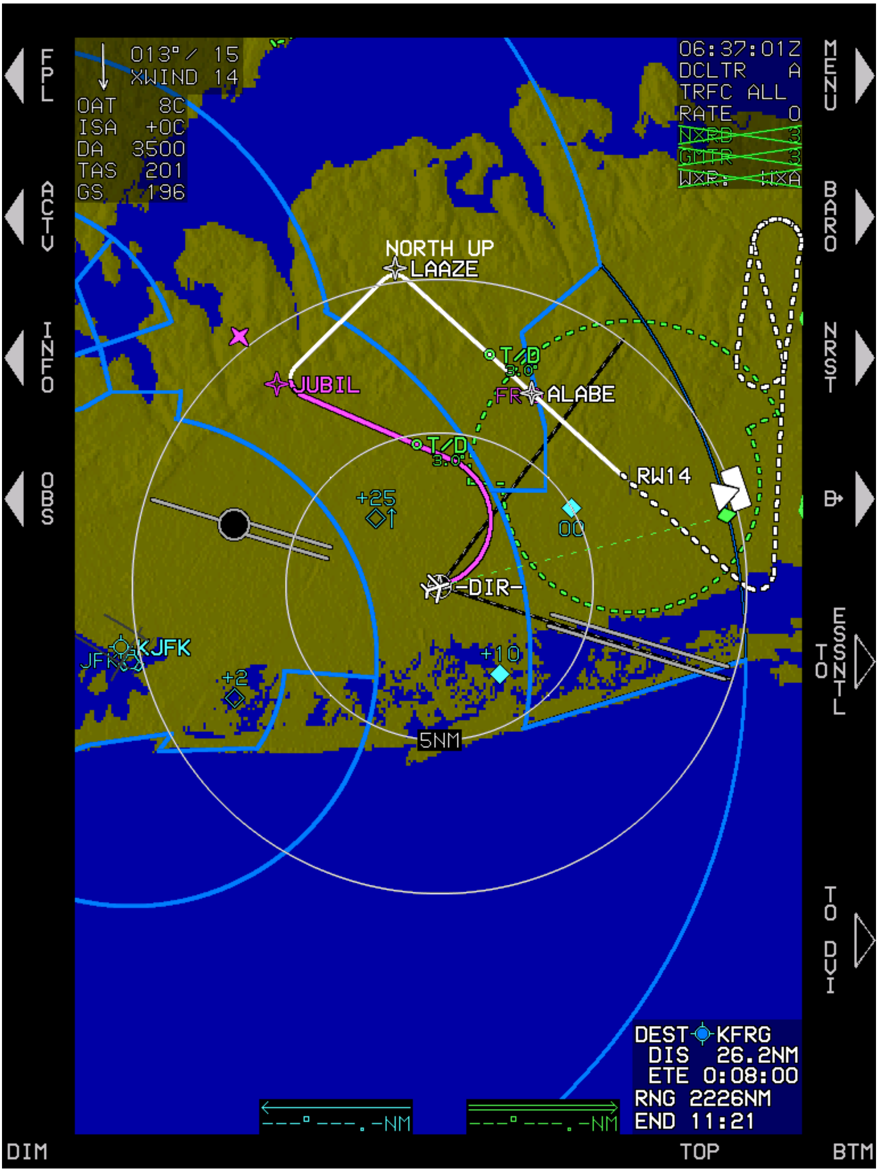


Figure 2-3: IDU-680 Multifunction Display (MFD) with Full Map Page

2.2.1. Functional Integration and Display Redundancy

IDUs incorporate a high-brightness AMLCD screen; bezel buttons; rotary encoder knobs and enter buttons; central processing unit; numerous RS-232, RS-422, and ARINC 429 receive and transmit ports; and discrete IO ports. Hardware and software are identical for all IDUs, and functionality is determined by configuration settings setup during installation. The IDUs are independently connected to all external sensors and independently perform all integrated functions (e.g., TAWS, FMS, ADS-B In, strikes, traffic, etc.)

The IDUs depend upon intra-system (between IDUs on a side – depicted as “Sync” in Figure 2-4) and inter-system (between IDUs on opposite sides – depicted as “Crosslink” in Figure 2-4) to achieve synchronization of integrated functions. They also depend upon intra-system communications to determine which IDU on a side (pilot or co-pilot) takes over transmit-enabled responsibilities. The transmit-enabled IDU is the IDU providing data to external sensors and generating audible alerts.

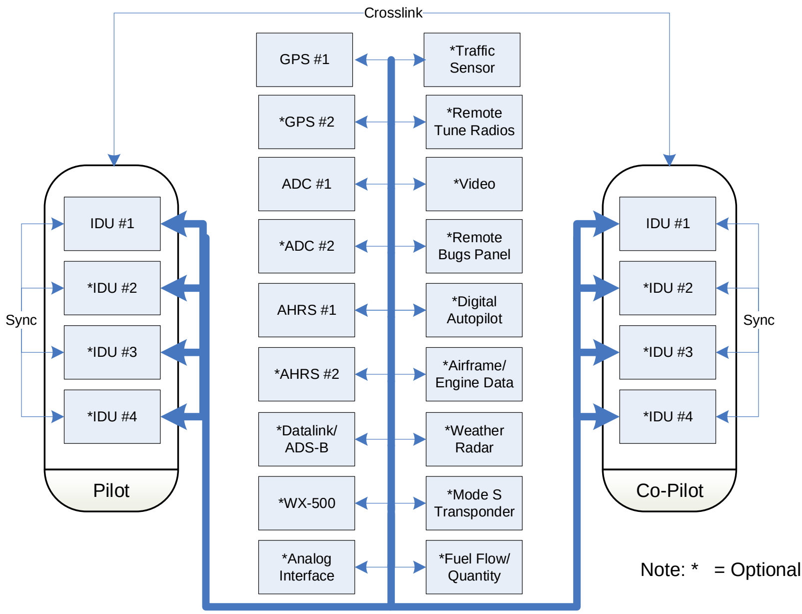


Figure 2-4: System Diagram

2.3. 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:

1) If a Weight on Wheels/Weight on Ground is enabled in EFIS limits the air or ground modes are determined solely from the EFIS limits.

2) Otherwise, mode is determined as follows:

   a) 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.

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

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

NOTE:

The application software for air mode or ground mode uses the following parameters: Ground speed and Airspeed (Knots) and Altitude (Feet)

2.3.1. IDU Initialization

Figure 2-5: IDU-680 Initialization Screen (CPML5)

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., “B”.)

Table 2-3: IDU Software Version and Part Number	
Version Number	**Part Number**
Rev 9.0B	25-680EFIS90B-SW-xxxx (IDU-680 CPM4)
	25-680EFIS90B-SW-xxxx (IDU-680 CPM5L)
	25-680EFIS90B-SW-xxxx (IDU-680 CPM5C)

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 2-4) and side designation (pilot or co-pilot). The IDU number is identified below the part number on the CRC screen (Figure 2-7).

Table 2-4: IDU Number Designation	
CPU/IDU #	**Definition**
“0”	Single-screen installation
“1”	IDU only shows PFD
“2”	First MFD in multi-screen installation
“3”	Second MFD in a multi-screen installation
“4”	Third MFD in a multi-screen 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 9.0B to 9.0C), 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 2-6: 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 BIT (built-in-test) 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 2-7: 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 2-8: 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.

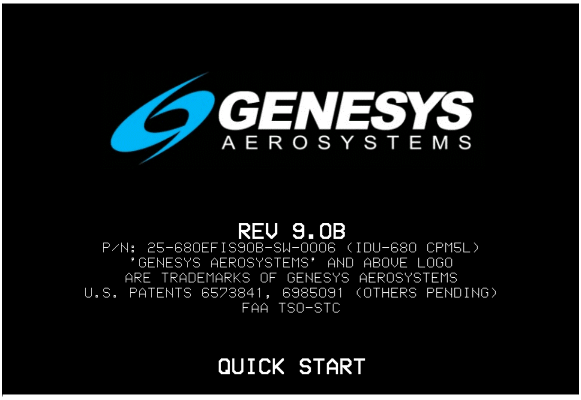


Figure 2-9: QUICK START Screen (CPM5L)

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.

2.4. 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.

2.4.1. Normal and Essential Modes

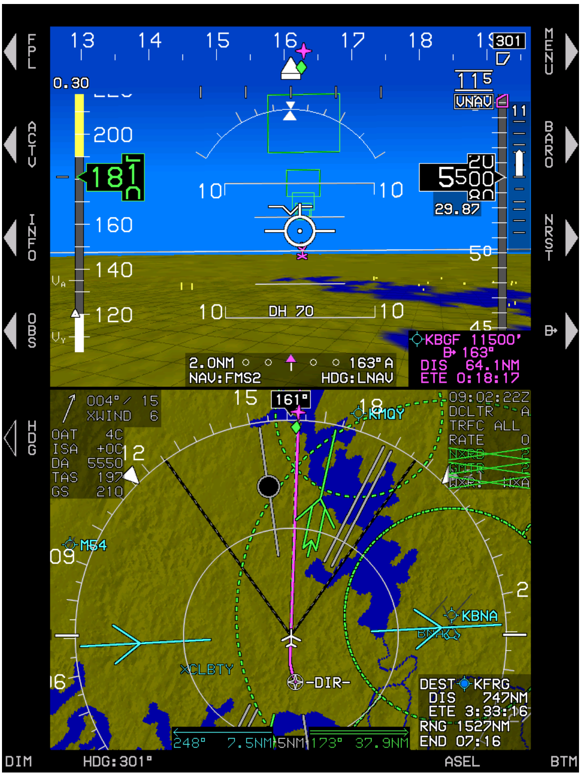


Figure 2-10: PFD Normal Mode

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 3 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.

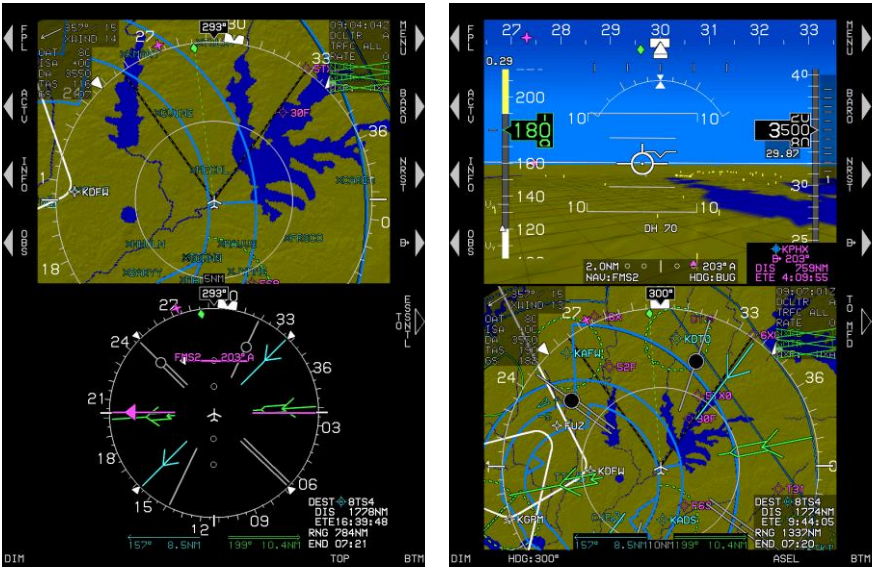


Figure 2-11: MFD Normal and Essential Mode

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 8 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).

2.4.2. 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

2.4.3. 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

2.5. 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 2-5: 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.)

Table 2-5: Color Conventions

Color	Use(s)	Examples
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.
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.	

Table 2-5: Color Conventions

Color	Use(s)	Examples
Red	Indicates aircraft limitations or conditions, which require immediate pilot action, or a device failure (red “X”).	
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.	

2.6. 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.

2.7. 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.

The following alerts are provided and described below:

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 audible alert is interrupted, and the outputs are deactivated (as set in EFIS limits).

2.7.1. Time-Critical Warning and Caution Alerts

Time-critical warning and caution alerts trigger the following elements (Table 2-6) and display in the pilot’s primary field of view with a shaded background (Figure 2-12). EFIS limits may have enabled the option for time-critical alerts to illuminate a master warning/master caution push button annunciator when equipped.

NOTE:

In the following tables, examples show shaded backgrounds on sky and terrain backgrounds for readability.

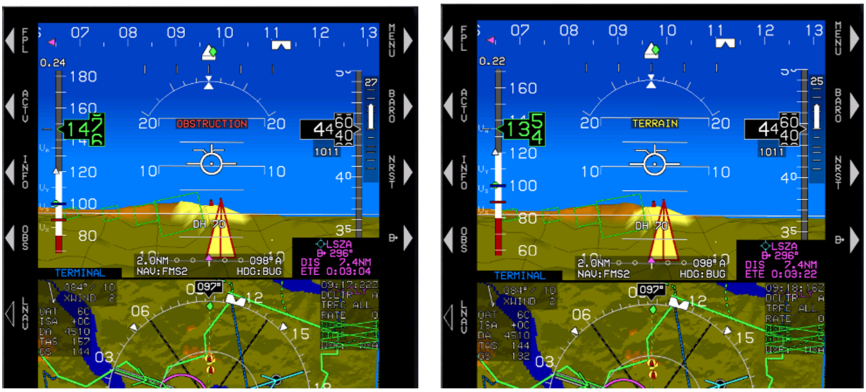


Figure 2-12: Time-Critical Warning and Caution Alerts

Table 2-6: 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 2-7: 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. **

Table 2-7: Time-Critical Warning and Caution Alerts

Visual Alert	Voice Alert	Condition ** No time delay
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.
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. **
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.

Table 2-7: Time-Critical Warning and Caution Alerts		
Visual Alert	**Voice Alert**	**Condition ** No 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)

2.7.2. Warning Alerts

Figure 2-13: Warning Alerts

Table 2-8: 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	

Table 2-9: Warning Alerts

Visual Alert	Voice Alert	Condition ** No time delay
CHECK BREAKER	"Check Electric, Check Electric"	Only active when ECBU is configured and the alert condition exists for more than 1 second.**
LOW FUEL	"Fuel Low, Fuel Low"	One of the following conditions is true: 1) A low fuel warning is active (EFIS limits) 2) A sensed fuel tank quantity is below its low fuel warning threshold 3) Total aircraft fuel is below the pilot-set emergency fuel threshold. 1-minute time delay.
Used on IDU #0 only. Duplicate time-critical warning alerts cover the case where IDU #0 is not displaying the PFI.		
OVERSPEED	"Overspeed, Overspeed"	Indicated airspeed exceeds redline (V_{NE}/V_{MO}/M_{MO} as appropriate) plus instrument error. **

Table 2-9: Warning Alerts

Visual Alert	Voice Alert	Condition ** No time delay
STALL	"Stall, Stall"	Activated above 100' AGL if IAS is below the higher of V_{S1} or V_{S1} corrected for G-load + 5 kts. Deactivated if stall-warning is set to 0. **
PULL UP	"Pull Up, Pull Up"	Within GPWS Mode 1 warning envelope. Half-second time delay.
	"Terrain, Terrain, Pull Up, Pull Up"	Terrain cell within TAWS FLTA warning envelope. Half-second time delay.
		Within GPWS Mode 2 warning envelope. Half-second time delay.
GLIDESLOPE	"Glide Slope, Glide Slope"	Within GPWS Mode 5 warning envelope. Half-second time delay.
OBSTRUCTION	"Warning Obstruction, Warning Obstruction"	Obstruction within TAWS FLTA warning envelope. Half-second time delay.
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. **

2.7.3. Caution Alerts

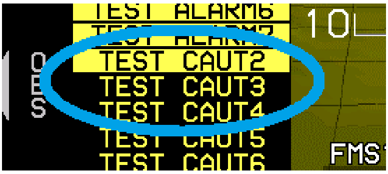


Figure 2-14: Caution Alerts

Table 2-10: 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

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
TERRAIN	"Caution Terrain, Caution Terrain"	Terrain cell within TAWS FLTA caution envelope. Half-second time delay. Within GPWS Mode 2 caution envelope. Half-second time delay.
SINK RATE	"Sink Rate, Sink Rate"	Within GPWS Mode 1 caution envelope. Half-second time delay.
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.
	"Too Low Gear, Too Low Gear"	Within GPWS Mode 4-2 "Too Low Gear" envelope. Half second time delay.
GLIDESLOPE	"Glide Slope, Glide Slope"	Within GPWS Mode 5 caution envelope. Half-second time delay.
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 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.

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
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 are met, this message appears instead. Status of the above auxiliary sensors can be viewed in the Faults menu. 5-second time delay.

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
CHECK BREAKER	Alert Tone	Only active when ECBU is configured and the alert condition exists for more than 1 second.
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 11) Ground speed 3-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. [2]

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
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]

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [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: 1) One of the low fuel caution as set in EFIS limits is active 2) One of the sensed fuel tank quantities is below its low fuel caution threshold

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
		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: Enroute 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 HDG2 FAIL HDG1/2 FAIL	Alert Tone	“HDG FAIL” applicable to single AHRS installation. “HDG# FAIL” applicable to dual AHRS installation. Indicates that Heading is invalid but other AHRS data parameters are normal (i.e., attitude is not Red-X’d). Half-second time delay. [1]

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
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 indicates OAT indication is invalid but other air data parameters are normal (i.e., air data not red-X'd) [1]. Half-second time delay.

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [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 the aircraft is below 2000' AGL in air mode without a valid radar altimeter reading. For ARINC 429 radar altimeter, indicates an SSM of failure warning is transmitting. 2-second time delay.
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.

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
STRK FAIL	Alert Tone	Only active when aux sensor caution split is asserted. No valid message received from 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.

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
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 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]
Used on IDU #0 only. Duplicate time-critical caution alerts cover the case when IDU #0 is not displaying the PFI.		
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	"Caution Terrain, Caution Terrain"	Terrain cell within TAWS FLTA caution envelope. Half-second time delay.
		Within GPWS Mode 2 caution envelope. Half-second time delay.
SINK RATE	"Sink Rate, Sink Rate"	Within GPWS Mode 1 caution envelope. Half-second time delay.
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.

Table 2-11: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode set in EFIS limits [4] Only active when CAUTION mode is enabled		
	"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	"Glide Slope, Glide Slope"	Within GPWS Mode 5 caution envelope. Half-second time delay.
OBSTRUCTION	"Caution Obstruction, Caution Obstruction"	Obstruction within TAWS FLTA caution envelope. Half-second time delay.
TRAFFIC	"Traffic, Traffic"	Not given if own aircraft below 400' AGL nor if target is below 200'AGL (ground target). **

2.7.4. Side-Specific Caution Alerts

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

Table 2-12: Side-Specific Caution Alerts

Visual Alert	Alert Tone	Condition ** No time delay
CHECK IDU 1 CHECK IDU 2 CHECK IDU 3 CHECK IDU 4	Alert Tone	When armed (i.e., at least one intra-system message has been received from the transmitting display), checks intra-system messages. Indicates either: 1) the screen counter value has not changed in the last 1 second ± 0.1 seconds; or 2) the intra-system message is not fresh (i.e., no message received for longer than 1 second ± 0.1 second). **

2.7.5. Advisory Alerts

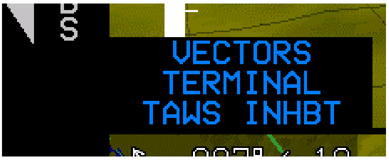


Figure 2-15: Advisory Alerts

Table 2-13: 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 2-14: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode is not enabled in EFIS limits [4] Only active when CAUTION mode is 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]
CHECK BREAKER	Chime	Only active when ECBU is configured and the alert condition exists for more than 1 second.
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. **

Table 2-14: 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-side (pilot and co-pilot) [3] Only active when single-pilot mode is not enabled in EFIS limits [4] Only active when CAUTION mode is enabled		
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 RALT	Chime	Indicates both sides are operating from same radar altimeter source. ** [1][2][3] [4]
SAME NAV	Chime	Indicates both sides are operating from same navigation source. ** [1][2][3] [4]
SAME GPS	Chime	Indicates both sides are operating from same GPS/SBAS source. ** [1][2][3] [4]
SAME DME	Chime	Indicates both sides are operating from same DME source ** [1] [3] [4]
SAME AHRS	Chime	Indicates both sides are operating from same AHRS source. [1] [4]
TAS INHBT	Chime	TAS aural inhibited through activation of TCAS/TAS audio inhibit EFIS limits. **
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]

2.7.6. 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 (if showing) or lower-left corner of the transmit-enabled IDU bottom area (PFI not showing).

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

Table 2-15: 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. 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 in nautical miles based upon current GPS/SBAS HPL. Value ranges from 0.01 to 15.0 NM.**
RNP: 0.10A RNP: 15.0A	Chime	GPS/SBAS automatic required navigation performance in nautical miles as acquired from navigation database. Value ranges from 0.01 to 15.0 NM.**
RNP: 0.10M RNP: 15.0M	Chime	GPS/SBAS manual required navigation performance in nautical miles as set by pilot. Value ranges from 0.10 to 15.0 NM.**
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. **

Table 2-15: Side-Specific Advisory Alerts

Visual Alert	Alert Tone	Condition ** No time delay
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. 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 20NM PTK = R 1NM PTK = R 20NM PTK ENDING	Chime	GPS/SBAS parallel offset path advisory. ## is nautical miles or KM (depending upon EFIS limits speed units) 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	Shown when FLTA function is automatically inhibited during normal operation. TAWS INHBT caution has priority.**
TRUE NORTH	Chime	System operating in true north mode. **

Table 2-15: Side-Specific Advisory Alerts		
Visual Alert	**Alert Tone**	**Condition ** No time delay**
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. **

2.7.7. 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 2-16: 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		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. **

Table 2-16: Audio-Only Caution and Advisory Alerts		
Caution or Advisory Alert	**Voice Alert/ Alert Tone**	**Condition ** No time delay**
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. ** 
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). **
Countdown Timer Chime	Chime	Sounds when countdown timer reaches 00:00:00. **
Level-off Advisory Alert	Altitude Alert Tone	Within the greater of 1000' or 50% of VSI from uncaptured selected or VNAV waypoint altitude. Inhibited in approach procedures. **
GPWS Mode 6 Advisory Alert	"Five Hundred"	Descending through 500' AGL advisory. Armed upon climbing through deadband value above 500' AGL. Half-second time delay.

2.7.8. Voice Alerts and Muting

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

2.7.9. 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. In the event there are more than 11 visual alerts, **MORE-PRS-MENU** appears for guidance in accessing the EXPAND CAS menu.

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. Only IDU-specific flags (i.e., CHECK IDU #) appear on these IDUs.

2.8. Database and Software Updates

2.8.1. 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.

2.8.2. 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 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 slip indicator or non-slip blank door cover at the bottom-center of the IDU bezel upward to the first detent position to expose the USB port.

When an update is performed, 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 USB flash drive.

2) With power off, insert the USB flash drive into the USB port.

CAUTION:

Always install a valid USB flash drive in the IDU prior to activating any ground maintenance function. Operation of the GMF without a valid USB flash drive installed may cause erroneous failure indications or corruption of the IDU.

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

4) Rotate ❶ to **Update Databases** and push to enter.

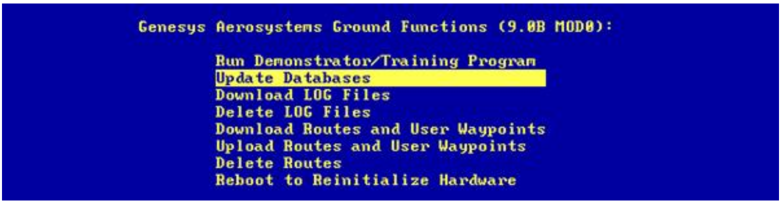


Figure 2-16: Ground Maintenance Page

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 USB flash drive, and lower the USB 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 2-5). 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.

2.8.3. Software and Terrain Database Update

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

2.9. 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 USB flash drive door.

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

Use the demonstrator to gain familiarity of the EFIS menu structure and location of button tiles for each operation. Load an instrument procedure prior to take off to view the expected sequence of events or use as Ground-Based Utility for creation and deletion of locked flight plans.

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 IDUs, the following action must be taken.

One USB flash drive must be installed in the IDU for this option to operate correctly and display terrain data. Operating the demonstrator mode without a USB flash drive or with multiple USB flash drives through a USB hub may cause loss of terrain information.

1) While in flight mode, activate the flight plan created in demonstrator mode.

2) 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.

2.10. EFIS Training Tool

In addition to the demonstrator program, the EFIS Training Tool (ETT) is available to load on a personal computer. The ETT is compatible with 32- or 64-bit versions of Microsoft Windows®. It serves as a Ground-Based

Utility tool for training pilots and provides features to play back log files from actual aircraft flight, record and capture images, create locked, unlocked flight plans, and user waypoints. See the installation and user guide distributed with the ETT installer for further details. Table 2-17 defines flight planner options for installed IDU-680 and Ground-based Utility.

Table 2-17: Flight Planning Options

Option	Flight Mode	Ground-Based Utility**
	IDU-680*	
Create	Yes	Yes
Lock 🔒	No	Yes
Activate	Yes	Yes
Activate 🔒	Yes	Yes
Edit	Yes	Yes
Edit 🔒	No	No
Reverse	Yes	Yes
Reverse 🔒	No	No
Delete	Yes	Yes
Delete 🔒	No	Yes
Rename	Yes	Yes
Rename 🔒	No	Yes

* PFD or MFD unless otherwise restricted.
**ETT or IDU operating in Ground Demonstration Mode.

Section 3 Display Symbology

3.1. Introduction

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

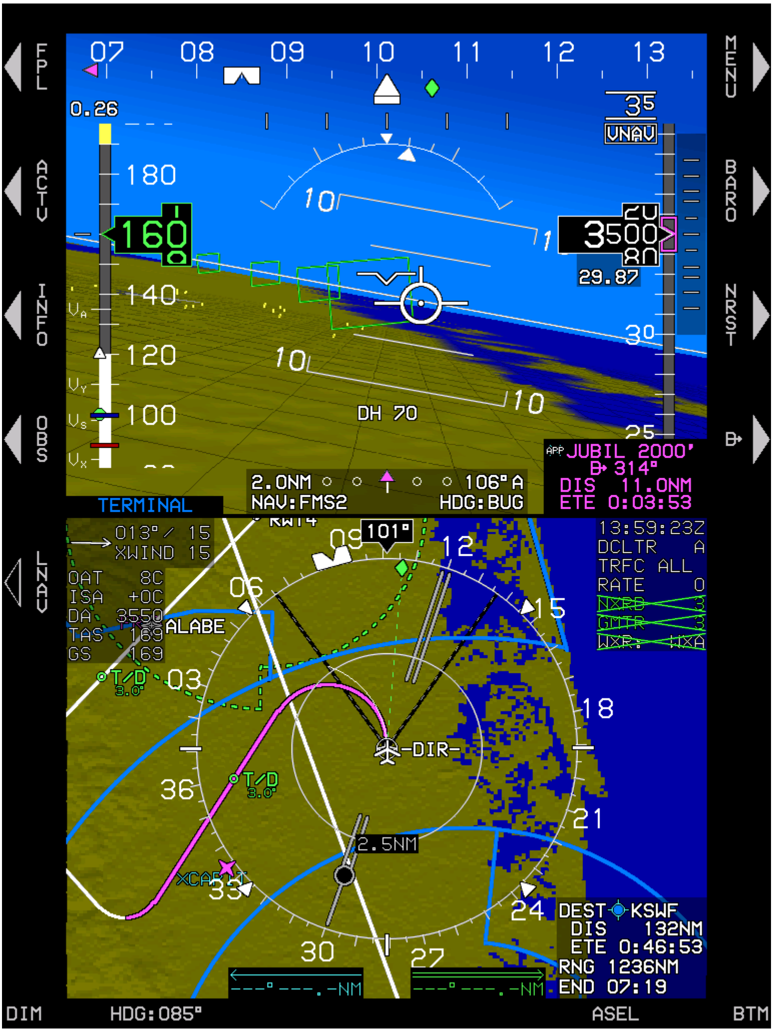


Figure 3-1: PFD Normal SVS Mode

3.1.1. 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

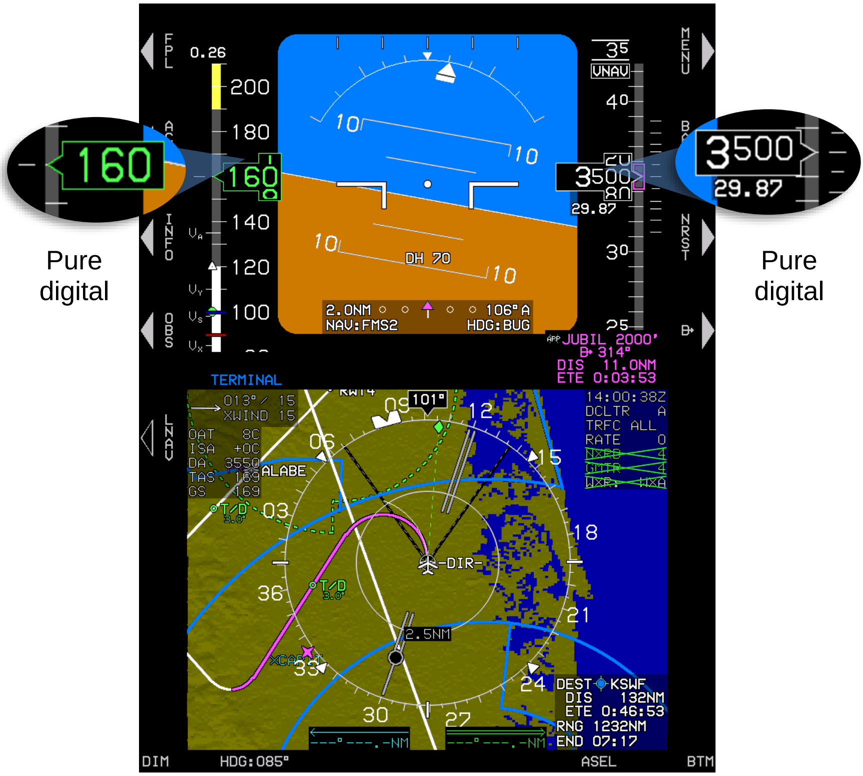


Figure 3-2: PFD in Basic Mode

3.1.2. MFD Display

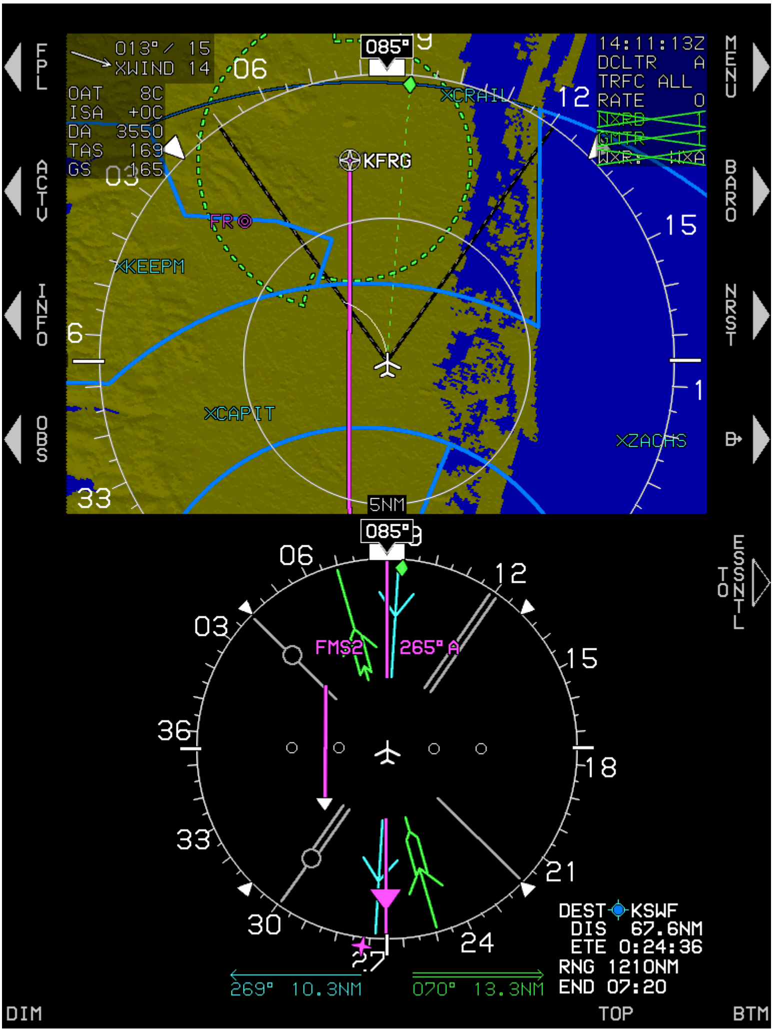


Figure 3-3: MFD in Normal Mode with Map Page Displayed on Top and HSI on Bottom

Figure 3-4: MFD in Essential Mode

NOTE:

Where distances are stated in "NM or KM" and altitudes are stated in "Feet or Meters," the following statement applies: depending on the setting of the "Speed Units" system limit.

3.2. Menu Functions

See Section 5 Menu Functions and Step-By-Step Procedures for menu philosophy description.

Figure 3-5: Knob Functions

Figure 3-6: Menu Management

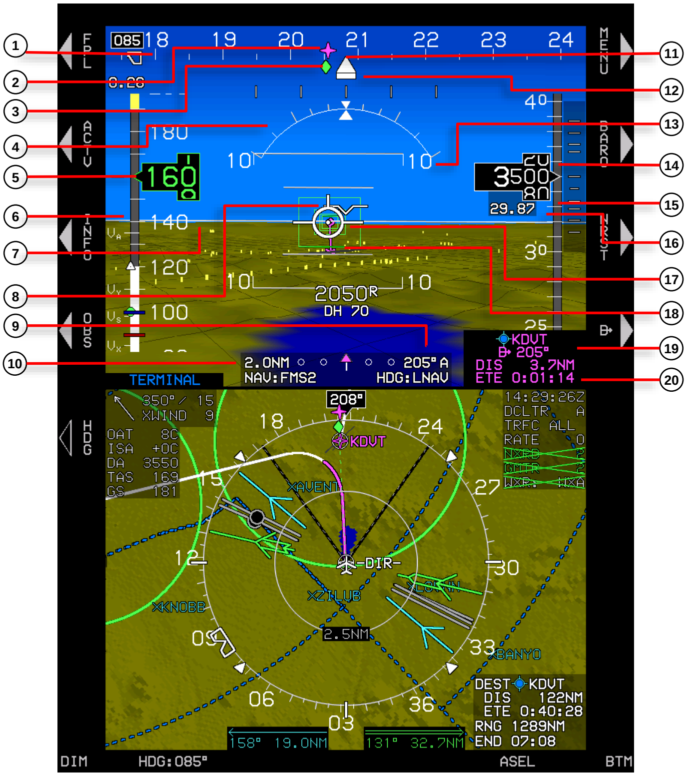
When the menu system is beyond the top-level, **EXIT (R1)** escapes to the top-level. When a menu level is deeper than the first level, **BACK (L1)** returns back one level through the menu system.

When the menu system is beyond the top-level, some menu options are not available. If a menu has been opened, any changes must be acknowledged, or **EXIT (R1)** must be pressed, to return to the top-level when finished with the open menu. To quickly verify the menu system is at the top level, **MENU (R1)** is displayed.

Figure 3-7: Top-Level Menu Indication

3.3. 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, traffic, and runways, are presented conformally as if seen directly in front of the aircraft while looking outside.



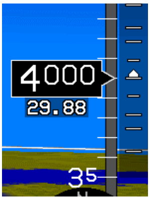
1) Directional Scale
2) Bearing to Waypoint
3) Track Pointer
4) Bank Angle Scale
5) Indicated Airspeed Readout
6) Indicated Airspeed Tape
7) Horizon Line
8) Waterline
9) Instantaneous bearing desired track to active waypoint
10) Course Deviation Indicator
11) Heading Pointer
12) Slip Indicator
13) Pitch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

Figure 3-8: PFI Symbology

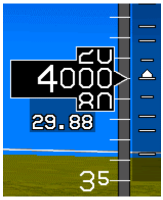
3.3.1. Altitude Display

The PFI has an altitude box with altitude scale on the right side of the display. The altitude box digitally displays barometric altitude as adjusted by an altimeter setting.

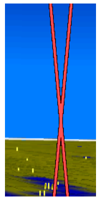
The digital display of barometric altitude in feet or meters depends on the speed units system limit. Altitude is either purely digital (nearest 10 measurement units) or rolling digits (nearest 20 units) as defined in EFIS limits. The altitude box has a pointer that interacts with the altitude scale, 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.



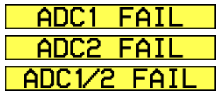
Pure Digital

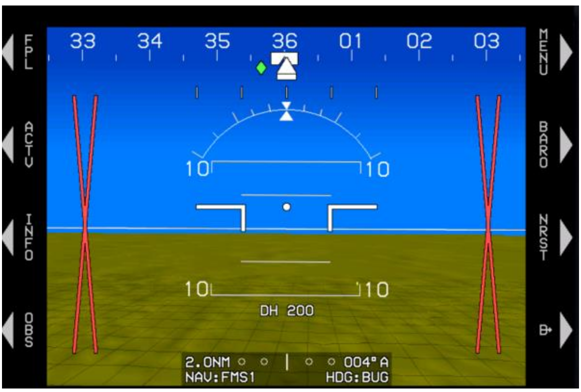


Rolling Air Data



ADC Failure





Single System ADC Failure (Red X's Only)

Figure 3-9: Altitude Display

3.3.2. Altimeter Setting

The altimeter setting is immediately below the altitude readout box and digitally displays the altimeter setting in either inches of mercury (inHg) or millibars (mbar) according to the user-selected units.

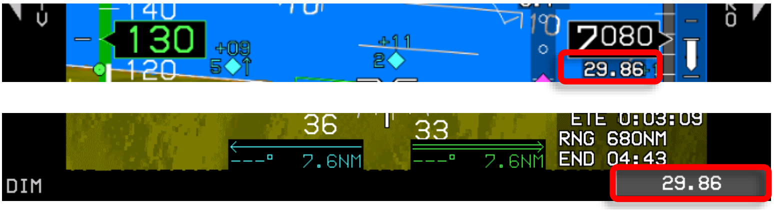
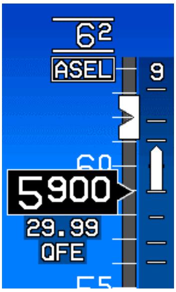


Figure 3-10: Altimeter Setting



Press **BARO (R2)** to enter altimeter setting mode and view the altimeter setting in inHg or mbar value in the lower right corner (Figure 3-10). Rotate ❶ CW to increase or CCW to decrease the altimeter setting. Push ❶ to enter the new value and close the menu.

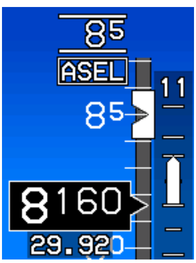
Figure 3-11: Selecting Altimeter Setting

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 as in Figure 3-11.

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.

3.3.3. Selected Altitude Sub-Mode (Target Altitude)

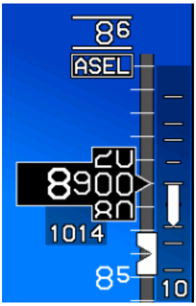


When in selected altitude sub-mode, the altitude scale has a user-settable target altitude bug. When using feet for altitude display, the target altitude bug has a resolution of 100 feet. The setting ranges from -1,000 feet to 50,000 feet at the high end.

Figure 3-12: Target Altitude

The target altitude bug setting annunciation includes "ASEL" indicating selected altitude sub-mode, and be used either as a visual reference or, when vertically or partially integrated through use of a vertical mode input, as a control parameter for climbs or descents.

> **NOTE:**
>
> Altimeter setting limits are 745-1100 (mbar) or 22.00-32.00 (inHg).



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

Figure 3-13: Target Altitude Bug

3.3.4. Altitude Display (VNAV Tile) (Analog Autopilot Integrated)

When enabled for performing VNAV with a manually selected altitude entered, **VNAV (L6)** appears.

Figure 3-14: Altitude Display (VNAV Tile)

> **NOTE:**
>
> See applicable autopilot pilot guide.

3.3.5. VNAV Sub-Mode

Altitude in Feet

Altitude in Meters

Figure 3-15: VNAV Sub-Mode

The VNAV altitude bug is a visual reference or, when vertically integrated with an autopilot either fully or partially integrated through the vertical mode configuration as a control parameter for climbs or descents. When not vertically integrated with an autopilot, the target altitude bug setting annunciation is colored white and the target altitude bug is filled-white at all times.

The VNAV altitude bug setting includes "VNAV" indicating VNAV altitude sub-mode.

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 3-26.

3.3.6. Minimum Altitude

A user-settable minimum altitude bug consists of a bold yellow line on the altitude scale and a yellow region on the altitude scale from the minimum altitude down to ground level. The minimum altitude bug value is displayed above the altitude scale 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.

If using feet for altitude display, the altitude values can also be presented in metric units (meter). The metric display of barometric altitude has a resolution of 1 meter. Similarly, the metric display of the target altitude bug setting has a resolution of 1 meter.

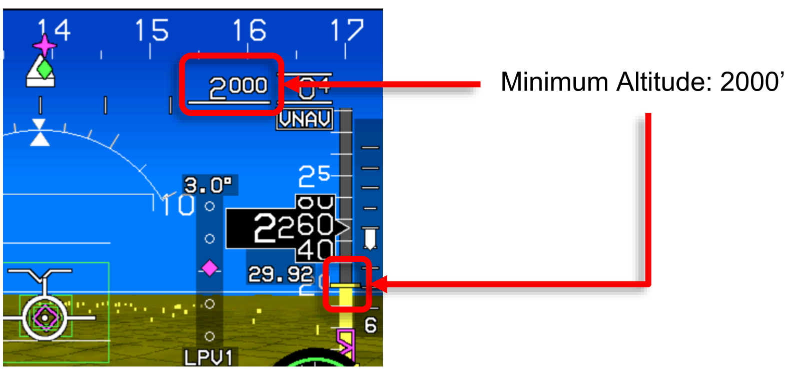


Figure 3-16: Minimum Altitude (Feet)

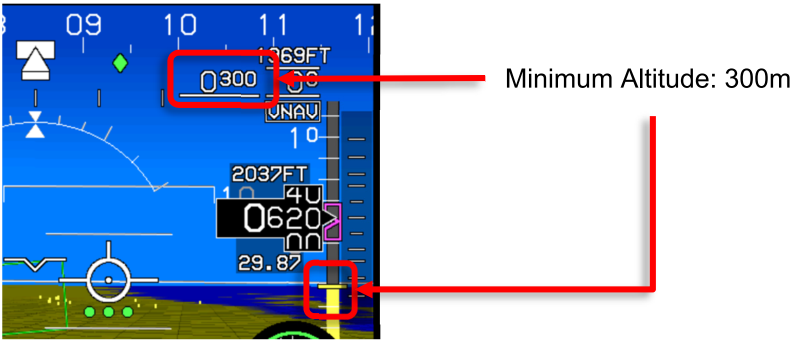
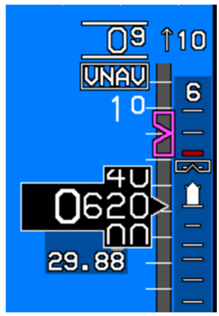


Figure 3-17: Minimum Altitude (Meters)

3.3.7. Vertical Speed Indicator

Altitude in Feet: 600 fpm descent



Altitude in Meters: 6 m/s climb

Figure 3-18: VSI

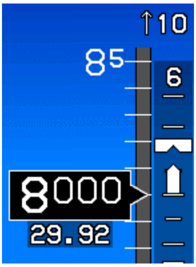
The vertical speed indicator (VSI) is depicted in a "worm" format providing analog and digital representation of VSI in feet per minute (fpm) or meters per second (m/s) depending on the speed units system limit.

Table 3-1: 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

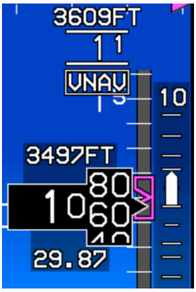
Table 3-1: Scale Graduations and Display		
Traffic Installed	**Scale Limit**	**Scale Graduations and Display**
Rounded to 1 m/s with Resolution of 1 m/s		
With TCAS-II	±10 m/s	±3, ±5, ±10 m/s Background of the VSI functions as an RA display with green and red regions to provide RA maneuver guidance.
Without TCAS-II	±80 m/s	±5, ±10, ±20, and ±80 m/s

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



The VSI indication can have a user-settable vertical speed bug with a 100 fpm resolution and a range from -3000 to +3000 fpm. It is mutually exclusive with the airspeed bug.

Figure 3-19: VSI Bug (Feet per Minute)



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

Figure 3-20: VSI Bug (Meters per Second)

3.3.8. Normal AGL Indication

AGL altitude is displayed above the course deviation indicator. The source for the indication is the source used by TAWS and displayed next to the AGL altitude as follows:

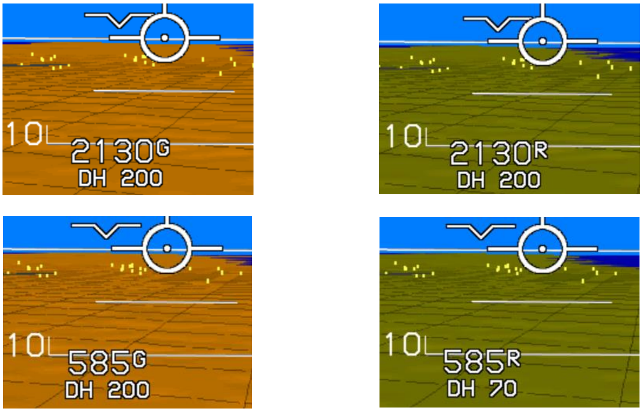
R = Radar altitude

G = GPS/SBAS geodetic height less database ground elevation

B = Barometric altitude less database ground elevation

Feet

Meters



(SVS Basic) AGL Based on GPS Altitude

(SVS TAWS) AGL Based on Radar Altitude

Figure 3-21: Normal AGL Indication

AGL altitude is not displayed when it is greater than the radar altimeter maximum valid altitude (2500' AGL or as set in EFIS limits) nor, when it is invalid or when an analog indication is selected by the user. Additionally, AGL indication includes the set decision height (see § 3.3.10).

Table 3-2: 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

3.3.9. Analog AGL Indication

User-selected analog AGL indication is displayed in the lower right corner of the PFI above the active waypoint identifier with a green circular tape and digital readout in the center. The AGL indication is displayed in feet or meters (depending on the speed units system limit). The circular tape has a green radial line at its end that disappears above 1000' or 500m AGL.

Analog AGL without DH | Analog AGL with DH

Feet

Meters

GPS/SBAS Source | Radar Altimeter Source | Above DH | Below DH with "Decision Height" aural annunciation

All images captured from PFI with SVS TAWS configured.

Figure 3-22: Analog AGL Indication

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

<table>
<tr><th colspan="4">Table 3-3: Analog AGL Indicator (Feet)</th></tr>
<tr><th colspan="2">Markings 0-1000 Feet</th><th>AGL</th><th>Scaling (clock position)</th></tr>
<tr><td>0-100 Feet</td><td>100 Feet-1000 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">Radial line on AGL scale 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>
</table>

<table>
<tr><th colspan="4">Table 3-4: Analog AGL Indicator (Meters)</th></tr>
<tr><th colspan="2">Markings 0-50 Meters</th><th>AGL</th><th>Scaling (clock position)</th></tr>
<tr><td>0-50 Meters</td><td>50 to 500 Meters</td><td>0m</td><td>6:00</td></tr>
<tr><td>Linear</td><td>Logarithmic</td><td>50m</td><td>12:00</td></tr>
<tr><td colspan="2" rowspan="2">Radial line on AGL scale disappears at 500 meters</td><td>100m</td><td>1:30</td></tr>
<tr><td>250m</td><td>3:00</td></tr>
</table>

Table 3-5: 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		✓
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 user deselects analog AGL.

3.3.10. Decision Height

User-settable decision height is displayed above the CDI 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 and readout turn amber (yellow). This is accompanied by "Decision Height" voice alert.

Feet

Meters

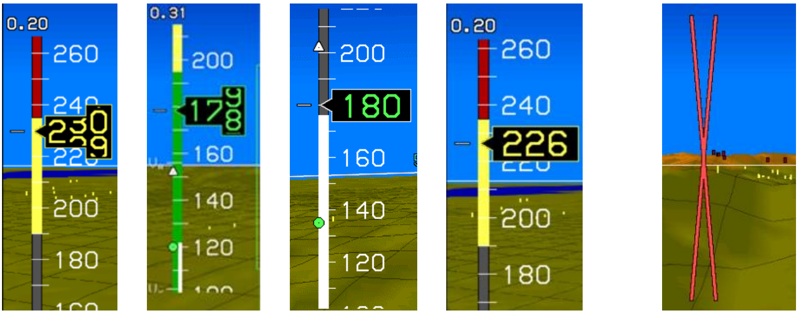
Figure 3-23: Decision Height (Based on GPS/SBAS)

3.3.11. Airspeed Display

Airspeed is digitally displayed in same color as airspeed scale in knots per hour, miles per hour, or kilometers per hour depending on the speed units system limit. The digital display is either pure digital or incorporates rolling digits as set in EFIS limits. Mach number is displayed above full time with resolution of 0.01 Mach.

The airspeed box pointer interacts with the airspeed scale and has graduations every 10 measurement units with labels every 20 measurement units with high numbers at the top.

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



Knots Km/h Knots Km/h

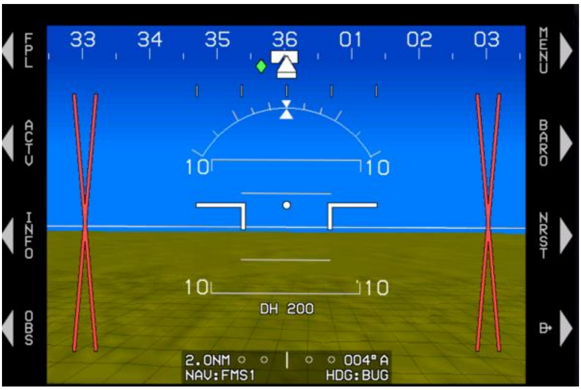
Rolling Digits Pure Digital

ADC Failure

ADC1 FAIL

ADC2 FAIL

ADC1/2 FAIL



Single System ADC Failure (Red X's Only)

Figure 3-24: Airspeed Display

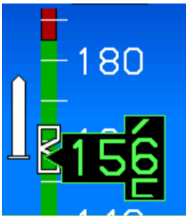
The airspeed indication can have a user-settable airspeed bug with a 1-knot resolution and a range from 1.2 x V_S (or configured minimum IAS bug speed, if higher) to red-line airspeed (lower of V_{MO} or M_{MO}). It is mutually exclusive with the VSI bug.

Table 3-6: Airspeed Bug Limits

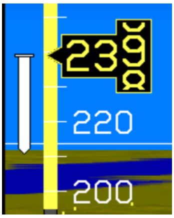
Low end	High end
Higher of 1.2 x V_S or 60KIAS	Red-line (V_{NE}, V_{MO}, or M_{MO})

NOTE:

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

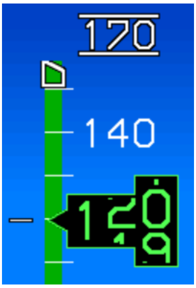


Indicating speed of 178 KIAS within 10 seconds



Indicating speed of 210 Km/h within 10 seconds

Figure 3-25: Airspeed Trend Noodle



When the airspeed bug value differs from aircraft speed to the extent the bug is off scale, the bug appears to be "parked."

Figure 3-26: Airspeed Bug Off Scale

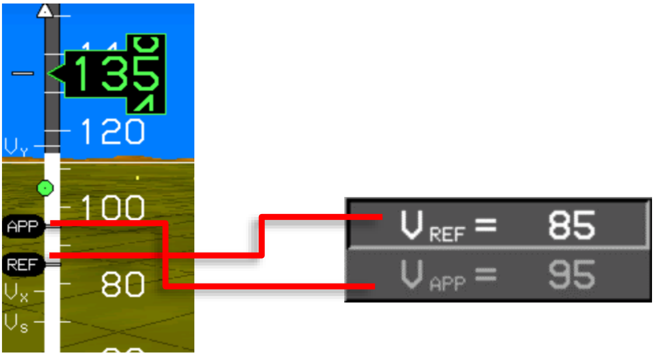


Figure 3-27: Airspeed Indicator V-Speeds

The airspeed scale background and readout for Part 23 airplanes have coloration as in Figure 3-28.

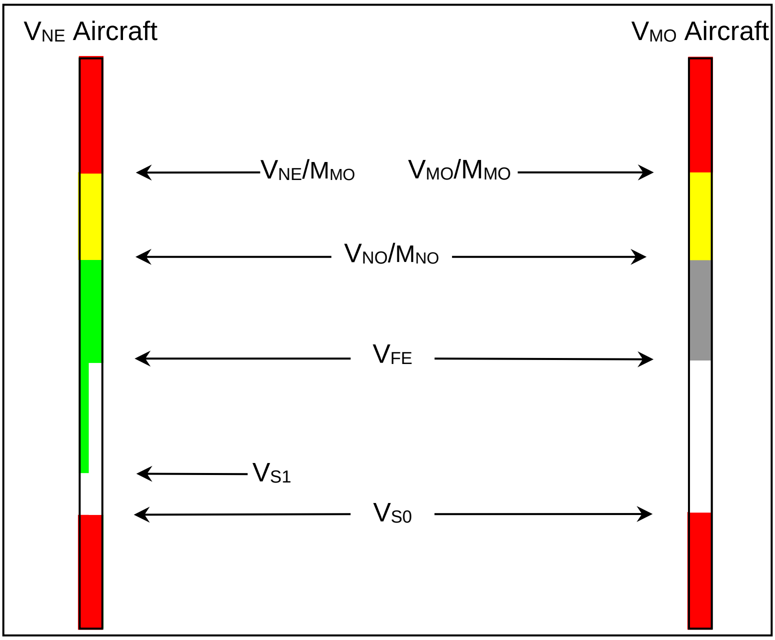


Figure 3-28: Airspeed Scale FAR Part 23

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:

1) For reciprocating multiengine-powered aircraft of 6,000 pounds or less, a red line at V_{MC}.

2) For reciprocating multiengine-powered aircraft of 6,000 pounds or less, a blue line at V_{YSE}.

3) A white VS marking at the aircraft's 1-G V_{S1} or a yellow VS marking at V_{S1} corrected for G-loading, whichever is higher.

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

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

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

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

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

The airspeed scale background for Part 25 airplanes (Part 25 "Airspeed Scale Type") has colored regions and readout coloration as in Figure 3-29.

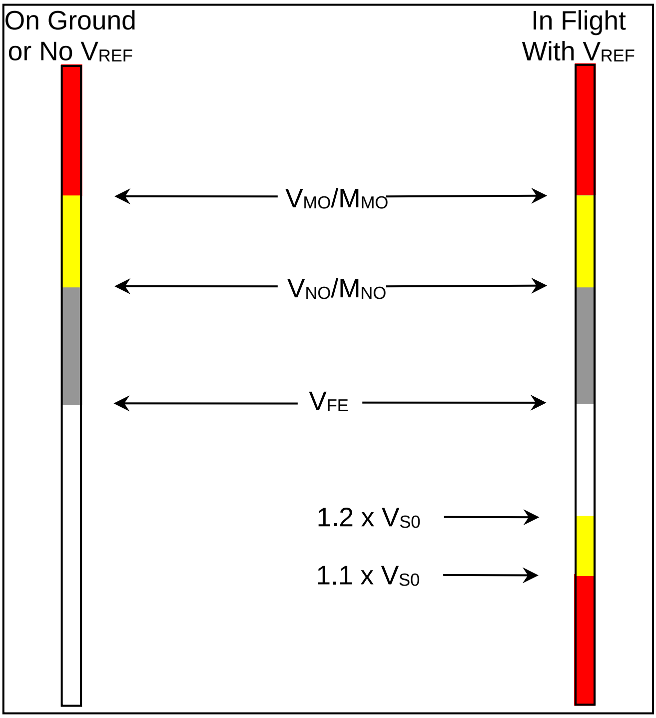


Figure 3-29: Airspeed Scale FAR Part 25

1) If in air mode with a user-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 user-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 user-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 user-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 user-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.

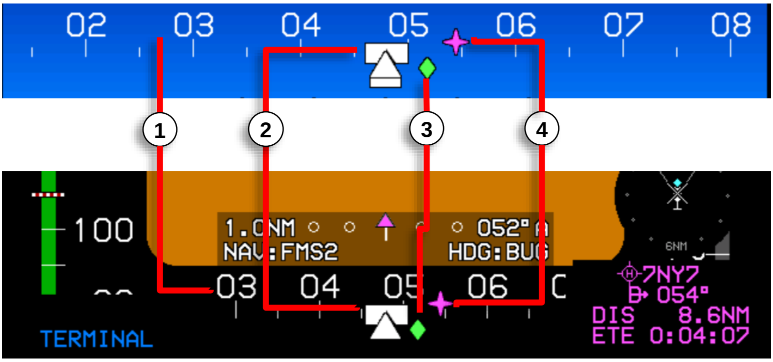
6) If enabled (V_{MFE} not 0), a "white triangle" maximum flap extension speed marker at V_{MFE}.

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 the user sets. The V_1, V_R, and V_2 symbols automatically declutter when above 2,000' AGL.

3.3.12. Heading Display

The heading scale with 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 user-settable heading bug interacts with the heading pointer.

Normal SVS Mode



Basic Mode

1) Heading Scale
2) Heading Pointer
3) Track Pointer
4) Active Waypoint Pointer

Figure 3-30: Heading Display

Figure 3-31: Dampened Integral Slip Indicator

> **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).

Table 3-7: Heading Display

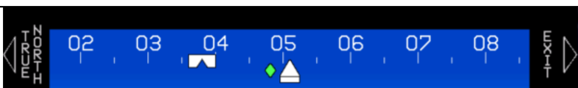
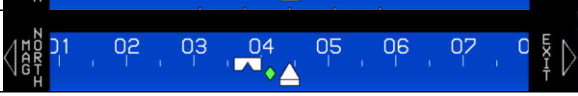
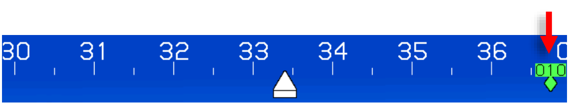
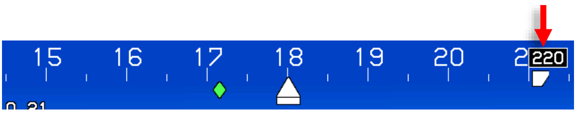
	Heading in Mag North mode
	Heading in True North mode
	Track pointer off the scale when aircraft track is displaced from boundaries

Table 3-7: Heading Display	
	The active magenta star-shaped waypoint symbol at a point corresponding with the active waypoint. When changed, the heading bug value is displayed for 5 seconds.
	The active waypoint pointer is beyond screen boundaries.
	When the heading bug is displaced beyond heading scale boundaries, the partial heading bug is shown at the heading scale limit with the heading bug value above.
	When AHRS is in DG mode, "DG" appears.

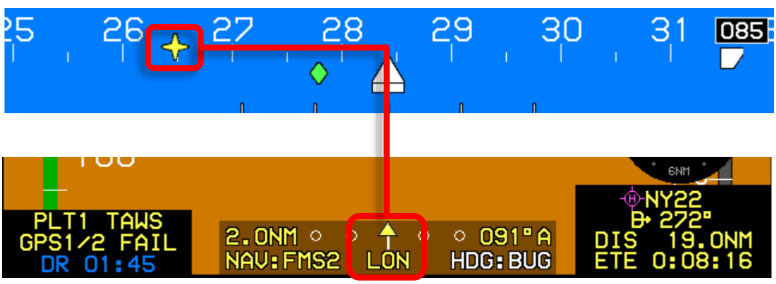
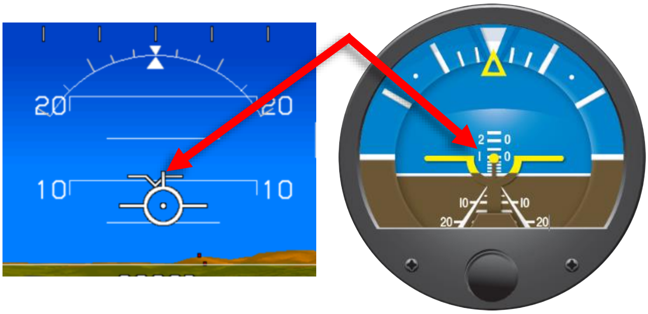


Figure 3-32: GPS Loss of Navigation (LON)

3.3.13. Pitch Scale

The PFI has large aircraft symbol reference marks 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 large aircraft symbol reference marks.



10° Nose up 10° Nose up

Figure 3-33: 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°.

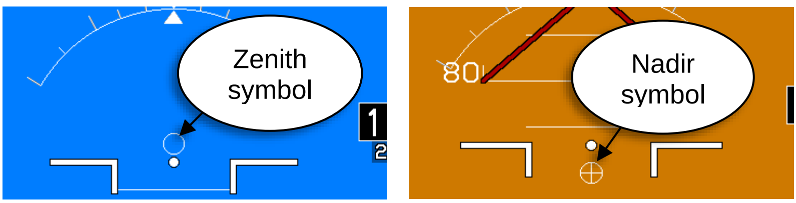


Figure 3-34: Pitch Scale Zenith and Nadir Symbol

3.3.14. 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 returns to within 10° of the horizon. 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

9) Mini map

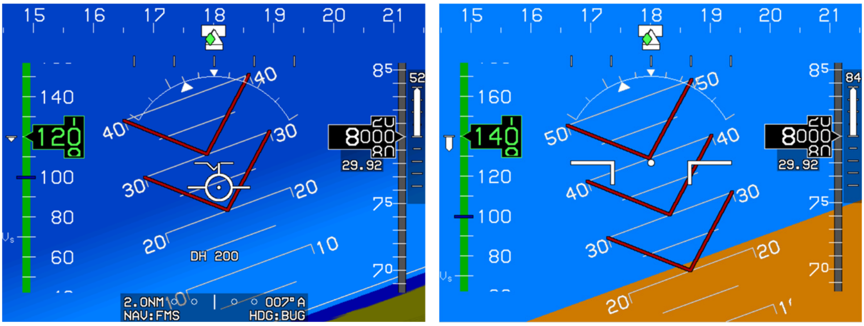
10) Mini traffic

11) In basic mode, PFD reverts to normal mode

12) In zoom mode FOV, PFD reverts to normal FOV

13) Runways

14) Menus



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

More than 30° pitch up and in Unusual Attitude Mode

Figure 3-35: Unusual Attitude Mode

3.3.15. Pitch Limit Indicator

The pitch limit indicator first appears above the applicable reference symbol (either the FPM 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 user 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 user-input V_{REF} by 1.23.

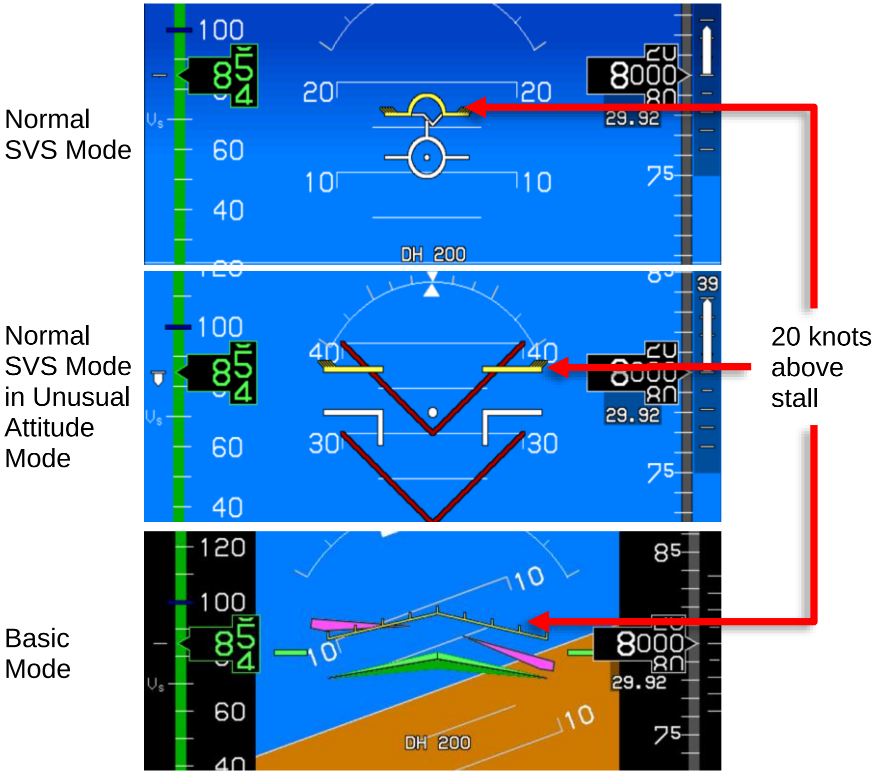


Figure 3-36: Pitch Limit Indicator (20 Knots above Stall)

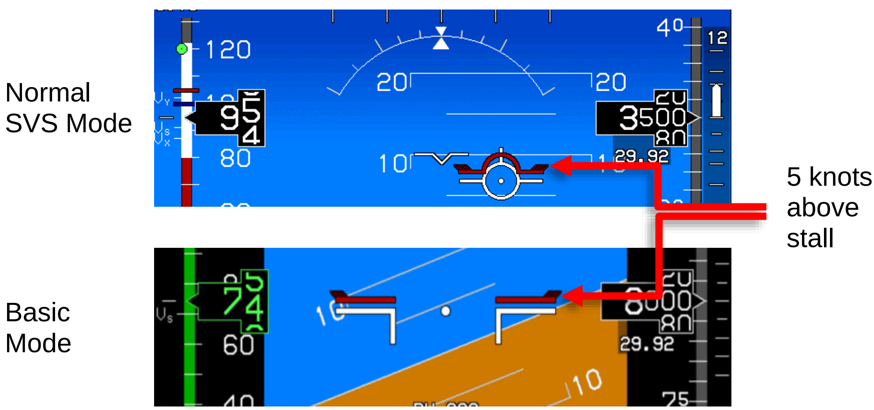


Figure 3-37: Pitch Limit Indicator (5 Knots above Stall)

3.3.16. Turn Rate Indicator

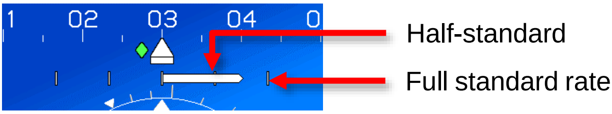
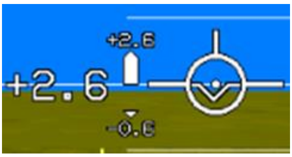


Figure 3-38: Turn Rate Indicator (Selected from Declutter Menu)

3.3.17. G-Force Indicator

G-force indicator appears in normal mode as depicted or next to the large aircraft symbol reference marks (basic or unusual attitude mode) when the difference between G-force and 1-G is greater than 0.3 Gs.

Figure 3-39: 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 3-40: G-Force Indicator Telltale Indications

3.3.18. Analog G-Force Indicator and Telltales

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 as long as 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, as long as the associated G limit has not been exceeded. The example reflects +6.1G and -4.1G EFIS limits.

Analog G-force indication displayed to nearest tenth G

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

Figure 3-41: Analog G-Force Indicator

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 3-42: RESET G

3.3.19. Landing Gear Indication

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

Normal SVS Mode

Basic Mode

Figure 3-43: Landing Gear Indication

3.3.20. PFI Background

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 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 FPM.

The background has two user-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.

A blended-tone sky is displayed in conjunction with the 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. Additionally, the blended sky increases the contrast of the directional scale, emphasizes the horizon, and provides a compelling visual cue to a nose-high attitude.

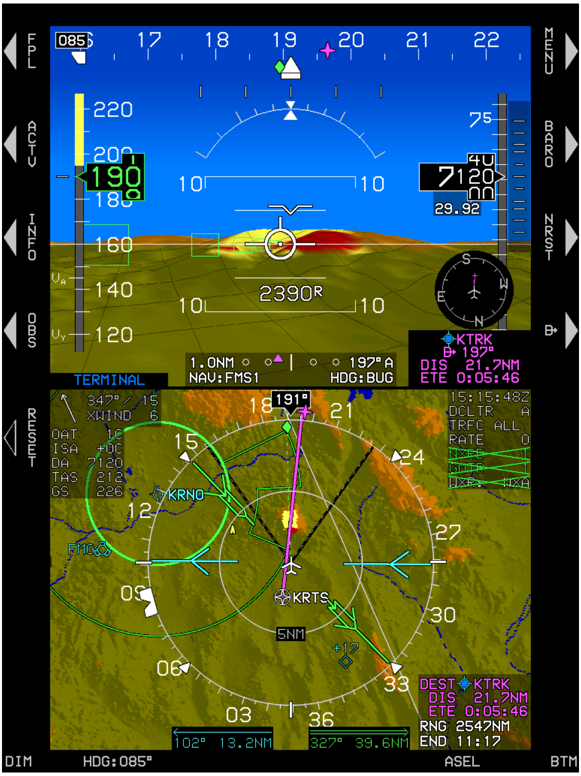


Figure 3-44: Terrain and Obstructions

Terrain and obstruction rendering uses hidden surface removal techniques, while terrain/sky rendering uses atmospheric perspective techniques. Terrain with obstruction rendering is collectively user-selectable to declutter the display. Terrain and obstruction rendering is disabled in the basic mode, unusual attitude mode, and during any reversionary mode. In unusual attitude mode, the blue-brown boundary line of the background decouples from the pitch scale at high pitch angles, so a sliver of the blue-brown boundary line always remains visible for guidance to the horizon.

The terrain ahead of the aircraft is shown conformally 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 is shown with a resolution as in Table 3-8. The 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).

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.

At latitudes greater than 75°, no grid lines are shown. To keep the grid spacing relatively consistent, the longitude spacing is increased at latitudes between 45° and 75°, according to Table 3-8.

Table 3-8: 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°

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.

Obstructions such as towers, antennas, buildings, and other manmade structures are shown on the PFI as vertical amber (yellow) lines. Obstructions are conformal in location and size and are only shown in conjunction with terrain, regardless of altitude. Obstructions representing a collision hazard are annunciated audibly and visually with a time-critical warning or caution alert. All vertical amber (yellow) lines in Figure 3-45 are obstructions near the airport. See Section 2 System Overview for a description of alerts when obstructions represent a collision hazard.

WARNING:

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

Obstructions without hazardous condition

Obstructions creating an OBSTRUCTION warning

Figure 3-45: PFI with Obstructions

Table 3-9: Terrain and Obstruction Rendering Levels

Feature	Terrain Coloring	Obstructions	Notes
SVS BASIC	Shades of brown for non-water terrain	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	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.
SVS TAWS	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		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.

Table 3-9: Terrain and Obstruction Rendering Levels

Feature	Terrain Coloring	Obstructions	Notes
		symbology (See Section 8 TAWS)	
None	No terrain nor obstructions are shown. Neither SVS BASIC nor SVS TAWS is selected.		

When terrain and obstruction rendering is 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.

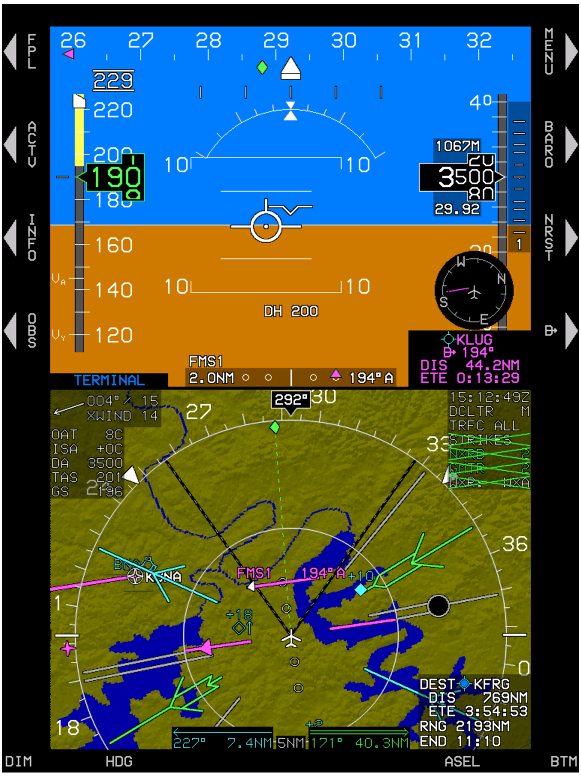


Figure 3-46: PFD with Terrain Deselected but Retained on Map

NOTE:

Independent declutter of obstructions is not possible.

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

3.3.21. Flight Path Marker (Velocity Vector)

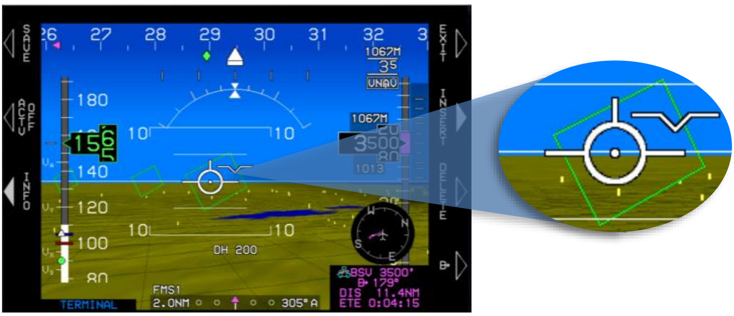


Figure 3-47: Flight Path Marker

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).

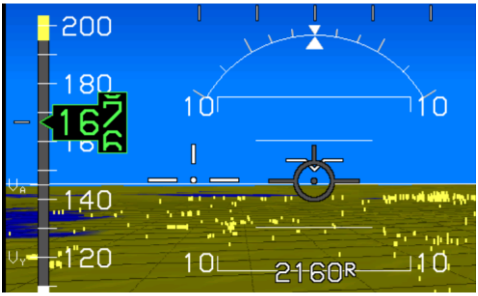
2) In unusual attitude mode, it disappears to allow the user to concentrate on the large aircraft symbol reference marks for unusual attitude recovery.

3) FPM at low speed (airspeed ≤ 45 KIAS) behavior further depends on whether or not the aircraft is in flight or on the ground and whether or not 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 and 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 3-48: Flight Path Marker Views

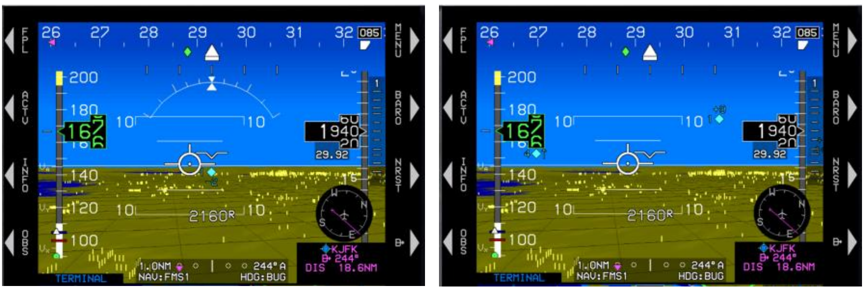
Table 3-10: Flight Path Marker Behavior	
FPM	**Crab Angle**
Cage (Become laterally centered on display)	When exceeding 15° (wide FOV) or 7.5° (narrow FOV mode)
Uncage (Resume lateral floating)	When returning below 13° (wide FOV mode) or 6.5° (narrow FOV mode)
FPM movement is dampened by reference to aircraft pitch and heading so as not to deviate from pitch or heading at a rate greater than 1°/sec.	

FPM Ghost

Figure 3-49: Flight Path Marker Ghost

Figure 3-50: Flight Path Marker Absence

3.3.22. Bank Angle Scale



With Bank Scale Without Bank Scale

Figure 3-51: Bank Angle

The bank scale and roll pointer are centered on the large aircraft symbol reference marks in basic or unusual attitude mode. When decluttering is not selected, the bank angle scale and sky pointer appear full time with a level, 10°, 20°, 30°, 45°, and 60° marks on the left and right sides. In Basic Mode, with the slip indicator enabled, the roll pointer incorporates an integral slip indicator responsive to lateral (Y-axis) G-force.

When not manually decluttered, the bank angle scale appears full-time. Both sky pointer and roll pointer configurations are shown in Figure 3-52, 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. Still, a bank angle scale and sky pointer are displayed when the magnitude of the bank angle exceeds 2.8°.

Sky Pointer

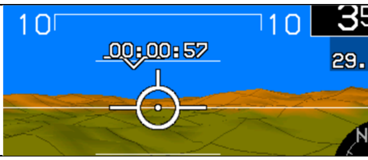
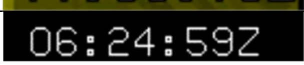
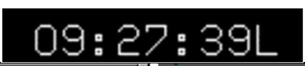
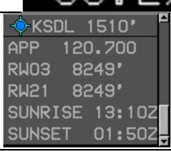
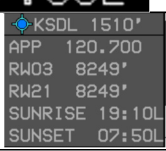
Roll Pointer

Figure 3-52: Roll vs. Sky Pointer

3.3.23. Timer and Time Indications

When selected, a countdown or count-up timer is displayed above the FPM or large aircraft symbol reference marks.

Table 3-11: Time Menu Options

	Count up and countdown timers appear on the PFI (or MFD in Essential Mode) above the FPM or large aircraft symbol reference marks.
	Flight timer appears on PFD or MFD for 10 seconds or until any button is pressed or ❶, ❷ or ❸ are rotated or pushed. It begins as soon as the aircraft transitions from ground mode to air mode and continues until the EFIS is powered down.
 	Zulu or UTC offset for Local time appears in the upper right corner of Map, HSI, Strikes, Traffic, Datalink, and WX-RDR pages.
 	Zulu or UTC offset for Local time appears in the upper left corner of Nav Log.
 	Sunrise and Sunset in Zulu or Local time

3.3.24. Marker Beacon Symbology

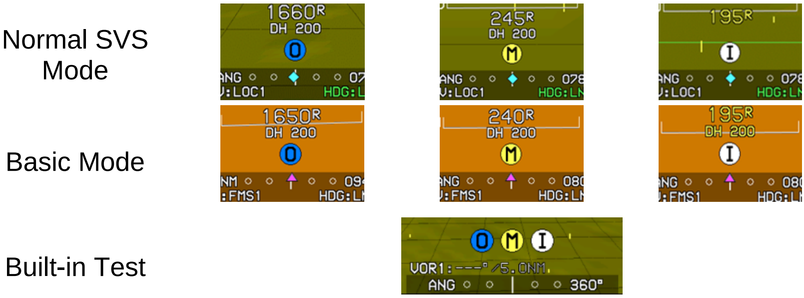


Figure 3-53: Marker Beacons

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 and 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.

3.3.25. Flight Director Symbology

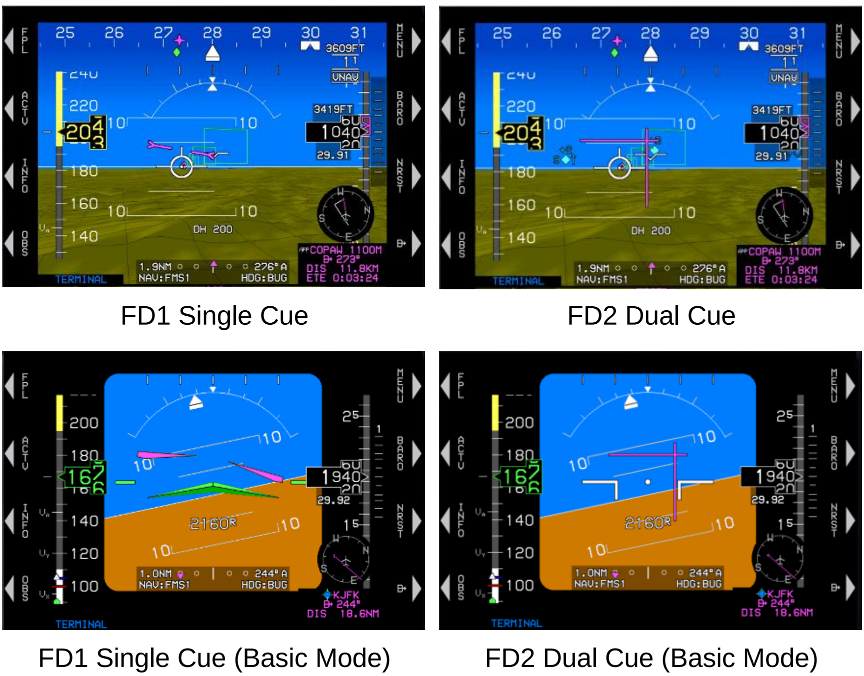
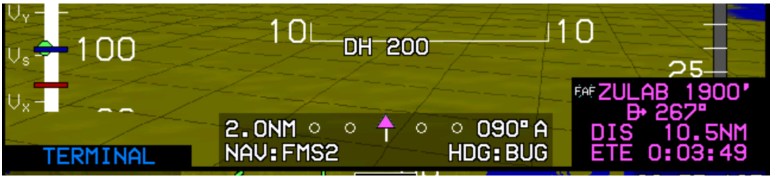


Figure 3-54: Flight Director

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 with one of the following symbols shown in normal mode. A waterline symbol 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.

3.3.26. Course Deviation Indicator

Without Autopilot



With Autopilot

Figure 3-55: 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 user 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 3-12 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 3-12: CDI Behavior and Color

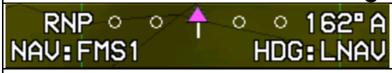
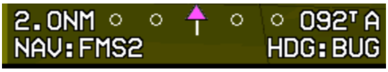
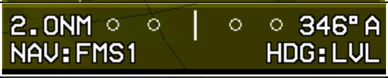
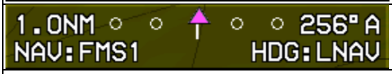
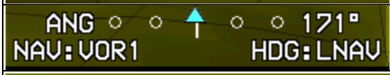
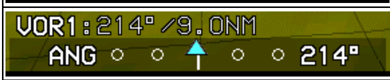
CDI Pointer and Condition	Color or Behavior
Full-Scale Deflection	Flash
Slaved to GPS/SBAS Scale is an appropriate FSD value for the mode of flight: En route: ±2NM From En route to Terminal: Change from ±2 NM FSD to ±1 NM FSD over a distance of 1 NM; start transition when entering terminal mode. From 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 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 105°)
	Red "X" displayed over CDI
	Holding the wings level
	Selected nav source FMS1
	Selected nav source FMS2 (Only available if a second GPS/SBAS receiver is installed).

Table 3-12: CDI Behavior and Color	
CDI Pointer and Condition	**Color or Behavior**
	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 105°)
	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

3.3.27. 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 105°)

4) NAV: VOR2/LOC2

3.3.28. Heading/Roll-Steering Sub-Mode

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

1) HDG: LVL (wing-leveling sub-mode guidance)

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

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

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

3.3.29. 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.

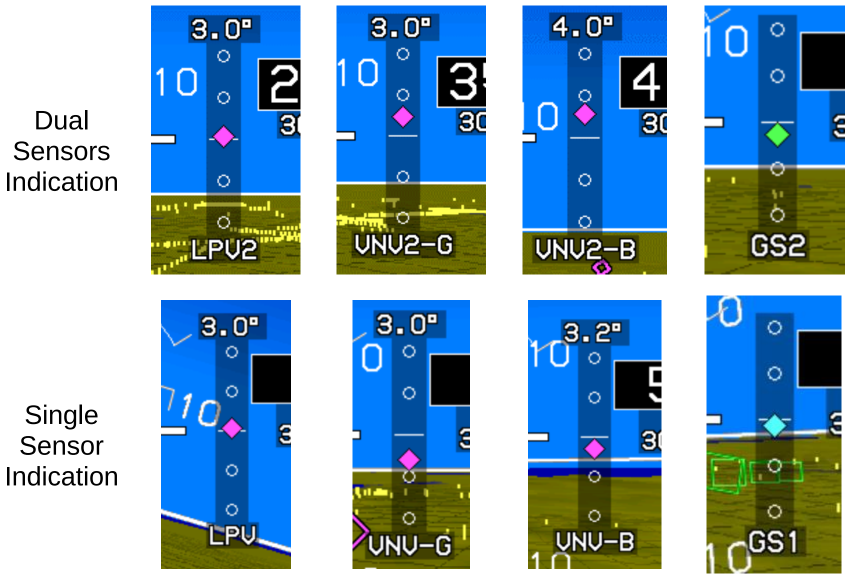


Figure 3-56: Vertical Deviation Indicator

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 user 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 user may follow guidance to LNAV minima as long as the specified temperature is within limits.

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

Figure 3-57: VDI Color during GPS/SBAS LON or VLON

Table 3-13: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
FMS	Conforms to the VDI display	Magenta
Glide Slope	The source must be valid when a valid glide slope is received.	Magenta (FMS), Cyan (VLOC 1), or Green (VLOC 2)
LPV or VNAV mode	The source is valid if: On VNAV descent segments when approaching the Top of Descent point to provide descent anticipation as long as 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	Magenta

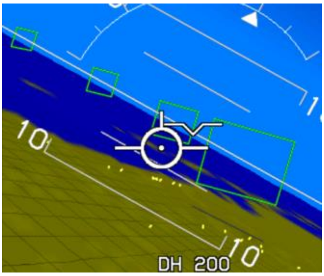
Table 3-13: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
	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 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 LON or GPS VLON	Pointer and Text Color Amber (Yellow)

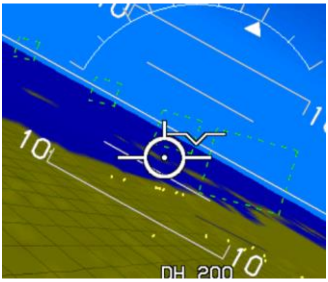
NOTE:

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.

3.3.30. Highway in the Sky/Skyway



Coupled to Skyway

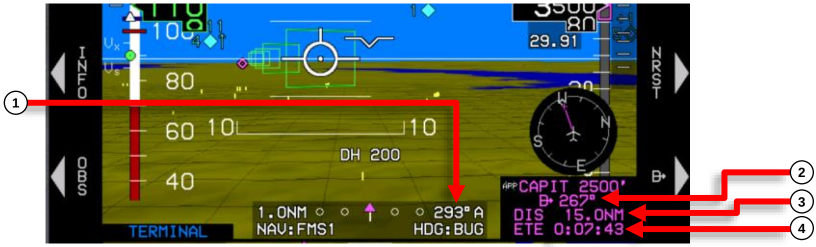


Uncoupled to Skyway

Figure 3-58: Highway in the Sky

When not decluttered, the EFIS displays the active navigation route or manual 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 7 IFR Procedures for details.

3.3.31. Active Waypoint and Waypoint Identifier



1) Instantaneous Bearing to Desired Track
2) Path to waypoint
3) Along-track Distance to Active Waypoint
4) ETE or ETA based on Along-track Distance

Figure 3-59: Active Waypoint

The EFIS displays the active waypoint symbol as 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.

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 but turns amber (yellow) in the event of GPS 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 3-60, the identifier includes a display of the VNAV altitude.

NOTE:

Only the active waypoint is shown on the PFI. 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.

Suppose the active waypoint is beyond the lateral limits of the display. In that case, the magenta waypoint direction pointer (i.e., magenta triangle) on the directional scale indicates the shortest turn direction 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 (e.g., VOR, NDB, user waypoint, or airport).

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

3.3.32. 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 3-60: Mini Map

Table 3-14: Mini Map Behavior (When Not Decluttered)

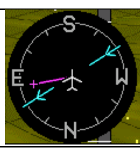
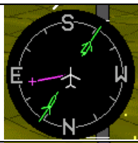
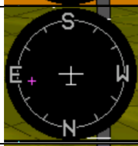
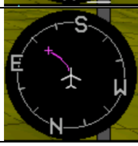
VOR Pointer, Active Leg, Ownship Symbol	Color	Condition
VOR 1	 Cyan	When valid

Table 3-14: Mini Map Behavior (When Not Decluttered)			
VOR Pointer, Active Leg, Ownship Symbol	**Color**		**Condition**
VOR 2		Green	When valid
Active Leg		Magenta	GPS/SBAS normal
		Amber (Yellow)	GPS/SBAS LON condition
Ownship Symbol		Airplane FAR 23 with V_{NE}	White Always
		Airplane with V_{MO}/M_{MO}	

3.3.33. Mini Traffic

Distance in NM

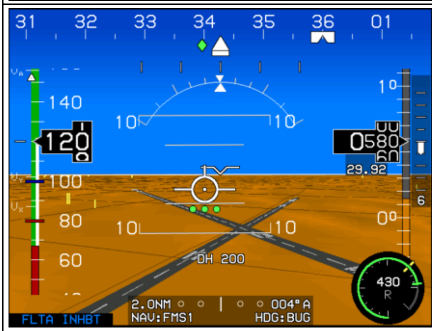
Distance in KM

Figure 3-61: Mini Traffic

When selected from the decluttering options, mini traffic is displayed in the lower right corner of the PFI above the active waypoint identifier. Display of the mini map, mini traffic, 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.

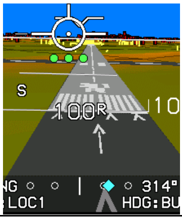
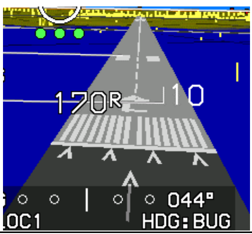
3.3.34. Runways

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.

Table 3-15: Runways	
	With SVS TAWS
	SVS Basic
	TAWS disabled

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 3-16.

Table 3-16: Runway Drawing Criteria

Feature	Color	Notes
Runway markings, aiming point markings, centerline, designation, and displaced threshold arrows	Dark gray 	According to characteristics from the navigation database, e.g., including position, orientation, length, and width
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 	

3.3.35. Imperial Unit Feet and Metric Units

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

VNAV Altitude in Meters

VNAV Altitude in Feet

VSI bug 3,000 fpm descent

Altitude in Meters

Altitude in Feet

Decent rate in fpm

Baro setting in inHg

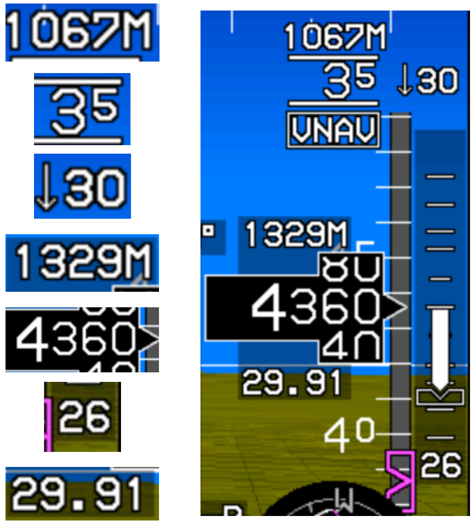


Figure 3-62: Altitude Display (Feet)

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

VNAV Alt in Imperial Feet

VNAV Alt in Meters

VSI Bug set to 15 m/s climb

VSI climb rate 4 m/s

Altitude in Imperial Feet

Altitude in Meters

Baro setting in mbar

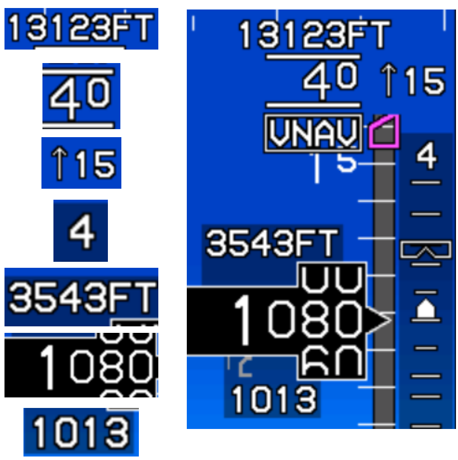


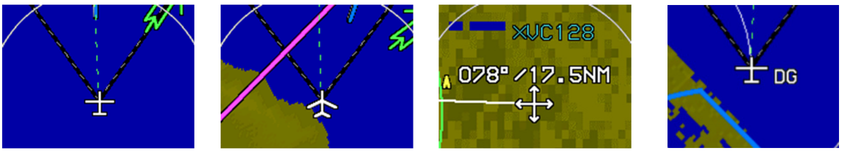
Figure 3-63: Altitude Display (Meters)

3.4. MFD Symbology

Navigation data is presented on a variety of MFD pages:

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

3.4.1. Ownship Symbology



Airplane FAR 23 with V_{NE} | Airplane with V_{MO}/M_{MO} | Pan Mode | AHRS in DG mode

Figure 3-64: Ownship Symbols

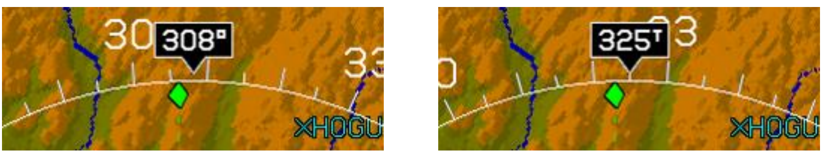
> **NOTE:**
>
> When not panning with the AHRS in the DG mode, “DG” appears to the right of the ownship symbol.

3.4.2. Moving Map

Table 3-17: Moving Map	
Basic Moving Map	
Moving Map with Instrument Approach	
North-Up Arc Mode with HSI Enabled and VOR1 Selected	

Table 3-17: Moving Map	
North-Up Centered Mode with HSI Enabled and VOR1 Selected	
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.	

3.4.3. Compass Rose/Map Boundary Circle Symbol



Normal Mode   True North Mode

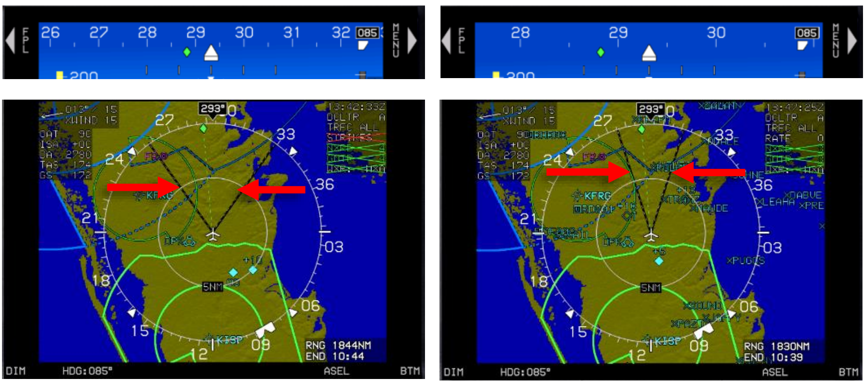
Figure 3-65: Compass Rose

Boundary circle in North Up Mode, a heading pointer appears on the map boundary circle.

Figure 3-66: Map Boundary Circle Symbol

3.4.4. Field of View Indication

FOV is indicated on the background 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.



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

Figure 3-67: Field of View

3.4.5. 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.

Table 3-18: 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

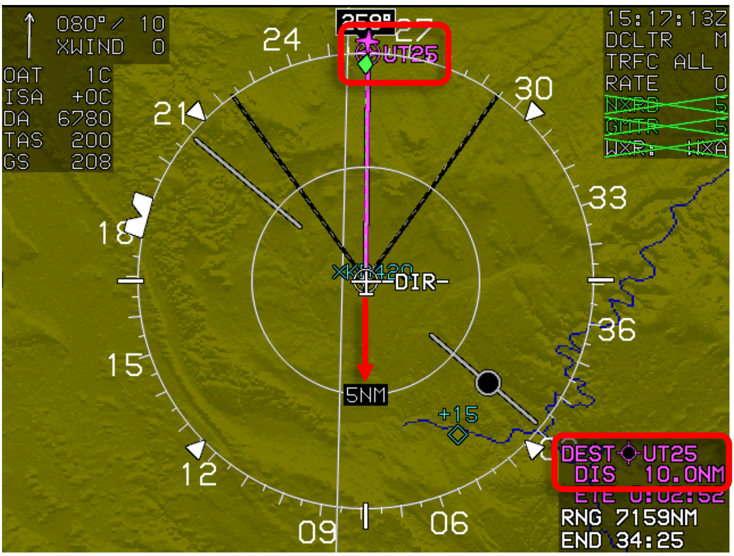


Figure 3-68: Map Range

3.4.6. 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 3-69: Glide Range

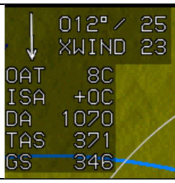
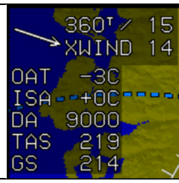
3.4.7. Clock/Options

The data in Table 3-19 are displayed in the upper right corner of the Map page.

<table>
<tr><th colspan="4">Table 3-19: Clock Options</th></tr>
<tr><th>Feature</th><th>Options</th><th colspan="2">Notes</th></tr>
<tr><td>07:14:44Z</td><td>Zulu Time hh:mm:ssZ</td><td colspan="2" rowspan="2">Synchronized with the GPS/SBAS constellation</td></tr>
<tr><td>13:10:50L</td><td>Local Time hh:mm:ssL</td></tr>
<tr><td>Declutter Mode</td><td>DCLTR A
DCLTR M</td><td colspan="2">= Automatic declutter mode
= Manual declutter mode</td></tr>
<tr><td rowspan="3">Terrain Status</td><td rowspan="3">Enabled or Disabled</td><td colspan="2">Indicated by the absence or presence of terrain</td></tr>
<tr><td>~~TERRAIN~~</td><td>Manually turned off</td></tr>
<tr><td>~~TERRAIN~~</td><td>Failed</td></tr>
<tr><td>Traffic Status</td><td colspan="3">See Traffic Appendix</td></tr>
<tr><td>Strikes Status</td><td colspan="3">See Strikes Appendix</td></tr>
<tr><td>Datalink Weather Status</td><td colspan="3">See Datalink Appendix</td></tr>
<tr><td>WX-RDR Status</td><td colspan="3">See WX-RDR Appendix</td></tr>
</table>

3.4.8. Air Data and Ground Speed

Table 3-20: 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. The direction readout uses the degree (°) symbol if referenced to magnetic north. Otherwise, a stylized true north (^{T}) symbol is used.

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

3) Outside Air Temperature: Digitally in °C or °F (as configured).

4) 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.

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

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

3.4.9. Fuel Totalizer/Waypoint Distance Functions NM/KM

GPS in normal state and current active waypoint

GPS in LON condition

GPS in normal state and not the current active waypoint

Figure 3-70: Fuel Totalizer/ Waypoint Distance Functions

Table 3-21: Fuel Totalizer/Waypoint Distance Functions

Function	Conditions	Type/Symbols
TO Waypoint	If there is an active flight plan, waypoint type, identifier, range, bearing, and ETE/ETA for the active waypoint ("TO") are shown. Waypoint information is magenta but turns amber (yellow) with GPS LON caution.	ETA or ETE Degree (°) or True North (^{T}) symbol
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.	
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.	

3.4.10. Navigation Data

Figure 3-71: Navigation Data and Airspace Depiction on Map Page

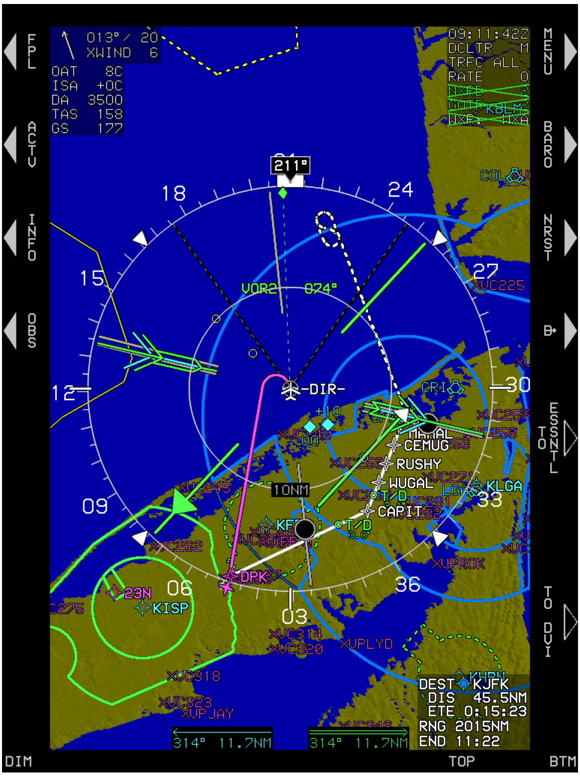


Figure 3-72: Navigation Data and Airspace Depiction (MFD Full Map)

NOTE:

The full map page only has a centered mode.

Navigation symbology is shown in the correct relationship to the ownship symbol and includes the symbols in Table 3-22. 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.

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 3-22: Navigation Symbology

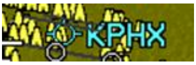
 	High Altitude Airways H AIRWAY ✓	 	Low Altitude Airways L AIRWAY ✓
	IFR Airport LRG APT ✓ IFR APT ✓		NDB NDBS ✓
	VFR Airport VFR APT ✓		DME only or TACAN VORS ✓
	VORTAC VORS ✓		User Waypoint USER WPTS ✓
	VOR VORS ✓		HSI overlay CDI scale HSI ✓
	User Waypoint in Pan Mode USER WPTS ✓		ENR FIXES ✓ TRM FIXES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

Table 3-23: Airspace Depiction

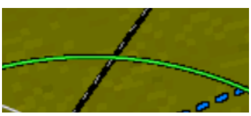
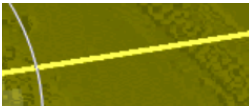
Type of ARINC 424 Airspace		Vertical Limits
	Dashed lines ARSPC CTRL ✓	More than ±500'
	Solid lines ARSPC CTRL ✓	Within ±500'
	Thick solid lines ARSPC CTRL ✓	Within airspace, vertical limits

Table 3-23: Airspace Depiction

Type of ARINC 424 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

3.4.11. Analog Navigation Symbology

When selected and valid, the EFIS displays analog (VOR1 [cyan] and VOR2 [green]) navigation symbology. 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.

Figure 3-73: Analog Navigation Symbology, HSI in ARC Mode

Figure 3-74: Analog Navigation Symbology, HSI in Centered Mode

3.4.12. Borders

National and United States state borders are drawn if selected at all map scales. They are white if the background includes terrain.

Figure 3-75: With International and State Borders

Figure 3-76: Without International and State Borders

3.4.13. Terrain/Obstructions

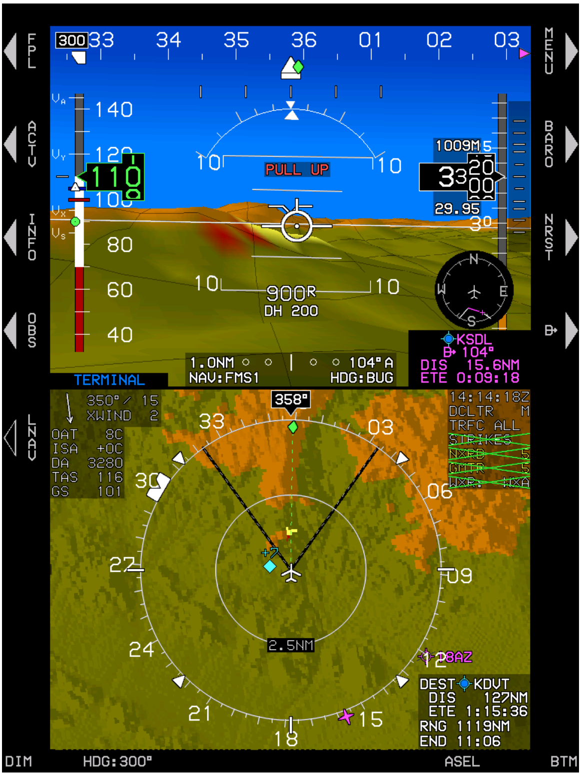


Figure 3-77: Terrain and Obstructions

Terrain and obstruction rendering is user-selectable to declutter the display by deselecting terrain *(independent declutter of obstructions is impossible)*. Furthermore, terrain and obstruction rendering is 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.

The terrain is displayed correctly to the ownship symbol using color to show the relationship to aircraft altitude.

Table 3-24: Terrain Color

Based on Aircraft Altitude	Color	Notes
Terrain at or below 100 feet below aircraft altitude (shades of green)		Terrain slope determines the shade
Terrain above 100 feet less than aircraft altitude (shades of brown)		
FLTA alerts	Amber and Red	See Section 8 TAWS
Water at all altitudes		It takes precedence over other colors

Table 3-25: Obstructions

Distances are always in NM		
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 2000' below aircraft	Not depicted
	Within 2000' but more than 500' below aircraft	Depicted in amber (yellow)
	Above aircraft altitude	Depicted in deep red

> **NOTE:**
>
> See Section 8 Terrain Awareness Warning System for obstructions causing TAWS alarms and depiction of different symbology.

3.4.14. Pan Mode

Pan mode is used to view 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 move the pan mode location north, south, east, and west in a north-up, centered orientation. Upon entering pan mode, the heading pointer, track pointer, lubber line, waypoint pointer, analog navigation symbology, and field of view lines are removed.

Figure 3-78 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 is highlighted with a flashing circle. Buttons are labeled for viewing or hiding waypoint information. When exiting pan mode, all settings are restored as before pan mode was enabled.

Figure 3-78: Pan Mode

3.4.15. Direct Point

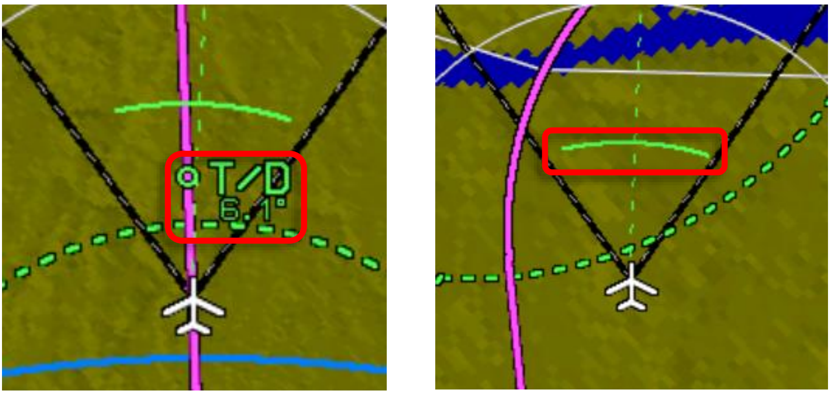
Unnamed waypoints appear depending on the procedure loaded when a direct-to command is entered. See Section 7 IFR Procedures for more information.

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 3-79: Direct Point

3.4.16. Altitude Capture Predictor/Top-of-Descent

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, altitude is captured and shown as a green arc ahead of the aircraft, marking the bottom-of-descent or top-of-climb point.



Top of Descent | Top of Climb/Bottom of Descent

Figure 3-80: Top-of-Descent or Top-of-Climb

3.4.17. 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.

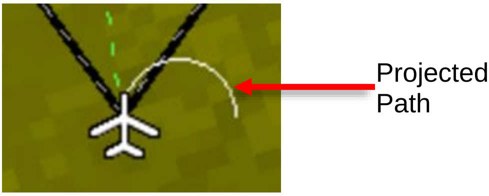


Figure 3-81: Projected Path

3.4.18. Active Flight Plan Path/Manual Course/Runways

3.4.18.1. Parallel Track

When an active flight plan and GPS/SBAS OBS setting are automatic, the flight plan path is shown in the correct relationship to the ownship symbol. See Section 5 Menu Functions and Procedures for details on creating a parallel track.

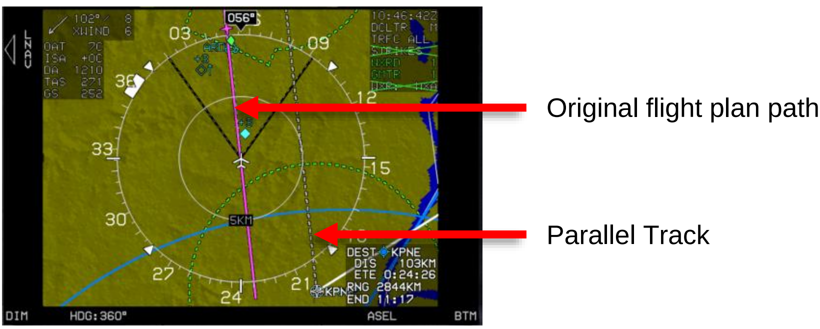


Figure 3-82: Parallel Track

3.4.18.2. 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 7 IFR Procedures for further details.

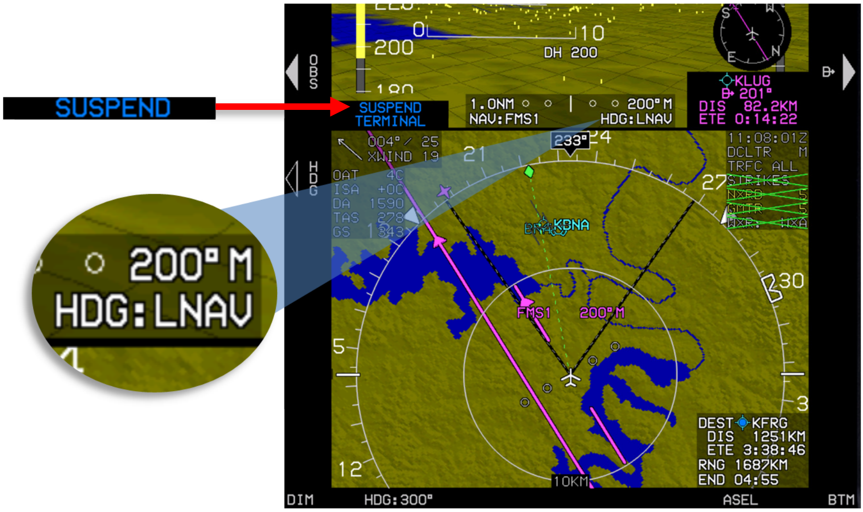


Figure 3-83: GPS/SBAS OBS Manual

3.4.18.3. Active Flight Plan Path

Figure 3-84: Loss of Navigation

3.5. HSI Page

When selected the following are displayed (as defined in Figure 3-85):

1) FMS1/FMS2 navigation with single magenta line,
2) VOR1 navigation with a single cyan line course pointer,
3) VOR2 navigation green double line course pointer,
4) ADF1 single line, or
5) ADF2 double line tuned to an NDB.

When the signal is invalid, the associated pointer is not shown. When the HSI NAV source fails, a red "X" is displayed in place of the HSI deviations.

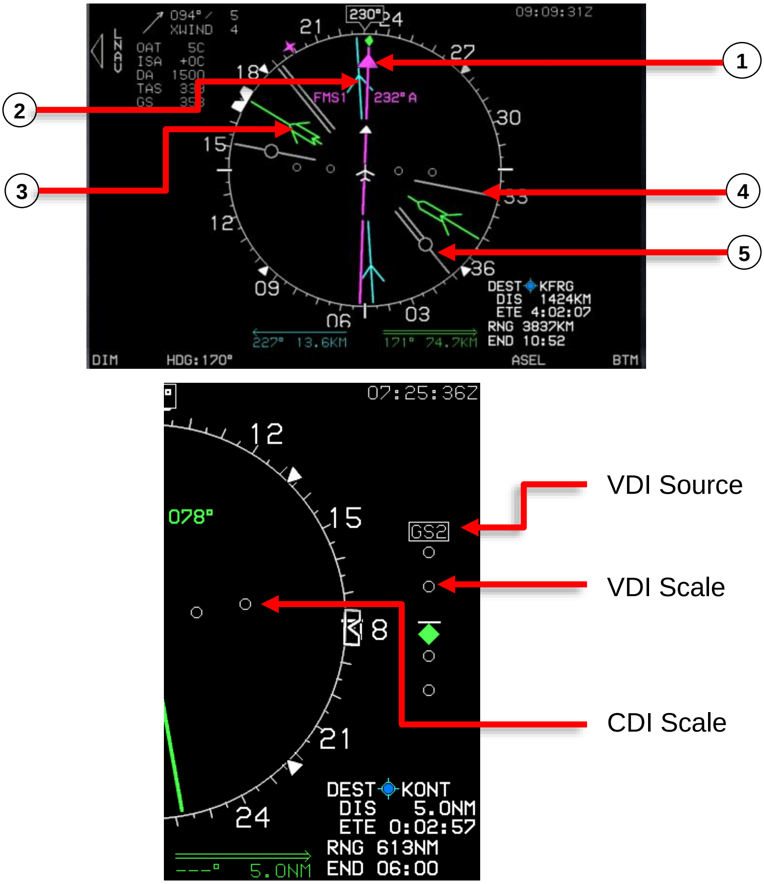


Figure 3-85: HSI Page

3.5.1. Compass Rose Symbols

Normal Mode

True North Mode

Figure 3-86: Compass Rose

When selected, a digital heading readout and pointer aligned with the longitudinal axis of the ownship symbol appears on the compass rose boundary circle. The heading readout uses the degree (°) symbol if referenced to magnetic north. Otherwise, a stylized true north.

See Section 7 IFR Procedures for the 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

3.5.2. Clock

Zulu Time

Local Time

Figure 3-87: HSI Clock

Zulu or Local Time: As specified in § 3.4.7.

3.5.3. Air Data and Ground Speed

Air data and ground speed are displayed as specified in § 3.4.8.

Figure 3-88: HSI Display Air Data and Ground Speed

3.5.4. Fuel Totalizer/Waypoint Distance Functions

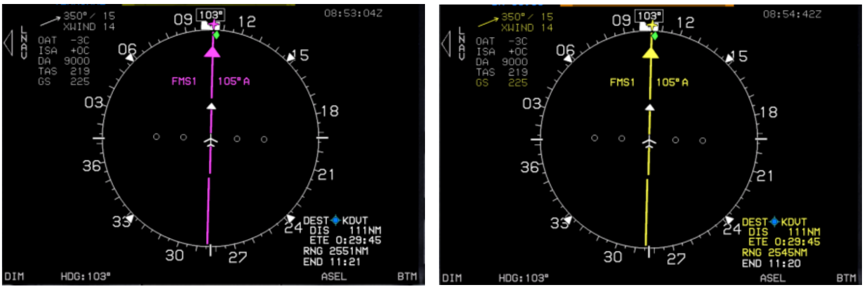
Fuel totalizer, waypoint, and waypoint distance are displayed on the HSI as specified in § 3.4.9.

Figure 3-89: HSI Fuel Totalizer/Waypoint Functions

3.5.5. Conventional HSI/PTR Format

When selected, the EFIS 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);
2) Cyan (if VLOC1 is the selected navigation source);
3) Green (if VLOC2 is the selected navigation source); or
4) Amber (Yellow) when HSI is slaved to GPS/SBAS, and there is a GPS LON condition.



Normal Magenta Pointer **GPS LON Amber (Yellow) Pointer**

Figure 3-90: HSI Pointer Color

The ownship symbol (Figure 3-64) 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.

3.6. HSI CDI and VDI Scale

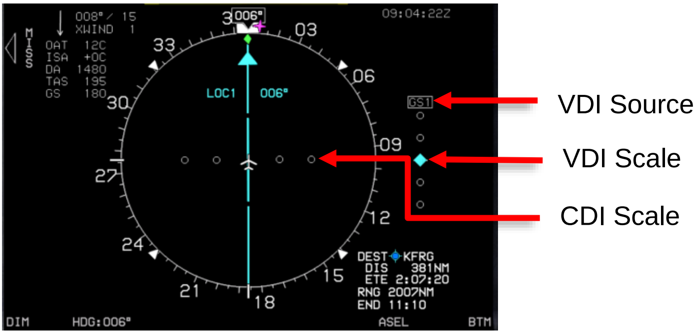


Figure 3-91: CDI Scale with VDI

A VDI appears when the VDI source is valid to display vertical deviation information for the currently selected navigation source. When the selected source is FMS, the VDI displayed on the HSI has the same behavior as the VDI displayed on the PFI, except for the VDI source displayed on the top of the VDI to avoid clutter with the following waypoint.

1) LPV1 or, if a second GPS/SBAS receiver is not installed, LPV. Annunciation is made when descending on the final approach segment in LPV mode.
2) LPV2 (only available if a second GPS/SBAS receiver is installed). Annunciation is made when descending on the final approach segment in LPV mode.
3) VNV1-G or, if a second GPS/SBAS receiver is not installed, VNV-G. Annunciation is made when descending on the final approach segment in LP, LNAV/VNAV, LNAV, or RNP modes when using GPS VNAV.
4) VNV2-G (only available if a second GPS/SBAS receiver is installed). Annunciation is made when descending on the final approach segment in LP, LNAV/VNAV, LNAV, or RNP modes when using GPS VNAV.
5) VNV1-B: Default FMS barometric VNAV mode.
6) VNV2-B: Default FMS barometric VNAV mode.
7) GS1: Glide slope #1.
8) GS2: Glide slope #2.

3.6.1. Analog Navigation Symbology

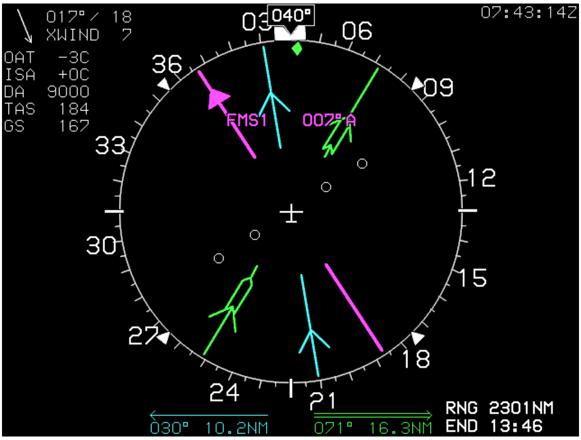
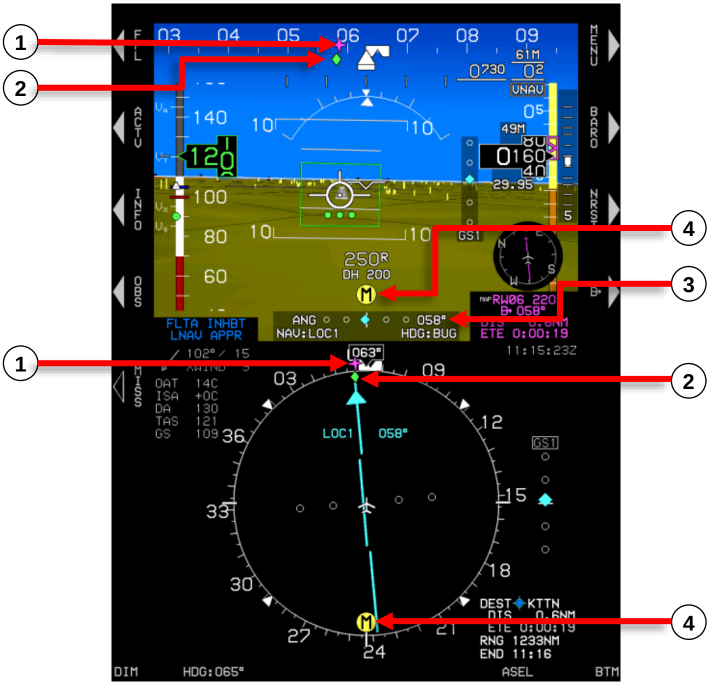


Figure 3-92: HSI (VOR1/VOR2)

When selected, the HSI displays analog (VOR1 [cyan] and VOR2 [green]) navigation symbology with an RMI pointer format overlaid on the HSI. When the signal is invalid, the associated pointer is not shown. When the signal is valid for VOR1 and VOR2, a bearing and distance display for the selected VOR pointers appears at the bottom of the display in the same color as the respective pointer. When an ADF2 is enabled, the ADF2 double pointer is shown in Figure 3-92.

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



1) Magenta bearing pointer to the active waypoint
2) Green track pointer
3) Final approach course
4) Valid marker beacon

Figure 3-93: HSI with Marker Beacon Displayed

3.7. Navigation Log

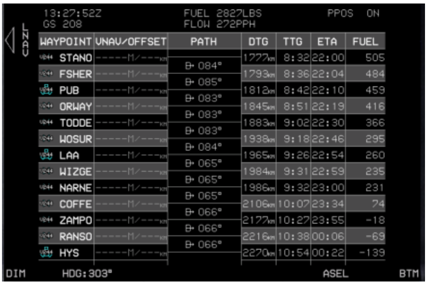
The NAV Log may be set to Waypoint to Waypoint (Wpt to Wpt) or Present Position to Waypoint (PPOS to WPT) display format as defined in Table 3-26.

Table 3-26: 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)
ETE	Time to Go (TTG)
ETA	ETA
Fuel Remaining	Fuel Remaining

PPOS status is annunciated in the upper right corner of the Nav Log.

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



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

Figure 3-94: Navigation Log

3.7.1. Clock and Ground Speed

The following are displayed in the upper left corner:

1) Zulu Time or Local Time: As specified in § 3.4.7.

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

3.7.2. 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.

3.7.3. 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 an available datalinked METAR, a graphical METAR is displayed as a colored fill within the circular part of the airport symbol, the convention as defined in Table 3-27.

Table 3-27: Datalinked 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	

Legends are drawn on top of the navigation data symbol 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.

3.7.4. 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 nautical miles or kilometers.

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 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). The vertical position of the VNAV and VNAV Offset column elements is aligned with the Waypoint Identifier column elements to indicate that the VNAV information applies to the associated waypoint.

NOTE:

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

3.7.5. 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 is 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, Race Track, 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.

3.7.6. 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. In the case of suppressed waypoints, skipped waypoints, discontinuities, or manual transitions, the distances between waypoints are shown in dashes. Distance column elements are offset from waypoint identifier column elements to indicate distance information applies to the leg between waypoints.

3.7.7. 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. In the case of suppressed waypoints, skipped waypoints, discontinuities, or manual transitions, the distance between waypoints is shown in dashes. ETE column elements are offset from waypoint identifier column elements to indicate that ETE information applies to the leg between waypoints.

3.7.8. 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. The ETA is shown as dashes in the case of suppressed waypoints, skipped waypoints, or manual terminations. ETA column elements align with waypoint identifier column elements to indicate ETA information applies to the associated waypoint.

3.7.9. 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. In the case of suppressed waypoints, skipped waypoints, or manual terminations, the remaining fuel is shown as dashes. The vertical position of the Fuel Remaining column elements is aligned with the Waypoint Identifier column elements to indicate that the fuel remaining information applies to the associated waypoint.

3.7.10. Distance To Go Column (DTG)

The distance between the waypoint and present position is displayed immediately to the right of the Path column. The distance readout is in nautical miles or kilometers. The distance between the waypoint and present position is calculated considering the associated path and parallel offsets. In the case of suppressed waypoints, skipped waypoints, discontinuities, or manual terminations, the distance between the waypoint and the present position is shown as dashes. The vertical position of the DTG column elements is aligned with the Waypoint Identifier column elements to indicate that the distance information applies to the associated waypoint.

3.7.11. 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. In the case of suppressed waypoints, skipped waypoints, discontinuities, or manual terminations, the TTG between the waypoint and present position is shown as dashes. The vertical position of the TTG column elements is aligned with the Waypoint Identifier column elements to indicate that the TTG information applies to the associated waypoint.

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:

1) Path data
2) Distance data
3) ETE data
4) ETA data
5) Fuel remaining data

Section 4 Reversionary Modes

4.1. 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.

To use this section, review the following table and notes to determine what feature or function is affected by one or more of the three sensors failed conditions. Examples follow with the IDU-680 displays in various configurations with a table breaking down the affected functions.

Not all possible IDU-680 display configurations and format combinations are represented here. All eight modes of system operation are represented for description purposes.

Table 4-1: PFD Functions

Function	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	-	-	-	-	-	-
G-meter	OK	OK	OK	-	OK	-	-	-
Ground Track	7	1	7	7	-	-	7	-
Heading Indicator	7	7	7	-	7	-	-	-
Horizon	OK	OK	OK	-	OK	-	-	-
Mini Map	7	1	7	7	-	-	7	-
Pitch Limit Indicator	OK	OK	-	8	-	8	-	-
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	-	-	-	-	-	-
Dynamic Stall Speed	OK	OK	-	8	-	8	-	-

Table 4-2: MFD Functions

Function	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	-
Glide Range	9	1	-	10	-	-	-	-
Groundspeed	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	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), 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: Based upon 1G stall speed.

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.

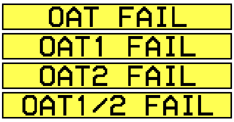
Note 22: N/A

Note 23: Assuming valid fuel flow information, both range and endurance are presented.

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, endurance only information is presented.

Note 25: Inhibited in accordance with the conditions specified in TAWS automatic inhibit function (abnormal operation).

4.1.1. OAT Sensor Failure Mode



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 4-1: OAT Sensor Fail

4.1.2. 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 4-2: GPS TRK

4.1.3. 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 have the ability to 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)**.

4.1.4. 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 4-3: 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) 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.

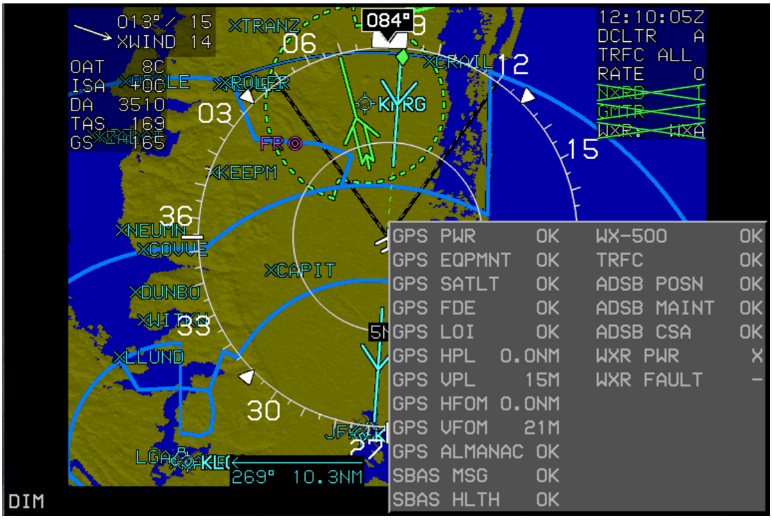
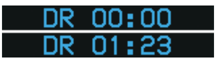


Figure 4-4: Faults Menu on MFD

4) 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 4-5: Dead Reckoning (DR)

5) Loss of Vertical Navigation (VLON)

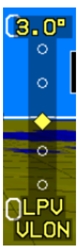


Figure 4-6: Loss of Vertical Navigation (VLON)

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.

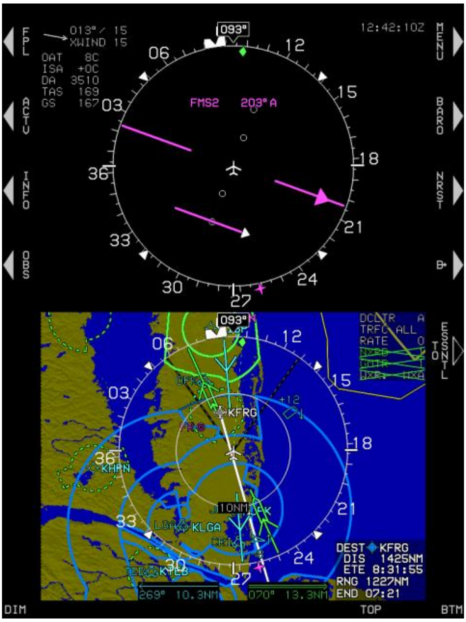
4.2. PFD and MFD Failure Mode Examples

GPS failure results in the EFIS operating in dead reckoning mode. The EFIS continues to provide navigational position, groundspeed, and ground track information, based upon the last known wind, current air data, and heading. The PFD and MFD are affected as follows:

4.3. PFD Failure Mode 0

Figure 4-7: PFD Failure Mode 0
GPS, ADC and AHRS Normal

4.3.1. MFD Failure Mode 0



Normal Mode

Essential Mode

Figure 4-8: MFD Failure Mode 0
GPS, ADC and AHRS Normal

4.4. PFD Failure Mode 1

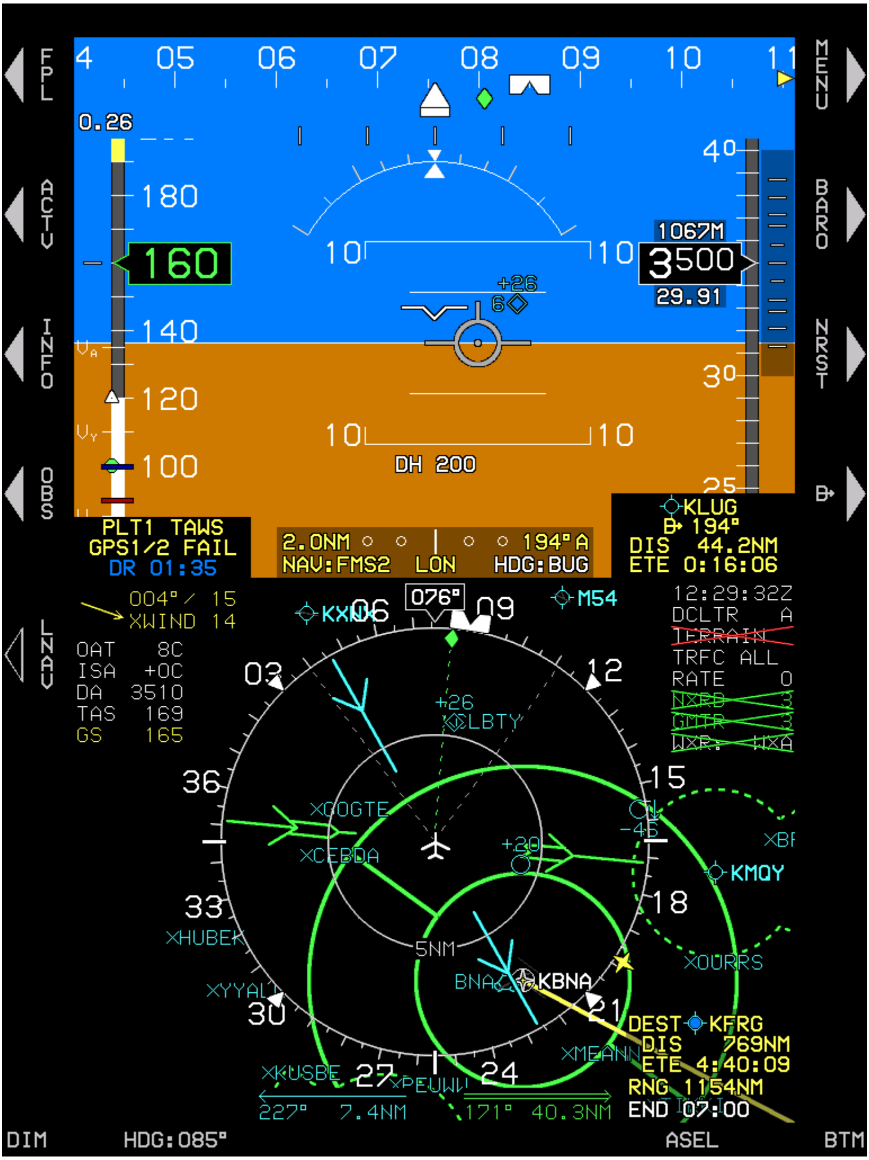
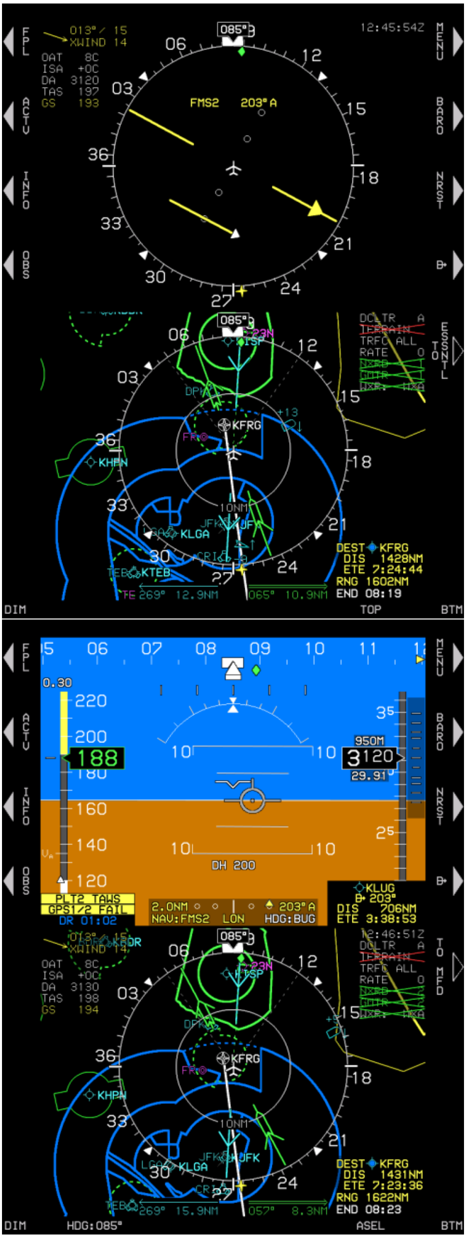


Figure 4-9: PFD Failure Mode 1
GPS/SBAS Failed, ADC and AHRS Normal

4.4.1. MFD Failure Mode 1



Normal Mode

Essential Mode

Figure 4-10: MFD Failure Mode 1
GPS/SBAS Failed, ADC and AHRS Normal

4.5. PFD Failure Mode 2

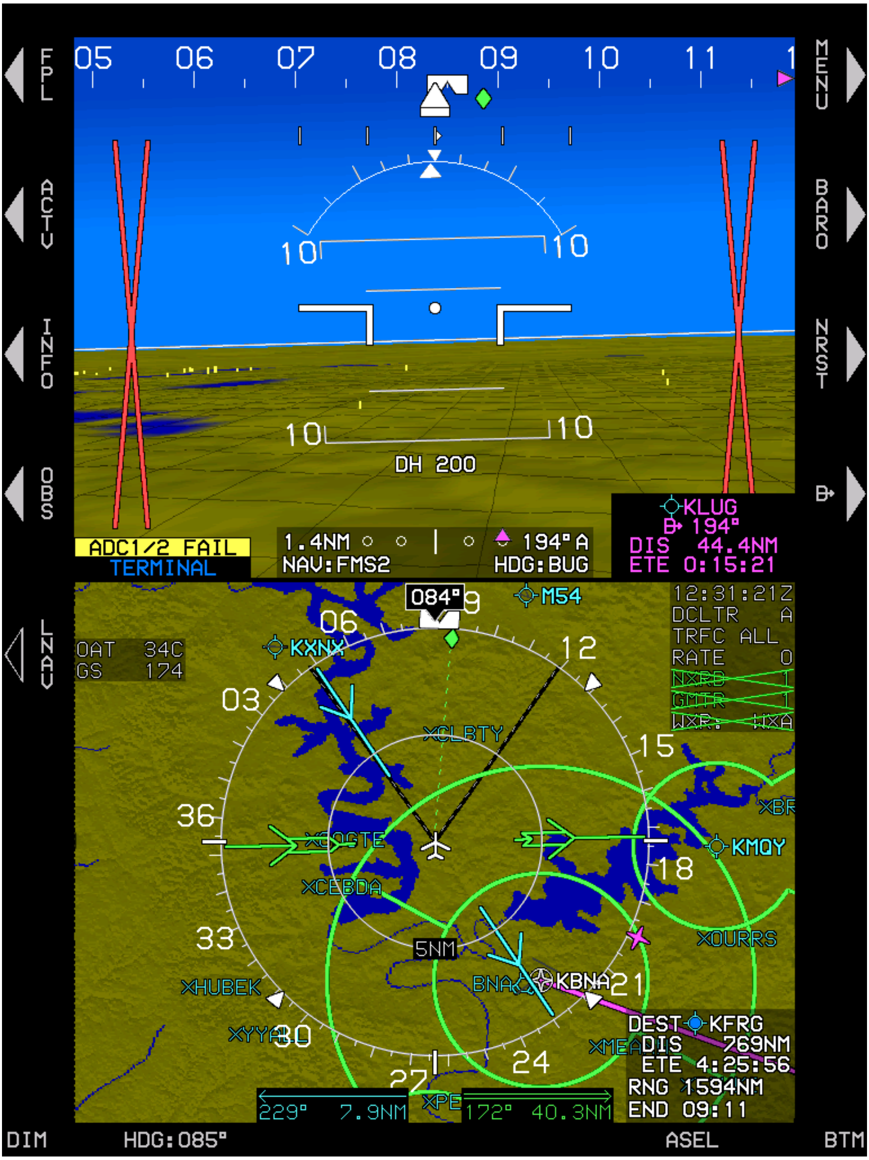


Figure 4-11: PFD Mode 2
ADC Failed, GPS/SBAS and AHRS Normal

4.5.1. MFD Failure Mode 2

Normal Mode

Essential Mode

Figure 4-12: MFD Failure Mode 2
ADC Failed, GPS/SBAS and AHRS Normal

4.6. PFD Failure Mode 3

Figure 4-13: PFD Failure Mode 3
AHRS Failed, GPS/SBAS and ADC Normal

4.6.1. MFD Failure Mode 3

Normal Mode

Essential Mode

Figure 4-14: MFD Failure Mode 3
AHRS Failed, GPS/SBAS and ADC Normal

4.7. PFD Failure Mode 4

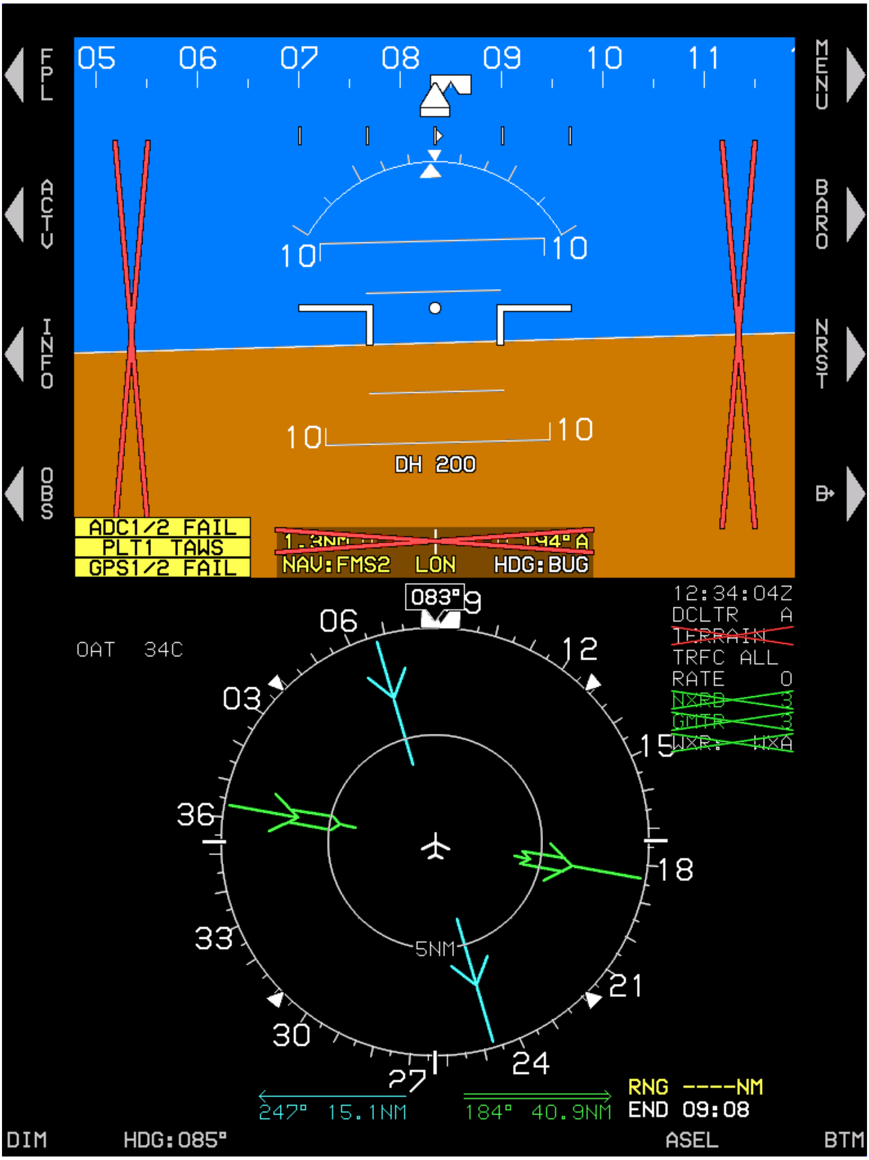
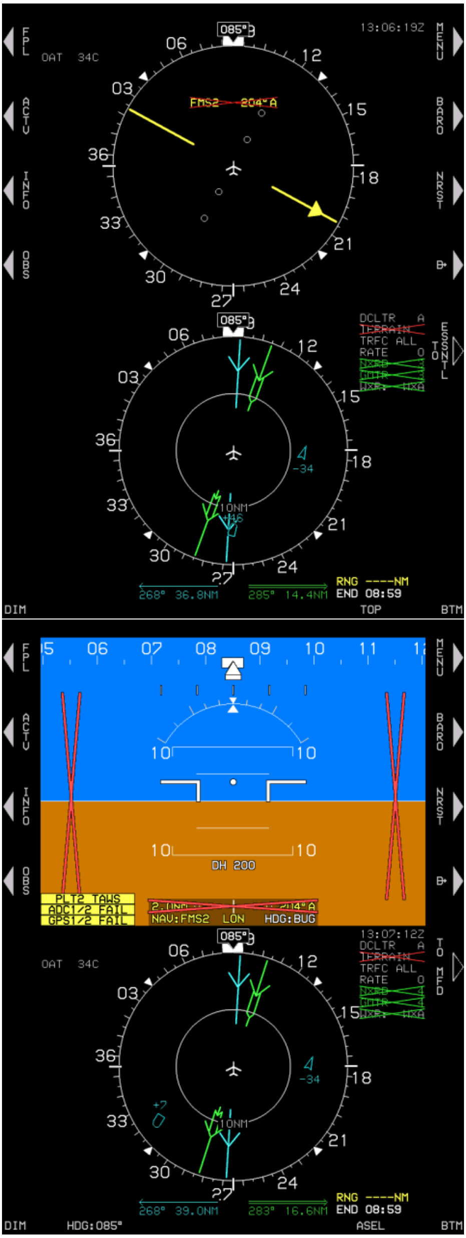


Figure 4-15: PFD Failure Mode 4
GPS/SBAS and ADC Failed, AHRS Normal

4.7.1. MFD Failure Mode 4



Normal Mode

Essential Mode

Figure 4-16: MFD Failure Mode 4
GPS/SBAS and ADC Failed, AHRS Normal

4.8. PFD Failure Mode 5

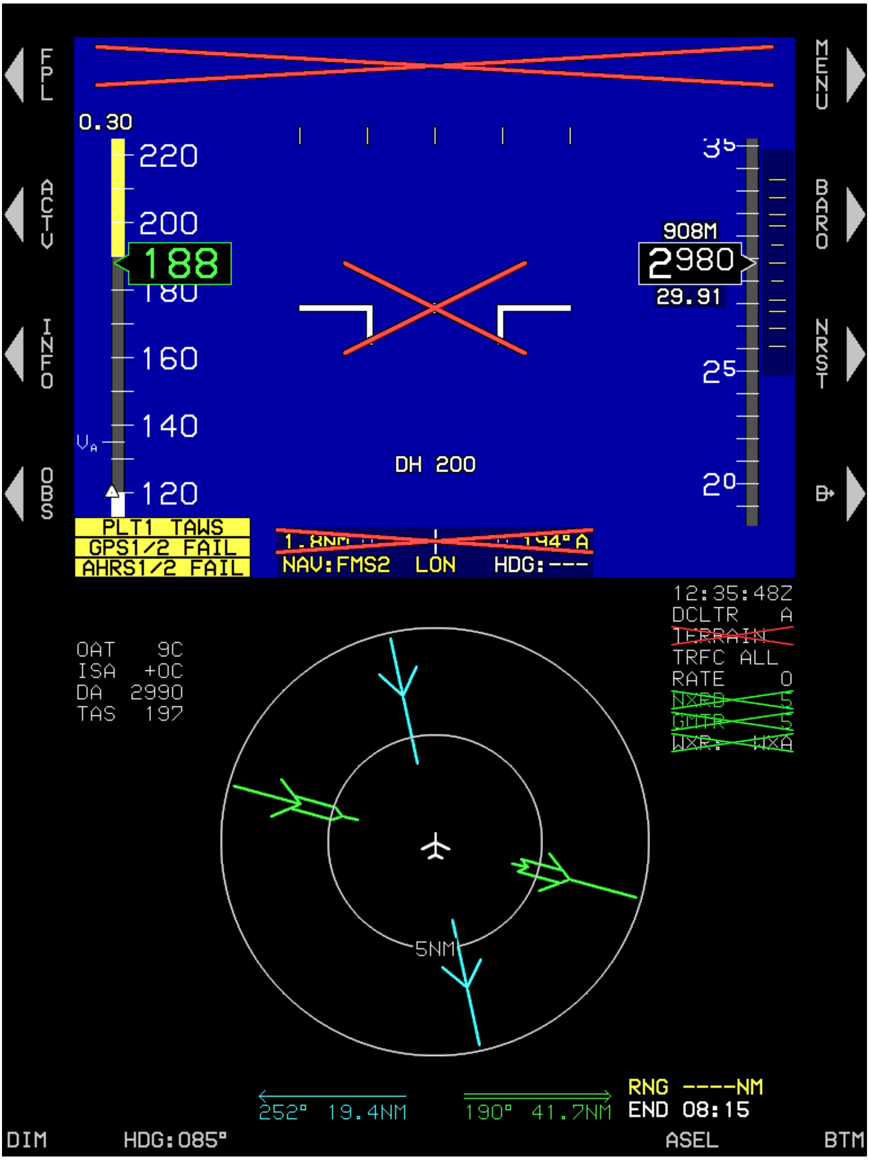
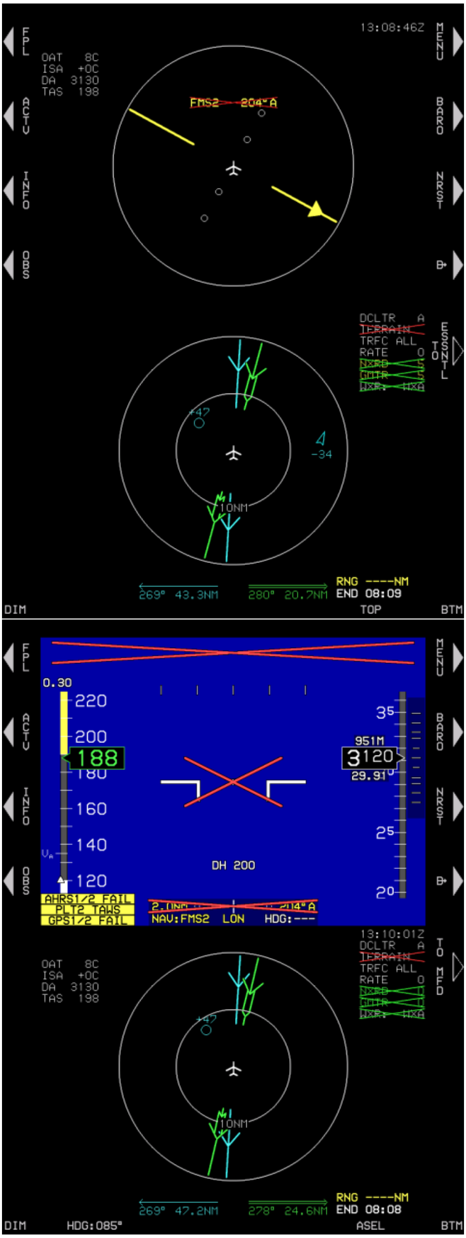


Figure 4-17: PFD Failure Mode 5
GPS/SBAS and AHRS Failed, ADC Normal

4.8.1. MFD Failure Mode 5



Normal Mode

Essential Mode

Figure 4-18: MFD Failure Mode 5
GPS/SBAS and AHRS Failed, ADC Normal

4.9. PFD Failure Mode 6

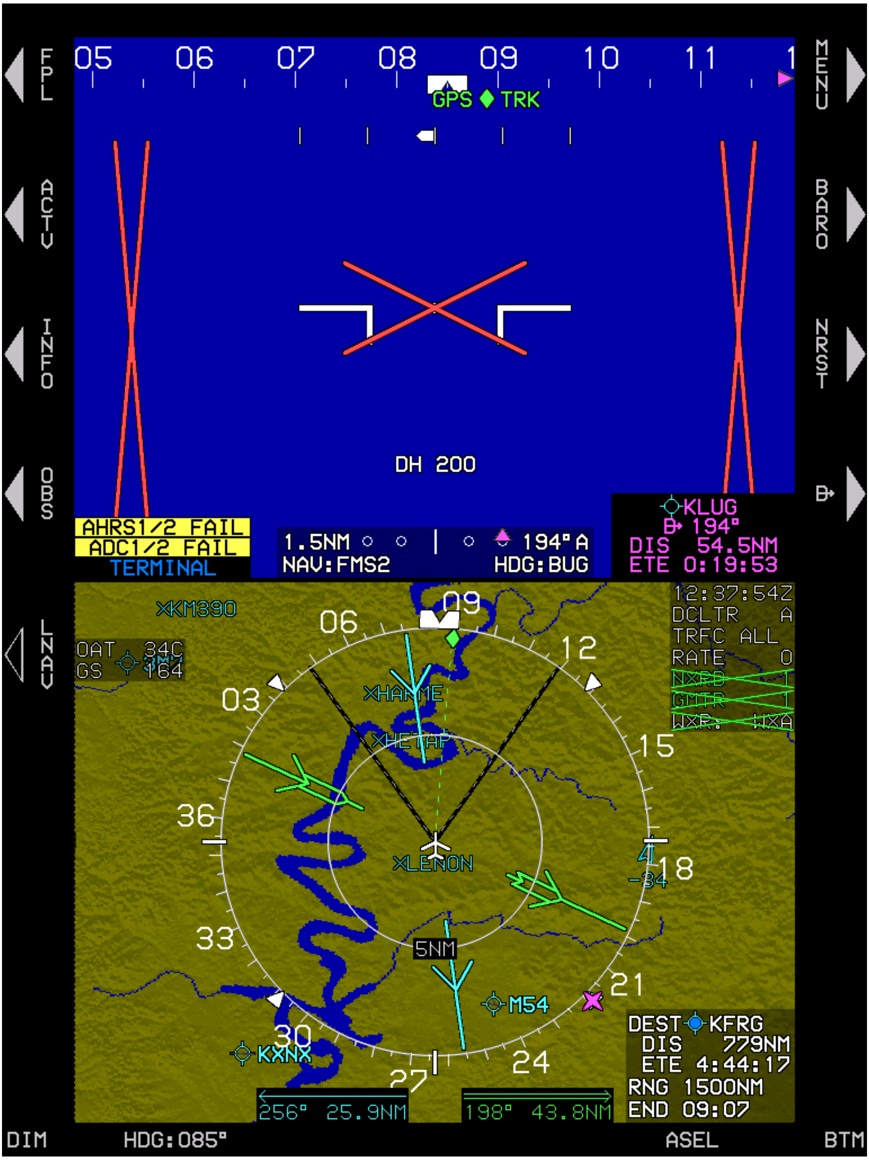
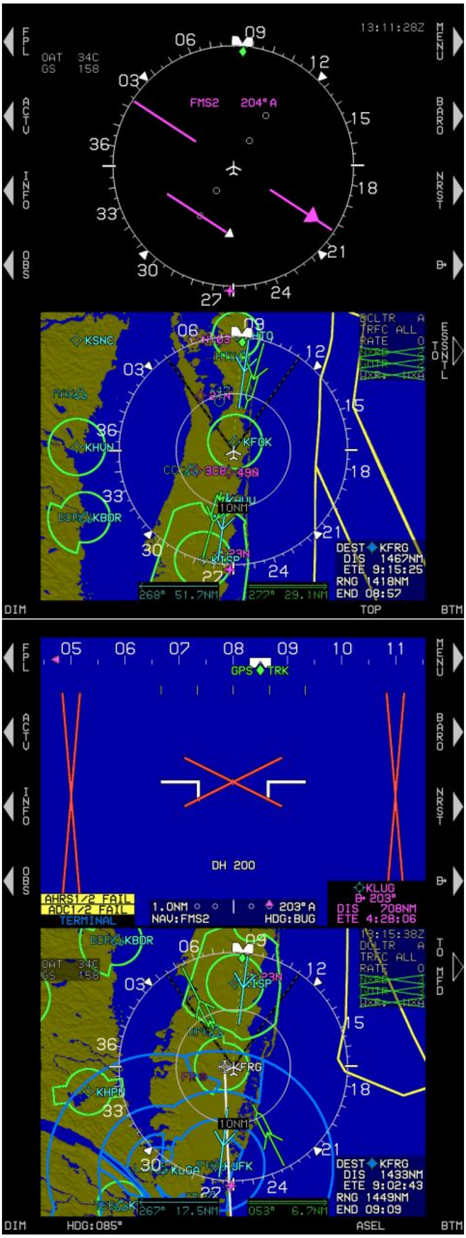


Figure 4-19: PFD Failure Mode 6
ADC and AHRS Failed, GPS/SBAS Normal

4.9.1. MFD Failure Mode 6



Normal Mode

Essential Mode

Figure 4-20: MFD Failure Mode 6
ADC and AHRS Failed, GPS/SBAS Normal

4.10. PFD Failure Mode 7

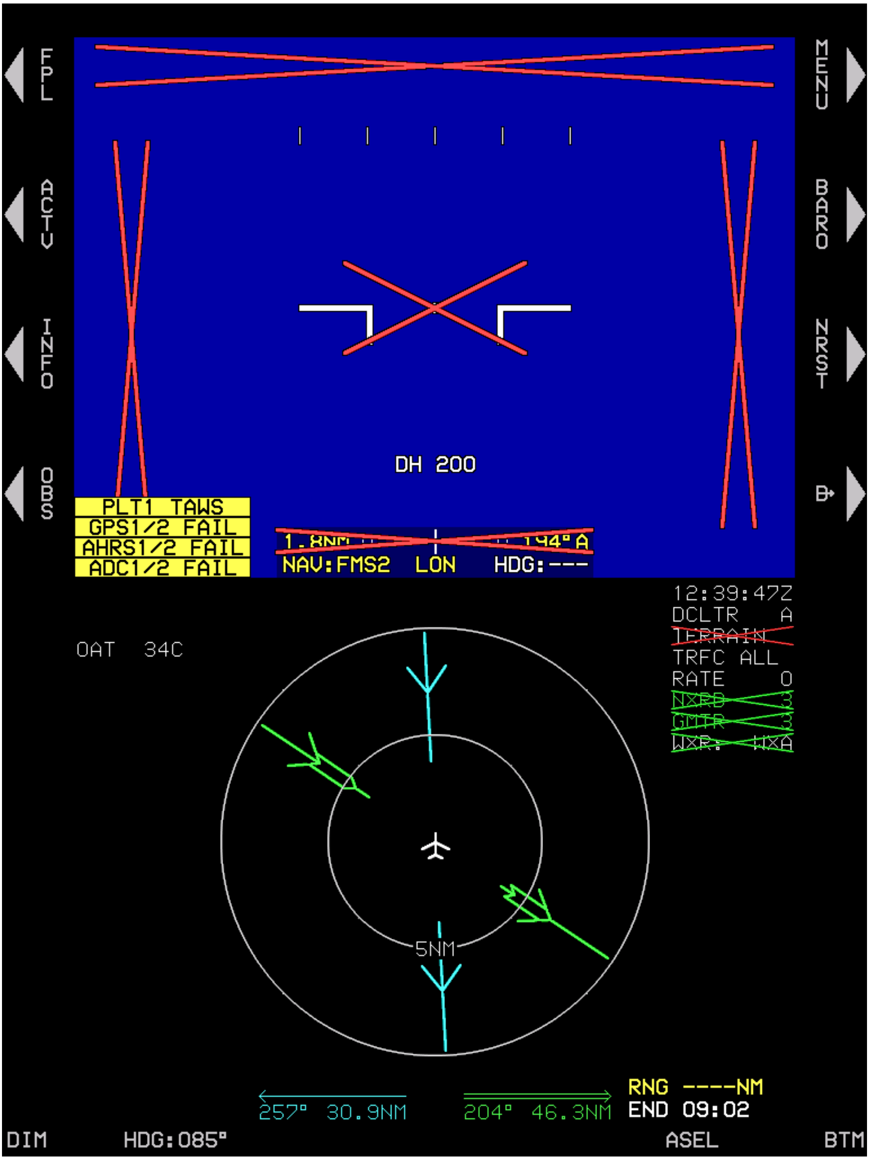
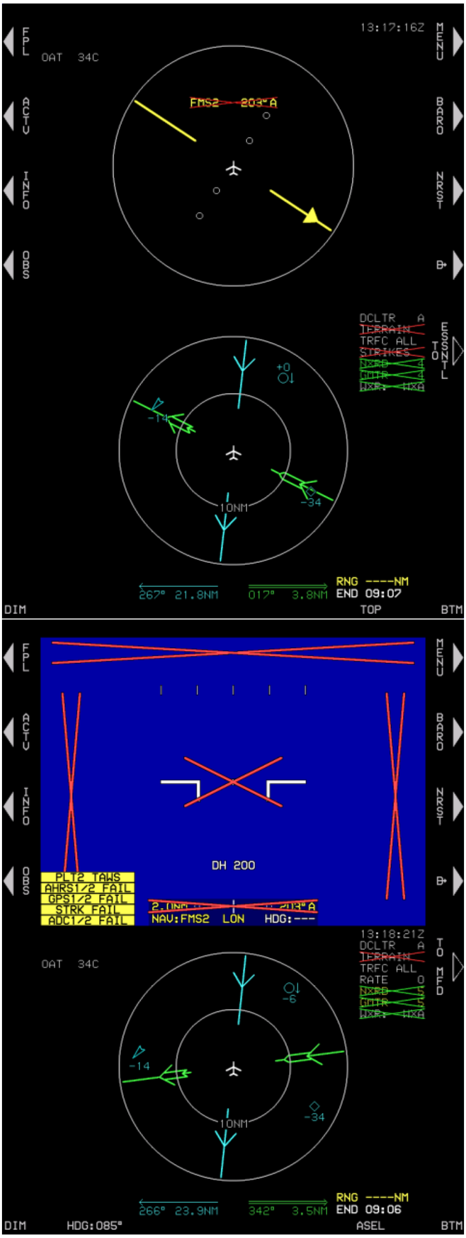


Figure 4-21: PFD Failure Mode 7
GPS/SBAS, ADC and AHRS Failed

4.10.1. MFD Failure Mode 7



Normal Mode

Essential Mode

Figure 4-22: MFD Failure Mode 7
GPS/SBAS, ADC and AHRS Failed

Section 5 Menu Functions and Step-By-Step Procedures

5.1. Menu Functions

Navigate menu functions with the 16 peripheral buttons and 4 knobs (❹,❸,❷, and ❶), except ❹ is only used for adjusting screen and button brightness and cannot be used for menu functions. It is always labeled **DIM**.

Figure 5-1: IDU-680 Input Controls

5.1.1. Menu Philosophy

The menu system and buttons with an action are clearly labeled. The following rules are in the design of the menu system:

EXIT (R1): Whenever menu system is beyond the top level, provides a one-touch escape to the top-level.

BACK (L1): Whenever soft menu level is deeper than the first level, regresses through the menu system by one level.

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.

Further menu levels

Without further menu levels

An empty triangle next to a menu legend means the button press is a final action. A filled triangle next to a menu legend means the button press leads to a further menu level. (See Section 3 Display Symbology for further details on menu functions.)

Figure 5-2: Indication of Further Menu Levels

> **NOTE:**
>
> When the menu system is beyond the top-level some menu options are not available. If a menu has been opened any changes must be acknowledged, or **EXIT (R1)** must be pressed, to return to the top-level when finished with the open menu. To quickly verify the menu system is at the top level verify **MENU (R1)** is displayed.

5.1.2. Avoidance of Autonomous Behavior

The MFDs 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.

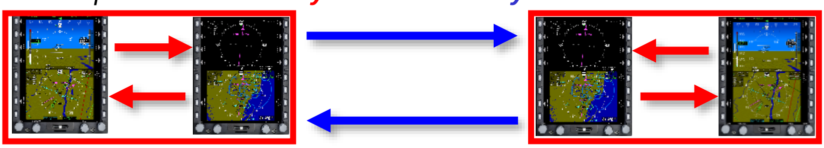
TAWS popups: When an FLTA alert is generated, a popup function enables PFI SVS (returns PFI to screen showing synthetic vision display) and activates terrain at an appropriate scale and format on the moving map page (one of the multi-function pages). This is a required function of TSO-C151b (Class A, B and C TAWS are described in Section 8 Terrain Awareness Warning System.)

Traffic popups: See Traffic appendix

5.2. 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 5-1. 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 5-1: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. 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”

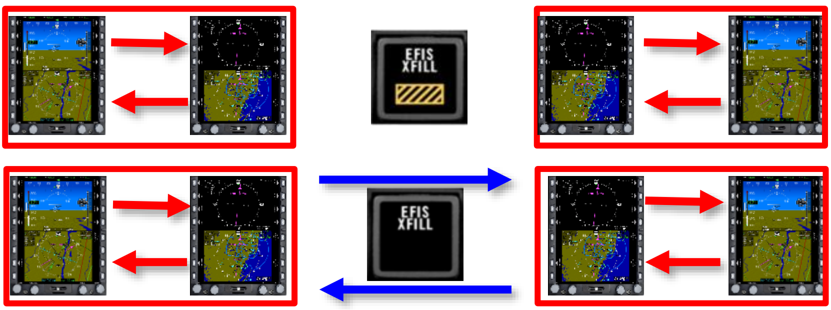
<table>
<tr><th colspan="2">Table 5-1: Menu Synchronization</th></tr>
<tr><th>Menu Parameter</th><th>Notes</th></tr>
<tr><td>Emergency and Minimum Fuel Settings</td><td>When enabled</td></tr>
<tr><td>Heading Bug and Heading Sub-Mode</td><td></td></tr>
<tr><td>Minimum Altitude Bug Value</td><td></td></tr>
<tr><td>VLOC OBS Settings</td><td></td></tr>
<tr><td>Roll Trim parameter</td><td>When equipped and enabled</td></tr>
<tr><td>Airspeed Bug Setting</td><td></td></tr>
<tr><td>Target Altitude Bug Setting</td><td></td></tr>
<tr><td>Timer Starting Signal</td><td>When configured and enabled</td></tr>
<tr><td>True North Mode</td><td></td></tr>
<tr><td>Settable V-Speeds</td><td></td></tr>
<tr><td>VSI Bug Setting</td><td></td></tr>
<tr><td>Crosslink Synchronization Status</td><td></td></tr>
<tr><td>TCAS-II control parameters</td><td></td></tr>
<tr><td>Traffic Filter Setting</td><td>When equipped and enabled</td></tr>
<tr><td>WX RDR Control Menu mode parameter</td><td></td></tr>
<tr><td>Transponder Selection</td><td>When equipped and enabled</td></tr>
<tr><td colspan="2">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.

</td></tr>
<tr><td>Active Flight Plan Parameters</td><td></td></tr>
<tr><td>Runway Display Parameters</td><td></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>
</table>

Table 5-1: Menu Synchronization

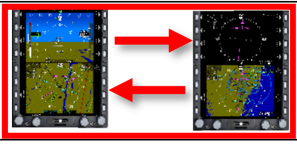
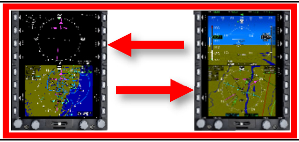
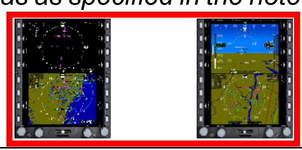
Menu Parameter	Notes
	
Sensor Selections	
Barometric Setting Parameters (Baro, Transition alt, Set QFE Baro)	
Intra-System Setting Parameters	When configured and enabled
Decision Height Setting	Dependent upon EFIS Limits "Dual DH not enabled"
Active Navigation Source	
PFD Basic Mode	
PFD Zoom Mode	
Navigation Preview Source	When enabled
PFD Analog AGL	
PFD Analog G-Force Indicator	
PFD Full-time Bank Scale	
PFD Flight Director	
PFD Mini Map	
PFD Altitude (meters)	
PFD Skyway	
PFD Terrain	
Rate of turn indication	
PFD Traffic Perspective	
PFD Mini Traffic	
UTC Offset (Time Zone)	
WX RDR Control Menu parameters	Synchronized onside when Honeywell RDR-2XXX is installed.
Weather Radar Scale	Onside because range is controlled by the weather radar.
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	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
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 WX-500 Strikes Page Settings	
MFD Selected Page	
MFD WX-500 Strikes Lightning	
MFD Traffic Page Settings (Show FL)	
MFD Map Page Settings	
MFD Datalink Page Settings	
DVI Mode Status	Support for DVI option
MFD Video Page Settings	Independent between top and bottom MFD areas with the exception of the following video hardware settings: 1) Selected Input 2) Brightness 3) Contrast 4) Saturation 5) Hue

5.3. Top-Level Menu

On the top-level menu consists of soft menu options along with option labels for the knobs.

5.3.1. PFD Top-Level Menu

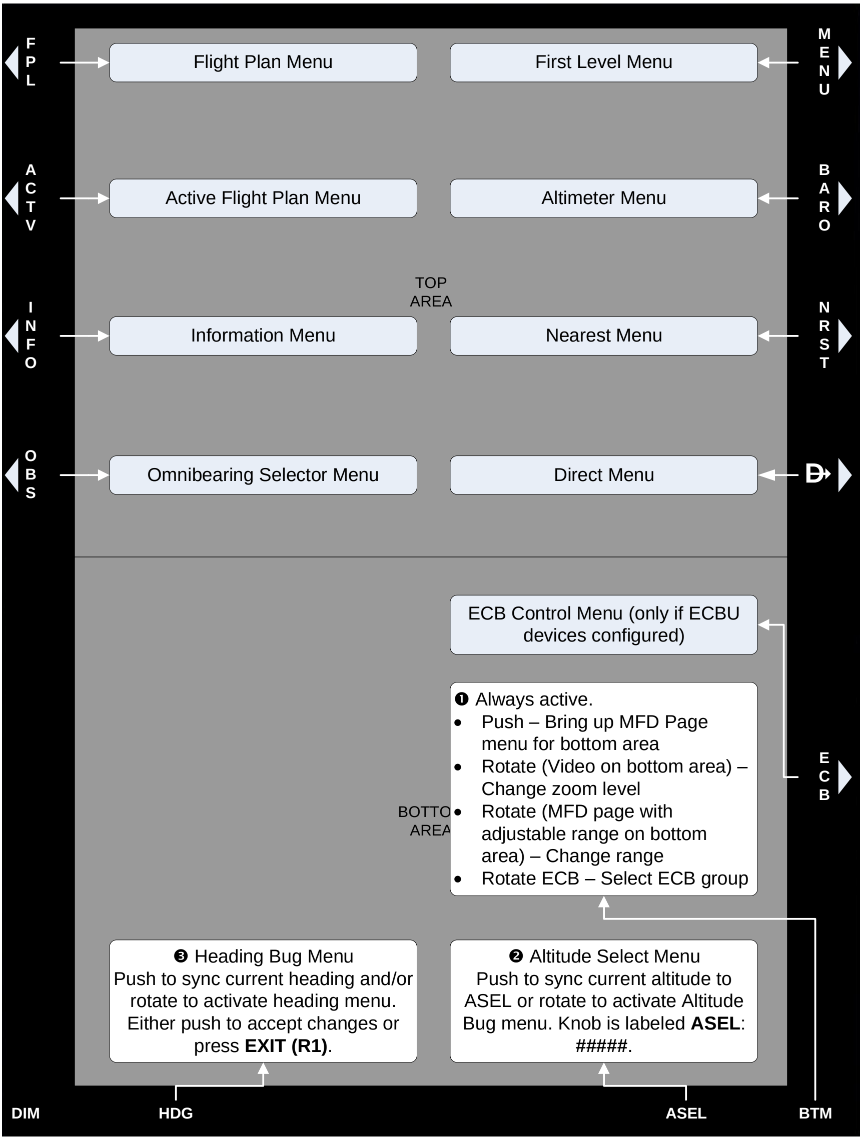


Figure 5-3: PFD Top-Level Menu

5.3.2. MFD Normal Mode Top-Level Menu

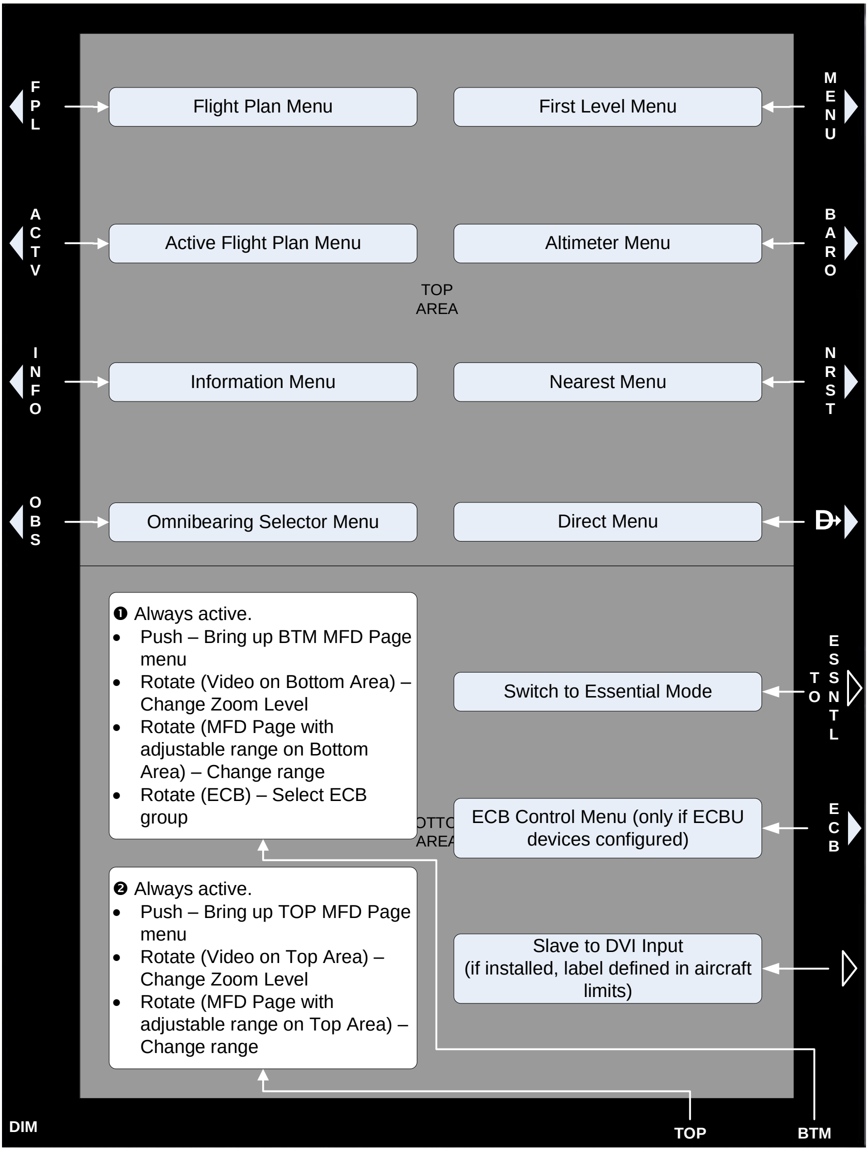


Figure 5-4: MFD Normal Mode Top-Level Menu

5.3.3. MFD Essential Mode Top-Level Menu

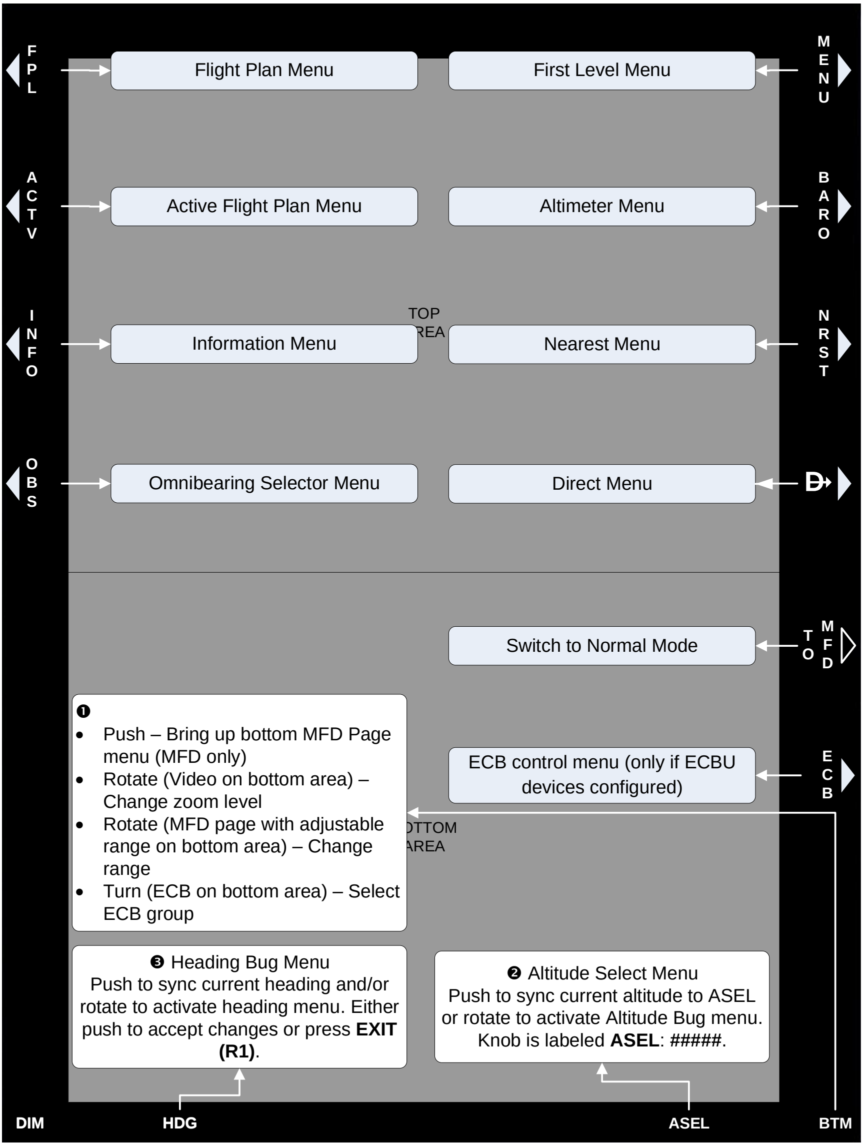


Figure 5-5: MFD Essential Mode Top-Level Menu

5.4. First-Level (PFD)

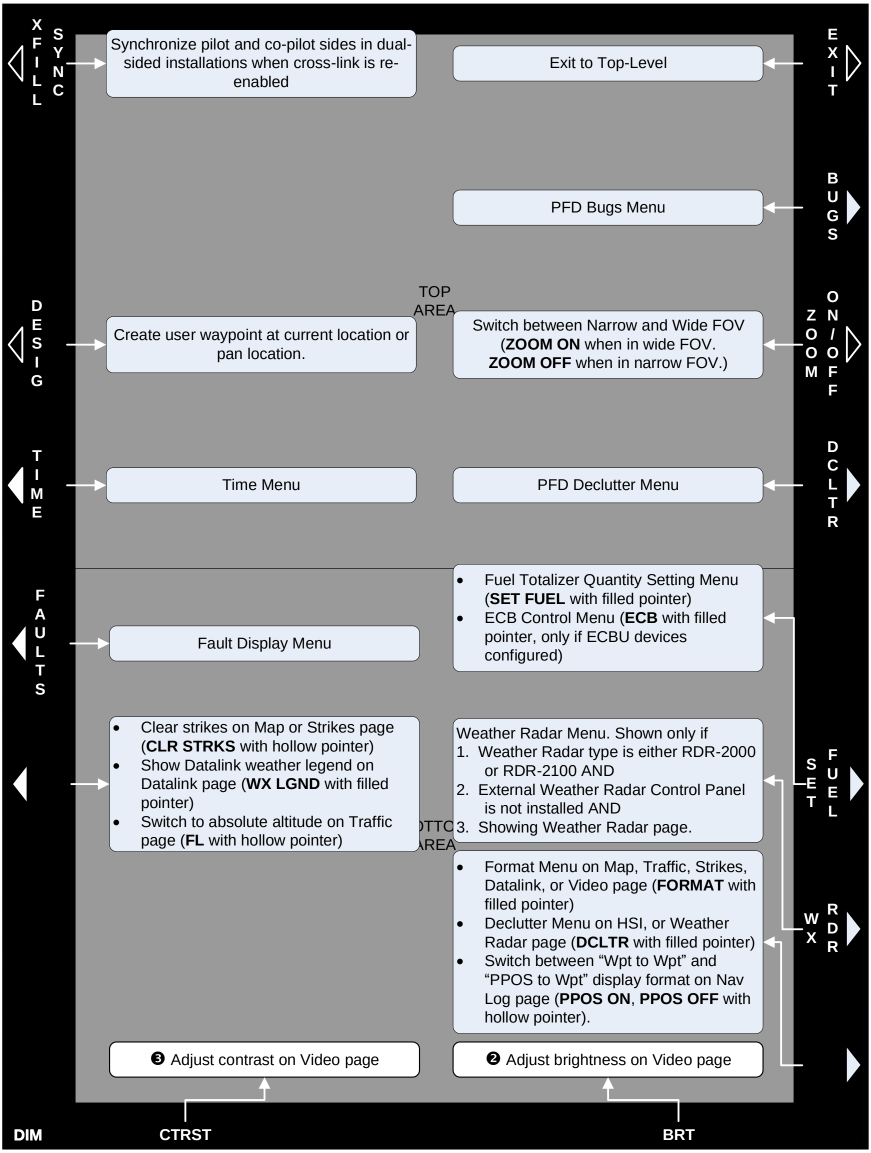


Figure 5-6: PFD First-Level (PFI in Top Area and MFD Page in Bottom Area)

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 5-2: Crossfill Inhibit/Arm/Sync Function

Crossfill [1]	Flight Plan	Indication (Pilot and Co-pilot)	Action to Synchronize Flight Plans		Result
			Pilot	Co-pilot	
Enabled (Cond.1)	Synchronized	None	None	None	No action required. Pilot and co-pilot sides already synchronized
Enabled (Cond.2)	Not Synchronized [2]	XFILL ARM	**MENU (R1)** **XFILL SYNC (L1)**	None	Pilot's flight plan is sent to co-pilot side and both sides are synchronized going forward. XFILL ARM is removed from both sides.
			None	**MENU (R1)** **XFILL SYNC(L1)**	Co-pilot's flight plan is sent to pilot side and both sides are synchronized going forward. XFILL ARM is removed from both sides.
Inhibited (Cond.3)	Not Synchronized	XFILL INHBT	Enable crossfill [1] (proceed to Cond. 2)		XFILL INHBT removed. XFILL ARM displayed on both sides.

(1) Crossfill is inhibited with the use of a latching (ON) crossfill inhibit switch. Crossfill is enabled by releasing (OFF) this switch. Location and number of crossfill inhibit switches in a cockpit varies by installation. Usually a single crossfill switch can be centrally located in a side-by-side cockpit within reach of both pilots. If a single switch cannot be installed within reach of both pilots (tandem cockpits or very wide cockpits), two switches can be installed such that they function in parallel (either switch inhibits or enables crossfill on both the pilot and co-pilot sides).

(2) Pilot and co-pilot flight plans can become unsynchronized under the following conditions:
Crossfill is inhibited, and pilot and co-pilot flight plans are separately changed before crossfill is re-enabled.
Either the pilot or co-pilot side is restarted with an active flight plan on the other side and crossfill enabled.
If XFILL FAIL condition exists and any changes are made to either side flight plans.

5.5. First-Level (MFD)

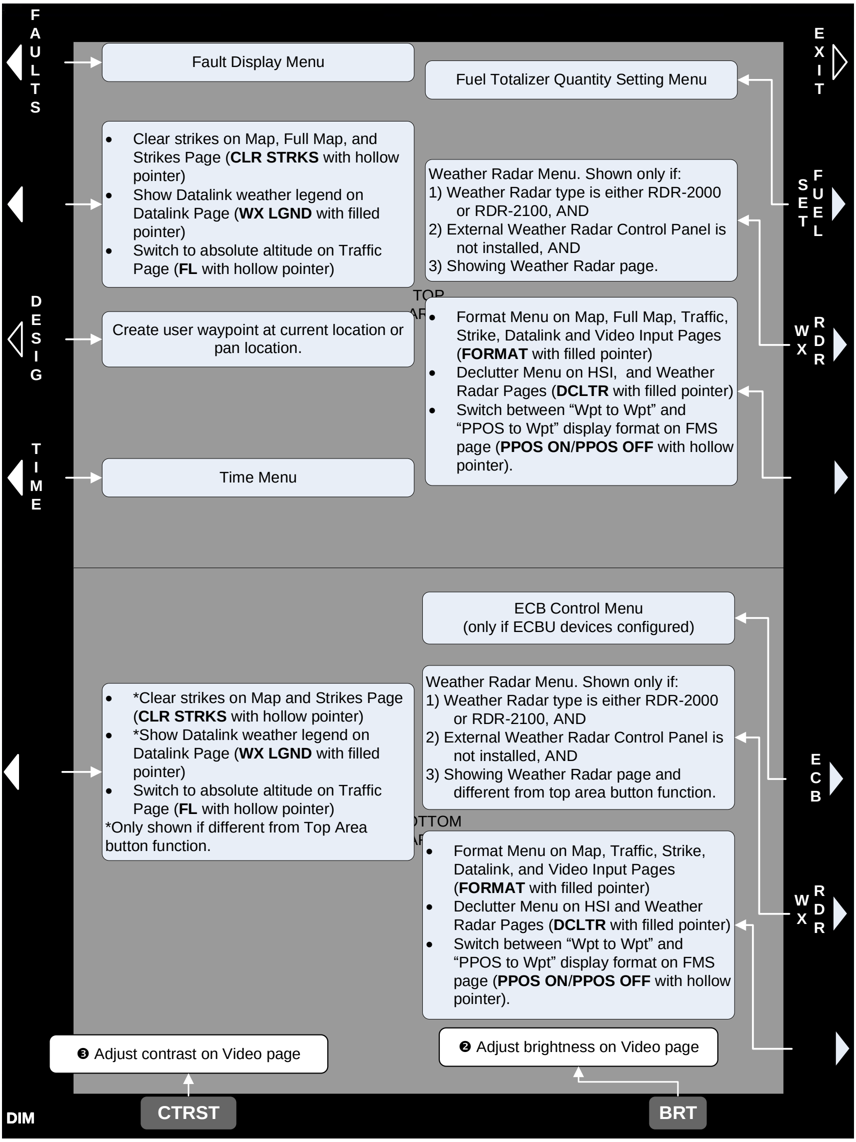


Figure 5-7: MFD Normal Mode First-Level (MFD Pages in Both Areas)

MFD page first-level options are shown adjacent to the area in which the MFD page resides. When an identical option is shown adjacent to both the top area and bottom areas, the option is only shown adjacent to the top area. (Options spelled the same but affect different areas of the display are not identical.)

5.6. 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. On any IDU, when **FPL (L1)** is pressed, a list for selection appears or if no flight plans are saved **NO SAVED FPLS** appears.

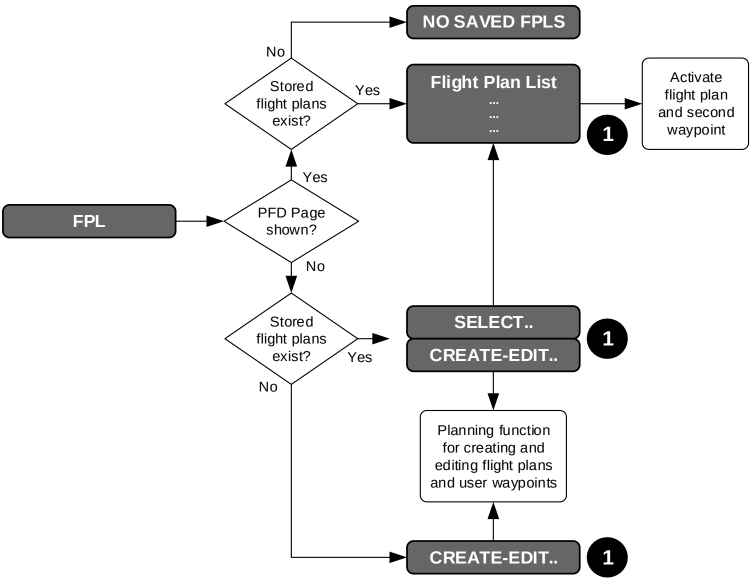


Figure 5-8: Flight Plan Menu (PFD or MFD)

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.

5.6.1. Flight Planner Page

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

1) Manage stored flight plans (activating, creating, editing, deleting, and reversing);

2) Manage user waypoints (creating, editing, and deleting); 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. When the flight planner page is accessed, it only appears in the bottom area. Upon activation of the flight plan menu, the EFIS checks for the existence of stored flight plans. If flight plans do exist, an option list is presented for selection or entering the flight planning 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.

5.6.2. Flight Plan (FPL) Menu Selecting and Activate on PFD (Step-By-Step)

1) Press **FPL (L1)**.

2) Rotate ❶ to **SELECT..** and then push to enter.

3) Rotate ❶ to desired flight plan and push to enter.

5.6.3. Flight Plan (FPL) Menu Create-Edit (Step-By-Step)

1) Press **FPL (L1)**.
2) Rotate ❶ to **CREATE-EDIT..** and push to enter.
3) Push ❶ to select **CREATE FLIGHT PLAN**.
4) Press **ADD (R6)** to create first waypoint.
5) Rotate 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.
6) If **NRST VOR (L7)** is pressed, rotate ❶ and push to enter desired VOR as the first VOR in the flight plan.
7) A VOR is added and the highlighted line is advanced to the next position below. Press **ADD (R6)** to create the next waypoint.
8) Continue adding waypoints as described in step above and progress up to as many as 100 waypoints.
9) 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)**.
10) Press **SAVE (R8)** to save changes to one of the 100 maximum saved flight plans.

5.6.4. Flight Plan (FPL) Menu Selection Edit Flight Plan on PFD or MFD (Step-By-Step)

1) Press **FPL (L1)**.
2) Rotate ❶ to **CREATE-EDIT..** and push to enter.
3) Rotate ❶ to **EDIT FLIGHT PLAN** and push to enter.
4) Rotate ❶ to desired flight plan requiring editing and push to enter.
5) Rotate ❶ to highlight waypoint where another waypoint is to be inserted above and press **INSERT (R6).**
6) Rotate and press 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.

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) Rotate ❶ to desired end point on airway and push to enter.

9) To delete any waypoint, rotate ❶ to desired waypoint. Press **DEL (R7)** to delete waypoint. Push ❶ to **CONFIRM DELETE WPT**.

10) If flight plan is satisfactory, press **SAVE (R8)** and then **EXIT (R1)** to exit the flight plan menu.

5.6.5. Activate Flight Plan PFD or MFD (Step-By-Step)

1) Press **FPL (L1)**.

2) Push ❶ to **SELECT..** from list of stored flight plans and push to enter.

3) Rotate ❶ to desired flight plan and push to enter. OR

4) Repeat step 1 and rotate ❶ to **CREATE-EDIT..** and push to enter.

5) Rotate ❶ to **ACTIVATE FLIGHT PLAN** and push to enter.

6) Rotate ❶ to desired saved flight plan and push to enter. The selection for activating is accepted. Push to enter.

7) Press **EXIT (R1)** to exit menu and restore to last MFD page on the bottom.

5.6.6. Reverse Flight Plan on PFD or MFD (Step-By-Step)

1) Press **FPL (L1)**.

2) Rotate ❶ to **CREATE-EDIT..** and push to enter.

3) Rotate ❶ to **REVERSE FLIGHT PLAN** and push to enter.

4) Rotate ❶ to desired flight plan and push to enter.

5) If no other flight plan to reverse, press **EXIT (R1)**.

5.6.7. Delete Flight Plan (Step-By-Step)

1) Repeat steps 1 and 2 in § 5.6.4.

2) Rotate ❶ to **DELETE FLIGHT PLAN** and push to enter.

3) Rotate ❶ to desired flight plan to delete. Push to enter.

4) Push ❶ to **CONFIRM DELETE FPL**.

5) The next flight plan is highlighted. If no further deletions, press **EXIT (R1)**.

5.6.8. Rename Flight Plan (Step-By-Step)

1) Repeat steps 1 and 2 in § 5.6.6.
2) Rotate ❶ to **RENAME FLIGHT PLAN** and push to enter.
3) Rotate ❶ to flight plan intended to rename. Push to enter.
4) Rotate and push ❶ create a new 12-character name for this flight plan.
5) Press **SAVE (R8)** to save changes.
6) If no further renaming is required, press **EXIT (R1)**.

> **NOTE:**
>
> A maximum of 999 user waypoints may be created and stored.
>
> If configured in EFIS limits, “Remote User Waypoint Designate switch” may be used to easily create a user waypoint.

5.6.9. Create User Waypoint

User waypoints may be created with three methods:

1) Latitude and Longitude
2) Radial and Distance
3) Overfly (Designate)

5.6.9.1. Create User Waypoint (LAT-LON) on PFD or MFD (Step-By-Step)

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

1) Repeat steps 1 and 2 in § 5.6.6.
2) Rotate ❶ to **CREATE USER WPT (LAT-LON)** and push to enter.
3) To name a new user waypoint, rotate ❶ and push to enter up to five-characters and or spaces.
4) With new user waypoint name created, push and or rotate ❶ to proceed through all fields as necessary.

5) 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.

6) Once all fields are entered, press **SAVE (R7)** to save user waypoint or press ⊕➔ **(R8)** to activate/save waypoint as the active waypoint and begin navigation guidance.

7) 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.

5.6.9.2. Create User Waypoint (RAD-DST) on PFD or MFD (Step-By-Step)

1) Repeat steps 1 and 2 in § 5.6.4.

2) Rotate ❶ to **CREATE USER WPT (RAD-DST)** and push to enter.

3) Identifier is automatically named “RD###” where ### is the next available radial distance waypoint number.

4) Rotate ❶ to enter identifier for reference waypoint and push to enter.

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

6) Rotate ❶ to desired waypoint and push to enter.

7) Rotate ❶ to enter the radial entry and distance from desired waypoint.

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

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

5.6.9.3. Create an Overfly User Waypoint (Step-By-Step)

1) When flying 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###,” where ### is the next available sequence overfly user waypoint number.

3) Use edit user waypoint function to change the waypoint name or characteristics (see § 5.6.9.3).

5.6.10. Edit User Waypoint on PFD or MFD (Step-By-Step)

1) Repeat steps 1 and 2 in § 5.6.4.

2) Rotate ❶ to **EDIT USER WPT** and push to enter.

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

4) Rotate and push ❶ to edit all fields and then push to enter.

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

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

5.6.11. Delete User Waypoint on PFD or MFD (Step-By-Step)

1) Repeat steps 1 and 2 in § 5.6.4.

2) Rotate ❶ to **DELETE USER WPT** and push to enter.

3) Rotate ❶ to desired waypoint to be deleted. Push to enter action.

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

5) 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 as described above;

2) Open a flight plan that uses the user waypoint;

3) Delete the existing waypoint from the flight plan;

4) Save and exit;

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

5.6.12. RAIM Prediction on PFD or MFD (Step-By-Step)

When selected, the RAIM prediction screen is only shown if the GPS/SBAS receiver is capable of performing a RAIM prediction (not suitable for enroute 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 is capable of performing a RAIM prediction.

1) Repeat steps 1 and 2 in § 5.6.4.

2) Rotate ➊ to **RAIM PREDICTION** and push to enter.

3) Rotate and push ➊ enter to the desired waypoint and select **INFO (R6)** to verify the waypoint.

4) Rotate and push ➊ to enter **UTC TIME:** and **UTC DATE:**.

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

6) 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: (“Pseudo-random noise” sequences, or gold codes, that each satellite transmits to differentiate itself from other satellites in the active constellation). Specify 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.

5.7. Active Flight Plan (ACTV) Menu (PFD or MFD)

See Section 7 IFR Procedures for active flight plan description.

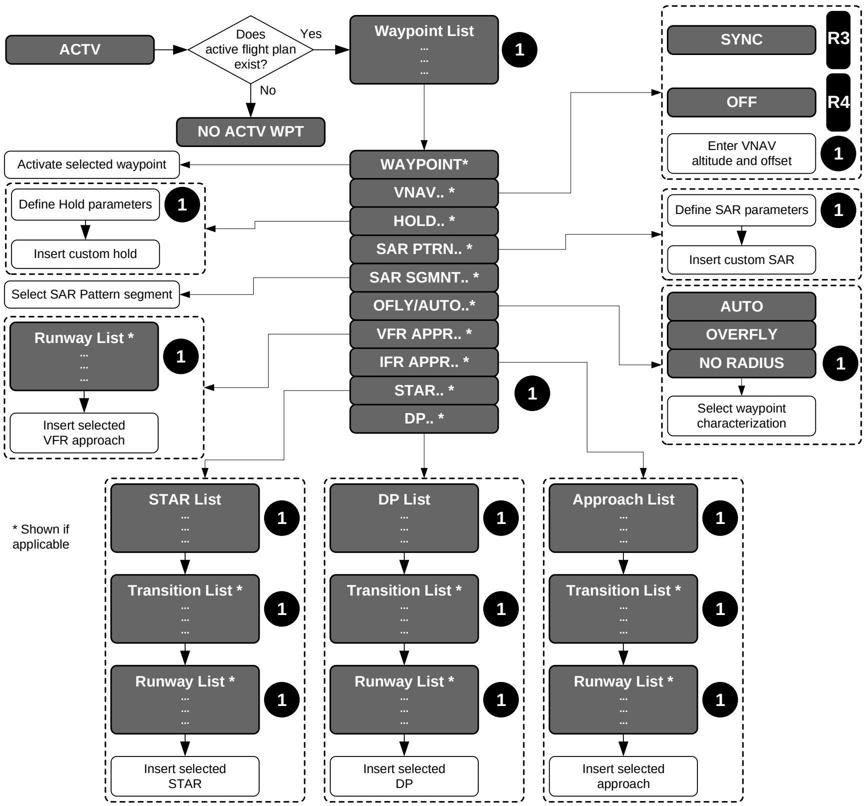


Figure 5-9: Active Flight Plan Main Menu

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.

When VNAV altitudes and offsets that come from the navigation database or that have been manually entered are shown in white. VNAV and offset altitudes 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.

5.7.1. Active Flight Plan (ACTV) Menu Options

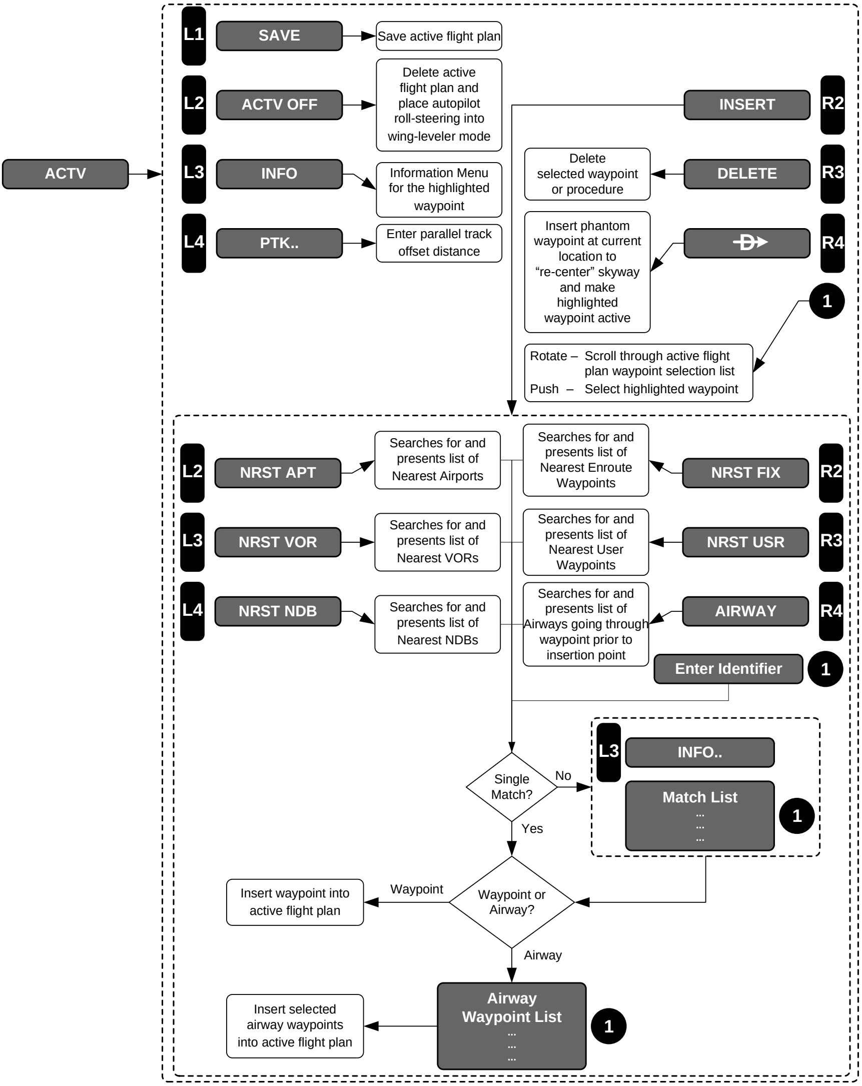


Figure 5-10: Active Flight Plan Menu Options

The active flight plan menu options are defined in Table 5-3. 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.

Table 5-3: 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. 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.
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.	The range of parallel offsets are 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.

Table 5-3: Active Flight Plan Menu Options

Menu Options	Action for Active Flight Plan	Limitations
NRST APT (L2)	Search for airports of runway length criteria set in EFIS limits.	**NO RESULTS**: No eligible airports within search area or selection list includes bearing, distance to each result. **INFO**: After adding waypoint, aids in selection.
NRST FIX (R2)	Search for fixes	**NO RESULTS**: No fixes within search area or selection list includes identifier, bearing and distance to each result. **INFO**: Provides information and aids in selection and includes datalinked weather information when available and enabled.
NRST NDB (L4)	Search for NDBs	**NO RESULTS**: No NDBs within search area or selection list including identifier, bearing, and distance to each result. **INFO**: Provides information and aids in selection.
NRST USR (R3)	Search for nearest user waypoints	**NO RESULTS**: No user waypoints within search area or selection list including identifier, bearing, and distance to each result. **INFO**: Provides information and aids in selection.
NRST VOR (L3)	Search for nearest VORs	**NO RESULTS**: No VORs within search area or selection list including identifier, bearing, and distance to each result. (Geodetic results only) **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 is 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.

Table 5-3: Active Flight Plan Menu Options

Menu Options	Action for Active Flight Plan	Limitations
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 fewer than three 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, user 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 user selected exit point. If there is no result, user 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.

5.7.2. Active Flight Plan (ACTV) Menu Options (Step-By-Step)

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

5.7.3. Active Flight Plan (ACTV) HOLD Menu Option (Step-By-Step)

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

2) Rotate ❶ to desired waypoint. Push to enter.

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

4) Rotate 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.

5.7.4. Active Flight Plan (ACTV) NRST Menu Option (Step-By-Step)

1) With active flight plan displayed, rotate ❶ to desired waypoint where a new waypoint is to be inserted above and press **INSERT (R2)** to see NRST options. Then 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.

5.8. Information (INFO) Menu

The amount and type of information presented depends upon the type of waypoint as in Table 5-4.

> **NOTE:**
>
> Frequencies are only sent to either com or nav radios in the standby position. It is up to the user to swap frequencies to the active position in the applicable radio.

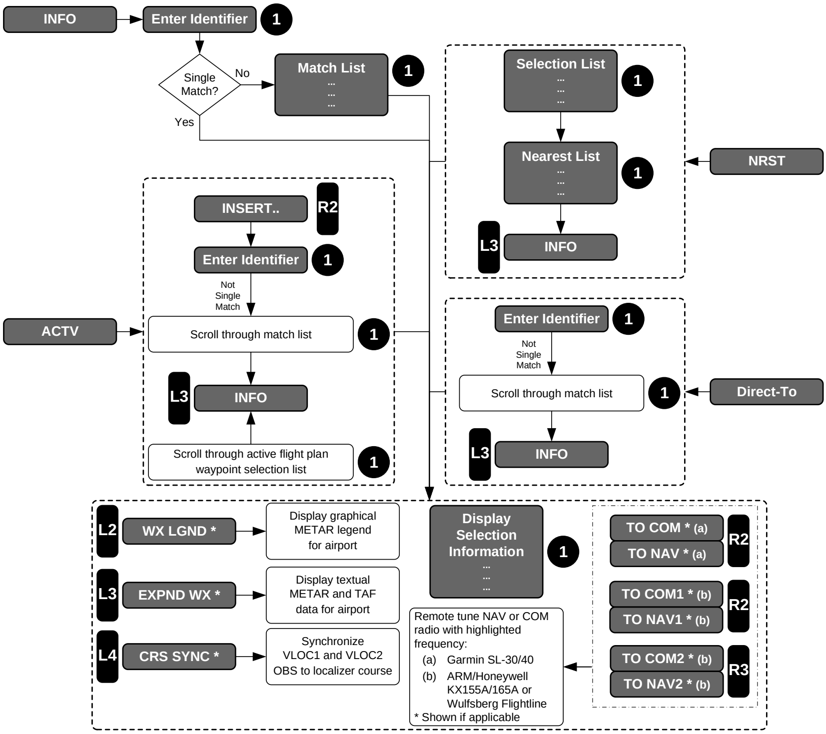


Figure 5-11: Information Menu

Table 5-4: 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 time	NAVAID Type Frequency	Communication frequencies Airport runway data (1) Airport elevations are in feet or meters depending speed units setting
(1) With Datalink available and enabled, airport graphical METAR, current altimeter setting and current wind conditions are presented. Current wind conditions are in knots or meters depending on speed units setting. If textual METAR data for a specified airport is not available, the date field is presented as "----".		

Table 5-5: 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.

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.

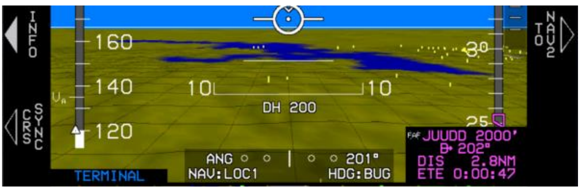


Figure 5-12: CRS SYNC

5.8.1. Information (INFO) Menu (Step-By-Step)

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

2) Push ❶ to view information.

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

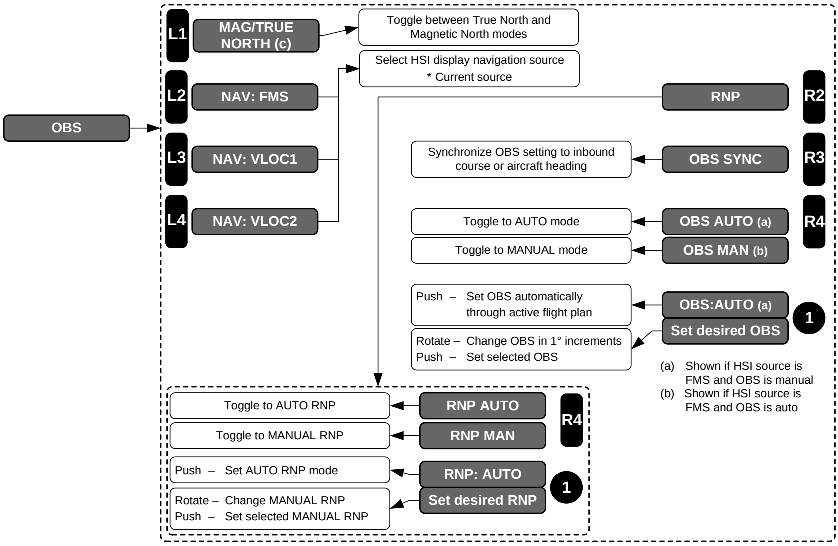


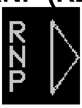
Figure 5-13: Omnibearing Selector (OBS) Menu (without NAV Preview)

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 5-6).

Table 5-6: Omnibearing Selector (OBS) Menu Options

OBS (L4)	OBS SYNC (R3)	OBS MANUAL (R4)	Nav Source and CDI Indication
FMS (L2) 	Only available with active waypoint. Synchronizes **FMS** to inbound course	Only available with active waypoint. Settable in increments of 1° with ❶	GPS navigation source: FMS1 or FMS2
VLOC1 (L3) 	Synchronizes **VLOC1** or **VOR1** to the inbound course or if the inbound course cannot be determined, to aircraft heading.	Settable in increments of 1° with ❶	LOC1, VOR1, BC1

Table 5-6: Omnibearing Selector (OBS) Menu Options

OBS (L4)	OBS SYNC (R3)	OBS MANUAL (R4)	Nav Source and CDI Indication
VLOC2 (L4) 	Synchronizes **VLOC2** or **VOR2** to the inbound course or if the inbound course cannot be determined, to aircraft heading.		LOC2, VOR2, BC2
RNP (R2) 	When selected, allows for **RNP(R4)**  or 	Rotate ❶ to set desired manual RNP value	Manual RNP is selectable between 0.15NM and 15NM. 0.01 increments RNP 0.10-0.3 0.1NM increments RNP 0.3-2.0 1NM increments RNP 2.0-15 (Values always in NM)
TRUE NORTH (L1) 	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.		

5.9.1. Omnibearing Selector (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.)

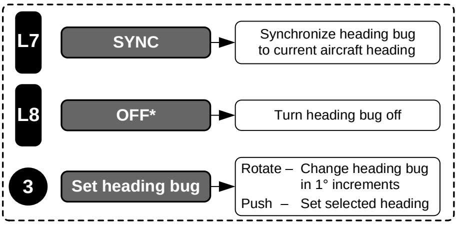
2) To select manual RNP, press **OBS (L4)** and then press **RNP (R2)**.

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

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

5.10. 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.



PFD (Normal and Essential Modes) (Where applicable)
MFD (Essential Mode Only)
* Not available if integrated autopilot installed

Figure 5-14: Heading Bug (HDG) Menu

5.10.1. Heading Bug (HDG) Menu with Analog Autopilot (Step-By-Step)

1) Rotate ❸ to enter heading mode.

2) Rotate ❸ to change heading bug in 1° increments.

3) Push ❸ to select set heading from previous step or press **SYNC (L7)** to synchronize current heading while in a turn or holding current heading.

4) 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.

5) HDG bug sub-mode is now HDG bug. Press **LNAV (L5)** to return to LNAV sub-mode.

5.10.2. Heading Bug (HDG) without Analog Autopilot (Step-By-Step)

1) Rotate ❸ to enter heading mode.

2) Rotate ❸ to change heading bug in 1° increments.

3) Push ❸ to select new heading or press **SYNC (L7)** to synchronize current heading.

4) Press **OFF (L8)** to turn off heading bug menu.

5) 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.

5.11. Altitude Bug (ASEL) Menu

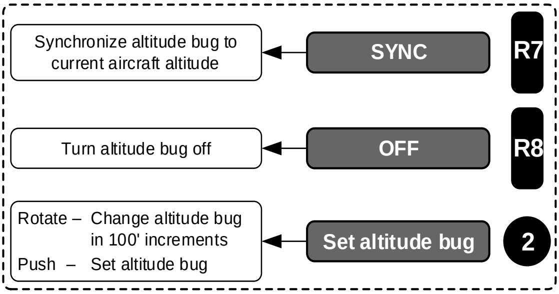


Figure 5-15: Altitude Bug (ASEL) Menu

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.

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

1) Rotate ❷ to enter altitude menu or push to synchronize current altitude to **ASEL**. Push ❷ to set target altitude to the current altitude without opening the ASEL menu.
2) Press **SYNC (R7)** to synchronize current altitude or press **OFF (R8)** to turn off ASEL selection.
3) Rotate ❷ to enter new target altitude.

5.12. Nearest (NRST) Menu

Nearest (NRST) menu options are defined in Table 5-7. Searches are conducted for 20 items within 240 NM. If list is empty, (no items within 240NM), **NO RESULTS** message is displayed.

See Section 7 IFR Procedures for NRST Menu ILS step-by-step details.

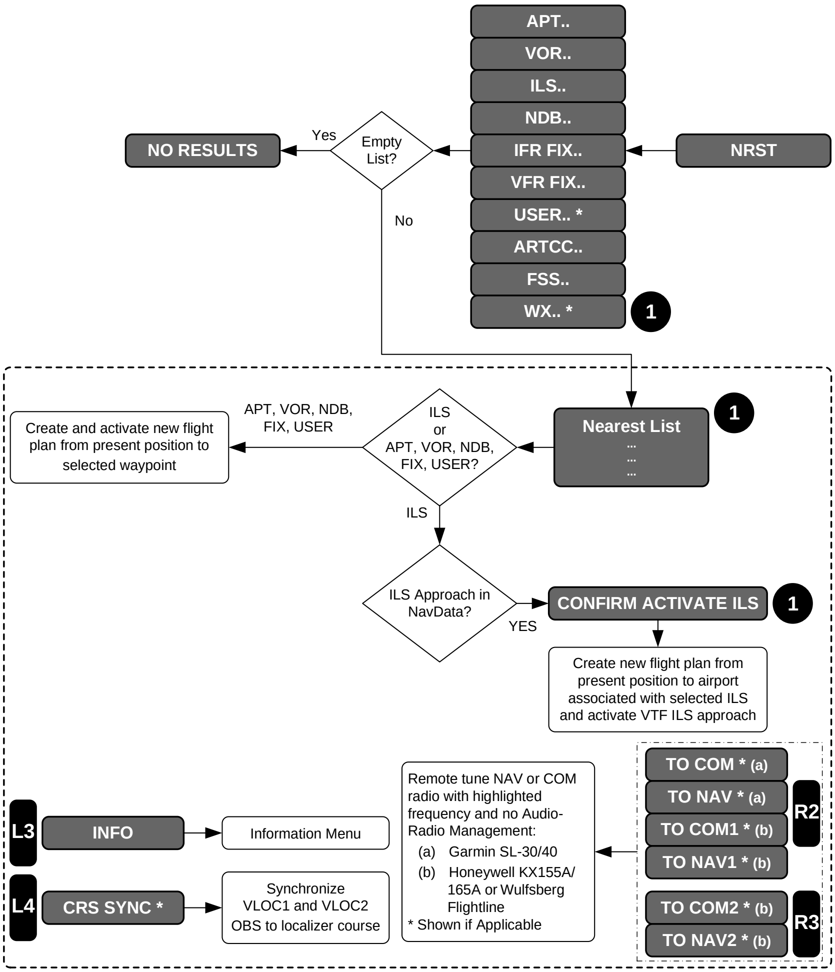


Figure 5-16: Nearest (NRST) Menu

Table 5-7: Nearest (NRST) Menu Options

Menu Options	Limitations
APT..	**INFO (L3)** available for further information. Identifier, geodetic bearing and distance*** to airport, indication of longest runway length in feet*, Sunrise/Sunset time 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.

Table 5-7: Nearest (NRST) Menu Options

Menu Options	Limitations
VOR..	**INFO (L3)** available for further information. Symbol, type facility, identifier, geodetic bearing and distance to VOR***, (current radial), Sunrise/Sunset time in Zulu or local time, and frequency.
ILS..	**ILS** Airport identifier, geodetic bearing to active runway threshold and distance ***, and localizer frequency. Where the current VLOC1 or VLOC2 OBS does not match the localizer course, **CRS SYNC (L4)** appears for one touch synchronizing VLOC1 and VLOC2 to the localizer course. **INFO (L3)** available for further information, Sunrise/Sunset time in Zulu or local time for that airport.
NDB..	**INFO (L3)** available for further information. **INFO**: Symbol, identifier, geodetic bearing and distance to NDB***, Sunrise/Sunset time in Zulu or local time, and frequency.
IFR FIX..	Symbol, fix 5-digit Identifier, airport associated, and geodetic bearing and distance*** to fix. **INFO (L3)** available for further information, Sunrise/Sunset time in Zulu or local time.
VFR FIX..	Symbol, fix long name, geodetic bearing to*** **INFO (L3)** available for further information, Sunrise/Sunset time in Zulu or local time.
USER..	If existing. Symbol, assigned name, geodetic bearing and distance*** to user waypoint. **INFO (L3)** available for further information, Sunrise/Sunset time in Zulu or local time.
ARTCC.. **FSS..**	RX, TX, or RXTX symbol, facility name, geodetic bearing and distance*** to antenna distance***, and frequency.
WX..	Type of airport symbol, facility name, geodetic bearing and distance*** to airport. **INFO (L3)** available for further information, Sunrise/Sunset time in Zulu or local time.

* Always in feet
** Always in NM
*** In either NM or KM depending upon EFIS setting limits.

5.13. Direct Menu

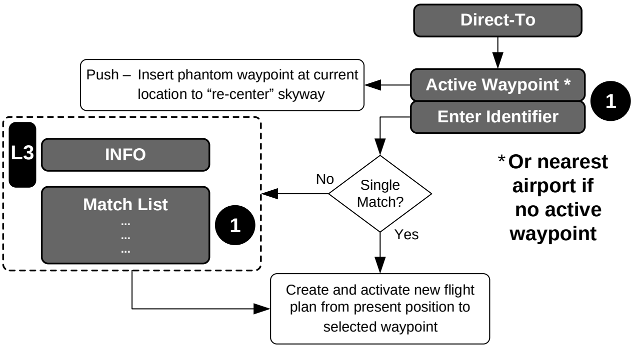


Figure 5-17: Direct Menu

Table 5-8: 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.

5.13.1. Direct Menu (Step-By-Step)

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

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

3) 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.

4) After creating new identifier or selecting from the **SEARCH** list, push ❶ to enter and create a new active flight plan from the present aircraft position.

5.14. Time Menu

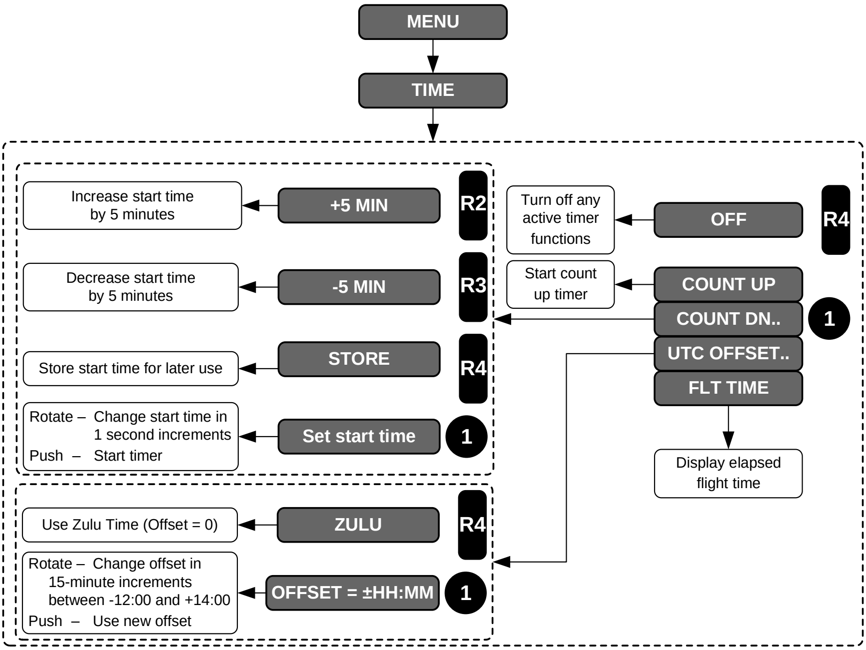


Figure 5-18: Time Menu

5.14.1. Time Menu (Step-By-Step)

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

2) Push 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) Push 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: ##:##:##.

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.

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

5.15. 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

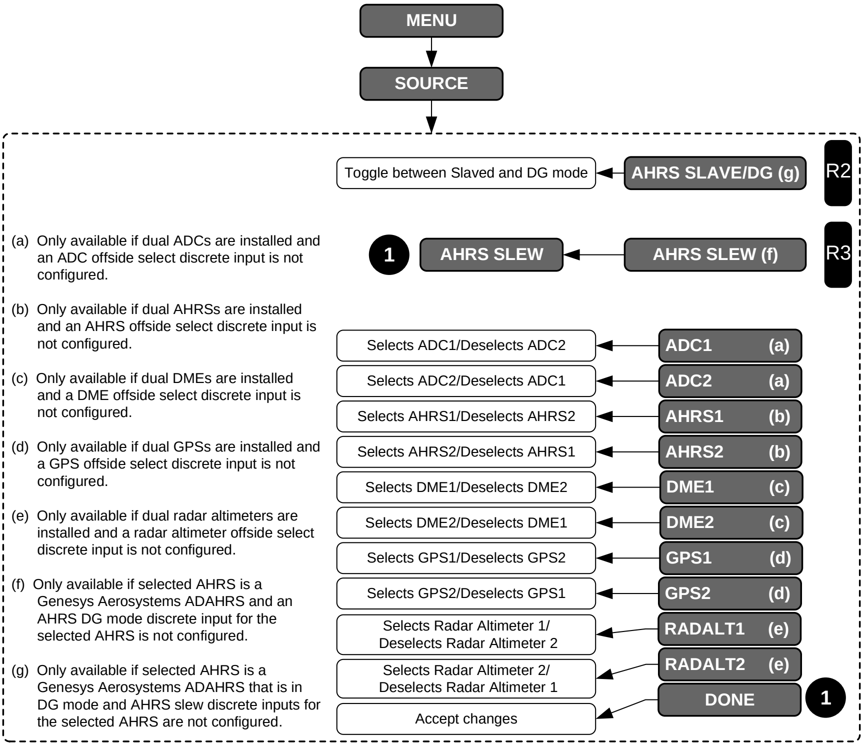


Figure 5-19: PFD Source Menu

5.15.1. PFD Page First-Level Source Selection (Step-By-Step)

1) Press **MENU (R1)**, and then press **SOURCE (L2)**.
2) Rotate ❶ to check desired source, push to select, rotate to **DONE** and push to enter or press **EXIT (R1)**.

5.15.2. AHRS Slave/DG/Slew

AHRS SLAVE/AHRS DG (R2) toggles between the two AHRS modes. **AHRS SLEW (R3)** enters a submenu to adjust the DG mode slewing value (if a DG/Slave input is not configured in EFIS limits for that AHRS.) When Genesys AHRS is installed and in DG mode without being configured in EFIS limits for the selected AHRS are not selected.

5.16. PFD Bugs (BUGS) Menu

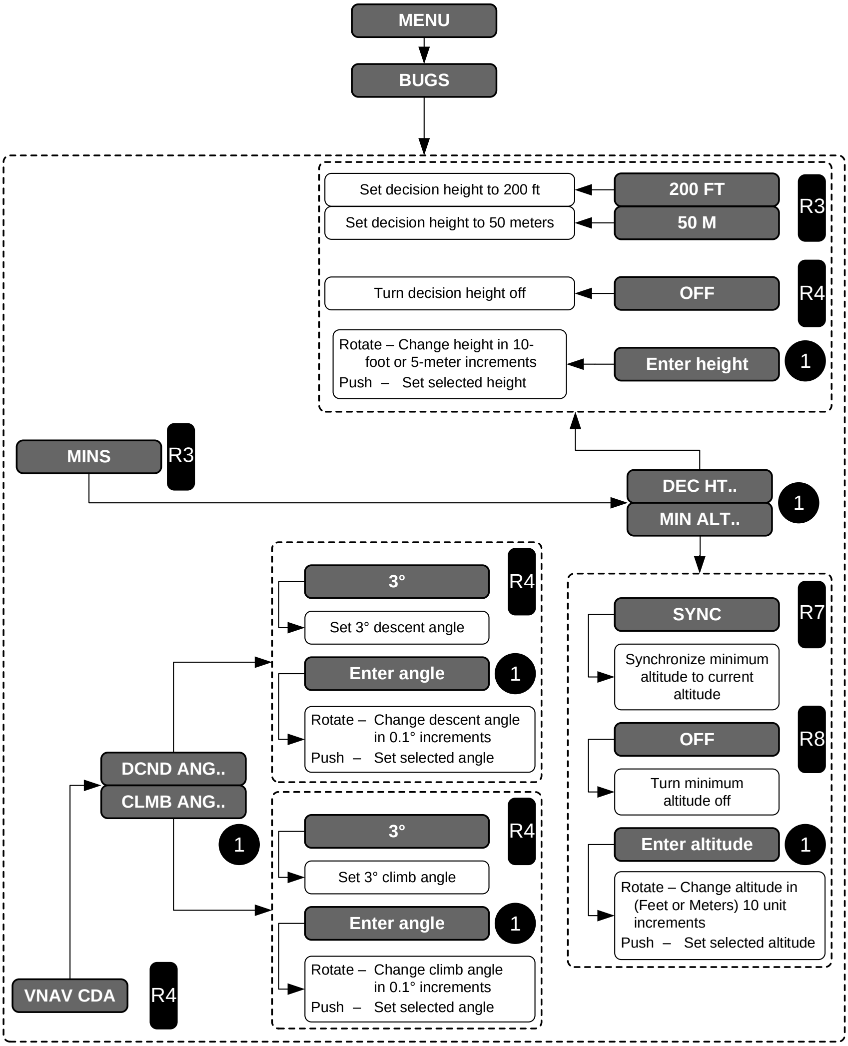


Figure 5-20: PFD Bugs (BUGS) Menu

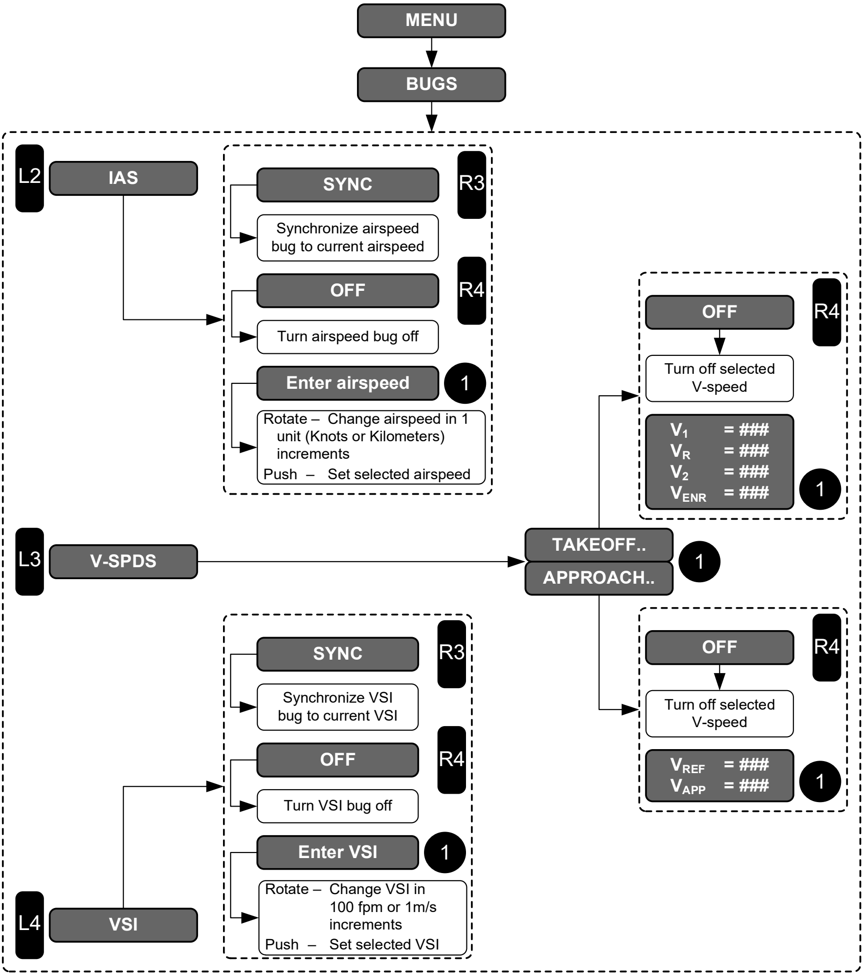


Figure 5-21: PFD Bugs (BUGS) Menu (Continued)

NOTE:

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

5.16.1. PFD Bug (BUGS) Menu (Step-By-Step)

5.16.1.1. Minimums

1) Press **MENU (R1)**, within 10 seconds, press **BUGS (R2)** to enter the Bugs menu.

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

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

4) 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.

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

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

7) Rotate ❶ to select desired barometric minimum altitude in feet or meters in increments of 10 units and push to enter.

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

5.16.1.2. VNAV Climb and Descent Angle

Selection brings up further action to select either climb angle or descent angle. Selecting either option allows the user 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) Rotate ❶ to enter 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.

5.16.1.3. 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.

5.16.1.4. 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 rotate ❶ to desired IAS Then push to enter.

5.16.1.5. 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) Rotate ❶ to desired V_{REF} speed and push to enter. Press **BACK (L1)** to regress in making entries.
4) Rotate ❶ to desired V_{APP} speed and push to enter.

5.17. PFD Declutter (DCLTR) 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.

Table 5-9: PFD Declutter Options

Option	Configuration		Notes
	Normal SVS	Basic	
ANLG AGL	✓	✓	Mutually exclusive
ANLG G	✓	✓	
MINI MAP	✓	✓	
MINI TRFC	✓	✓	
BANK SCL	✓		Always in view while in basic mode
BASIC	✓	✓	Switches PFD to basic mode
SKYWAY	✓		Skyway guidance symbology
SVS TAWS	✓		Non-TAWS perspective terrain and obstacle depiction (mutually exclusive with TAWS perspective terrain and obstacle depiction)

Table 5-9: PFD Declutter Options

Option	Configuration		Notes
	Normal SVS	Basic	
			SVS TAWS is labeled "SVS ADVNCD" when TAWS is not enabled
SVS BASIC	✓		TAWS perspective terrain and obstacle depiction (mutually exclusive with Non-TAWS perspective terrain and obstacle depiction)
TRAFFIC	✓		Perspective Traffic indications
TURN IND	✓	✓	Turn rate indication
FD1	✓	✓	Mutually exclusive
FD2	✓	✓	
METERS	✓	✓	When using feet for altitude, metric display of altitude, target altitude, and bug setting
FEET	✓	✓	When using meters for altitude, Imperial display (feet) of barometric altitude and target altitude bug setting

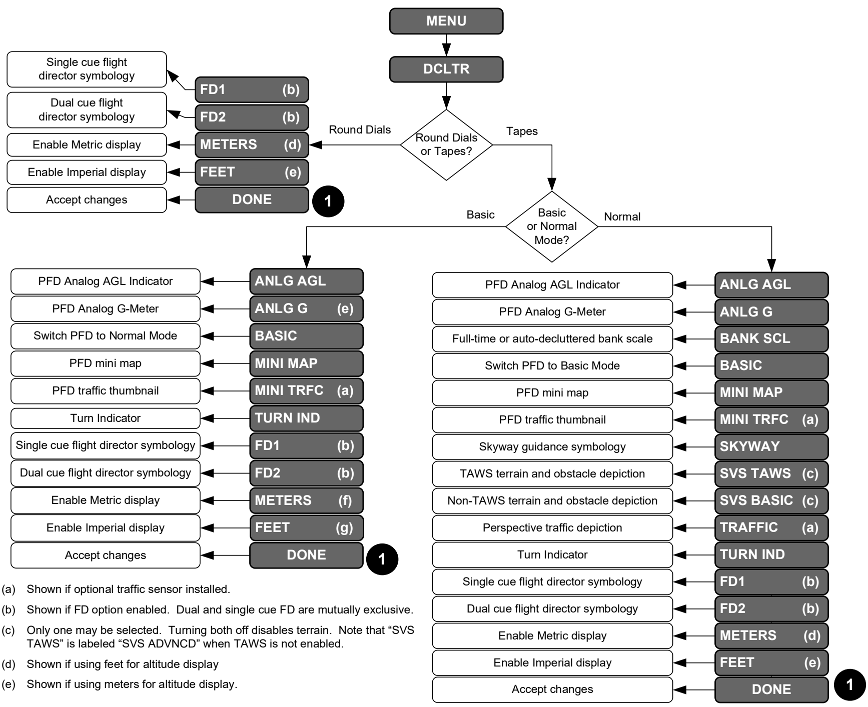


Figure 5-22: PFD Declutter (DCLTR) Menu

5.17.1. PFD Declutter (DCLTR) Menu (Step-By-Step)

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

2) Rotate ❶ to **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) Repeat step 1 and then rotate ❶ to **SVS TAWS** and push to deselect.

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

6) 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.

7) With **SVS TAWS** selected, the PFI area 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. The slope between adjacent terrain pixels in an increasing longitude direction determines shade used.

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

5.18. Altimeter (BARO) Menu

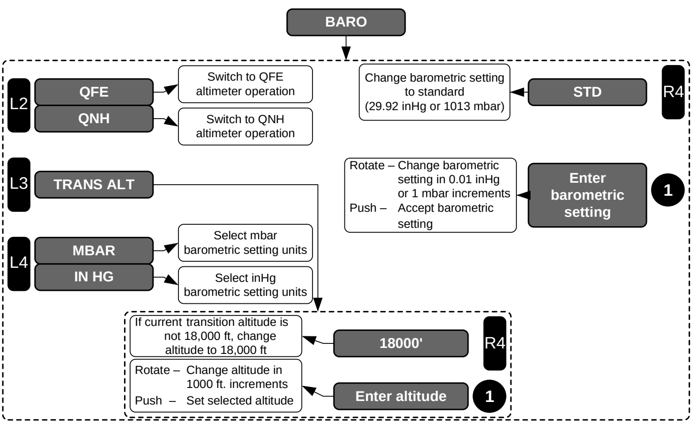


Figure 5-23: Altimeter Menu

5.18.1. Altimeter (BARO) Menu (Step-By-Step)

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

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

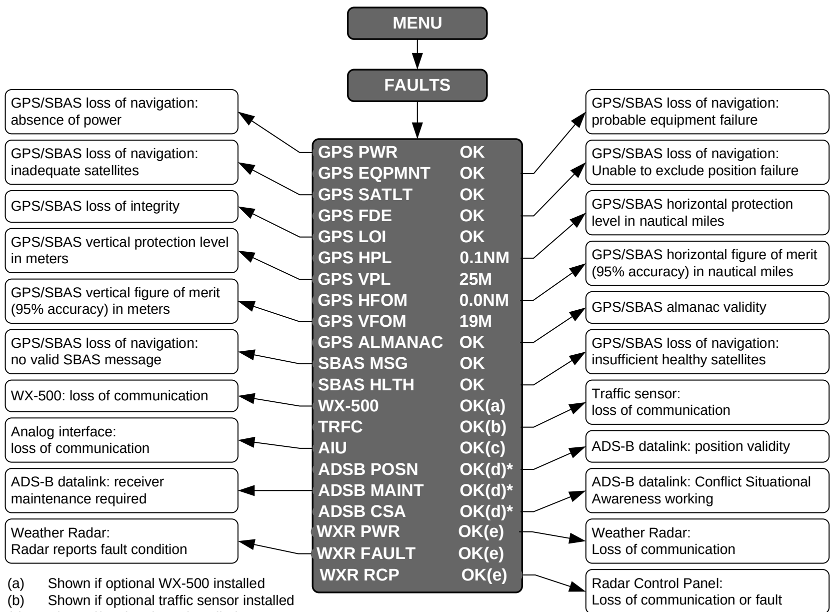
3) Repeat step 1. Press **TRANS ALT (L3)** to change transition altitude.

4) Rotate 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.

5.19. Fault Display (FAULTS) Menu



(a) Shown if optional WX-500 installed
(b) Shown if optional traffic sensor installed
(c) Shown if optional AIU installed
(d) Shown if optional ADS-B datalink installed
(e) Shown if optional weather radar installed, weather radar type is RDR-2000, RDR-2100 or RDR-1600 and external weather radar control panel installed.

Figure 5-24: 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. (For Example, the MSL altitude used in the TAWS algorithms use geodetic height converted to MSL with the current EGM (Earth Gravity Model) database. For this to be considered valid for use as MSL altitude, the VFOM must be less than or equal to 106 feet.) Additionally, the tertiary source for vertical speed is GPS/SBAS vertical speed providing the VFOM is less than or equal to 106 feet. When AGL altitude is based on BARO, it is because the RADALT was in a failed state (if so equipped) and the VFOM exceeded 106 feet rendering the vertical component of GPS altitude invalid in the MSL altitude calculation.

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 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.

5.19.1. Fault Display (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.

5.20. Fuel Totalizer Quantity Setting (SET FUEL) Menu

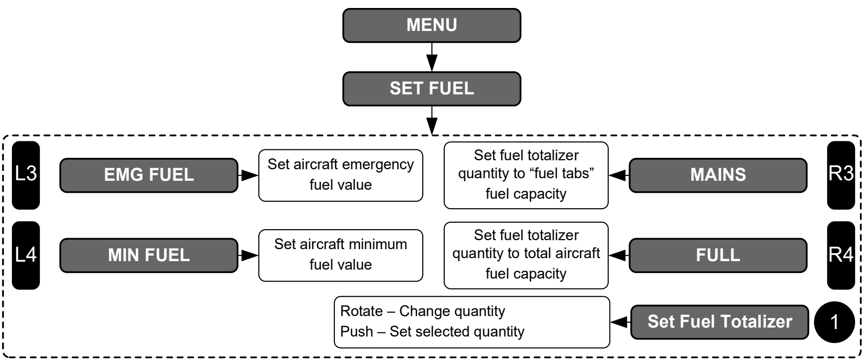


Figure 5-25: Fuel Totalizer Quantity Menu

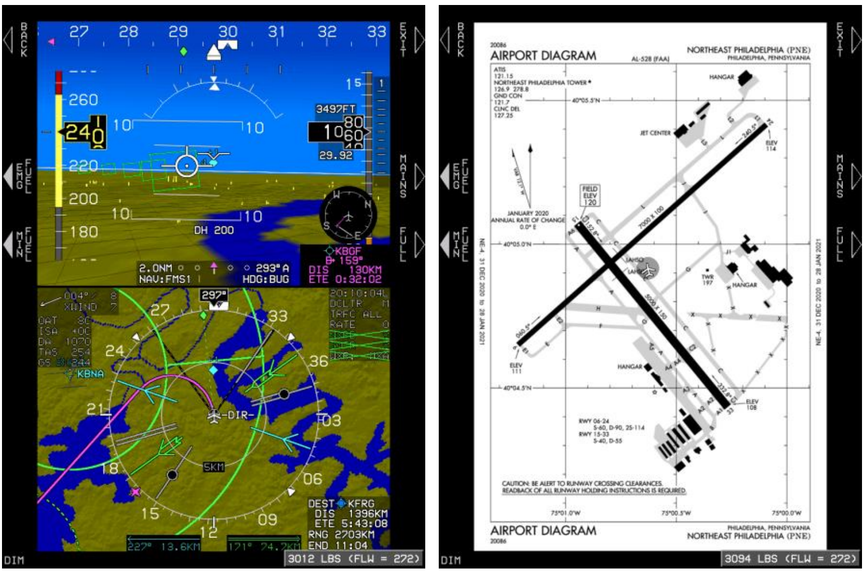
The Set Fuel menu allows the user to set the fuel totalizer quantity in increments of volume units. If either a fuel totalizer or fuel level sensing is configured in aircraft limits, set emergency and minimum fuel bugs in increments of volume units.

5.20.1. Fuel Totalizer Quantity Setting (SET FUEL) Menu (Step-by-Step)

1) Press **SET FUEL (R6)** (PFD) or **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.

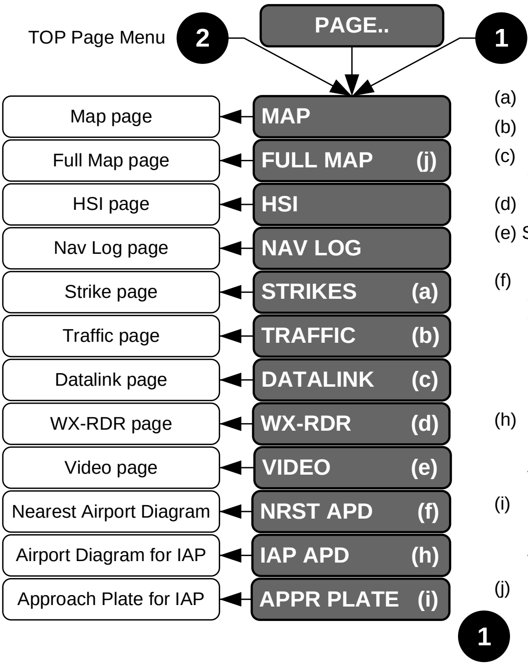
3) If an aircraft fuel caution or aircraft fuel warning is configured in the limits, set **EMG (L3)** and **MIN FUEL (L4)** fuel bugs in increments of volume units.



PFD MFD

Figure 5-26: Fuel Totalizer Quantity Setting (SET FUEL) Menu

5.21. MFD Page Menu



(a) Shown if optional WX-500 installed.

(b) Shown if optional traffic sensor installed.

(c) Shown if optional ADS-B or normal datalink installed.

(d) Shown if optional weather radar installed.

(e) Shown if one or more optional video inputs are enabled.

(f) CPM5 or above IDU-680 with chart database only. Shown if an airport diagram exists for one of the nearest 3 airports. Shown as full page portrait images. *Not shown on PFD or when MFD is in Essential mode or while flight planning.

(h) CPM5 or above with chart database only. Shown if an airport diagram exists for the instrument approach procedure loaded in the active flight plan.

(i) CPM5 or above with chart database only. Shown if an approach plate exists for the instrument approach procedure loaded in the active flight plan. * as shown in (g)

(j) Shown other than IDU #1.

Figure 5-27: MFD Page (PAGE) Menu

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

1) Push **TOP** ❷ or **BTM** ❶ to change MFD pages.

2) Push ❶ and then rotate to **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, **WX-RDR**, **VIDEO**, **NRST APD**, or **FULL MAP** and push to enter.

3) Push ❷ and then rotate to **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, **WX-RDR**, **VIDEO**, **NRST APD**, or **FULL MAP** and push to enter.

5.22. MFD Map Page Format Menu

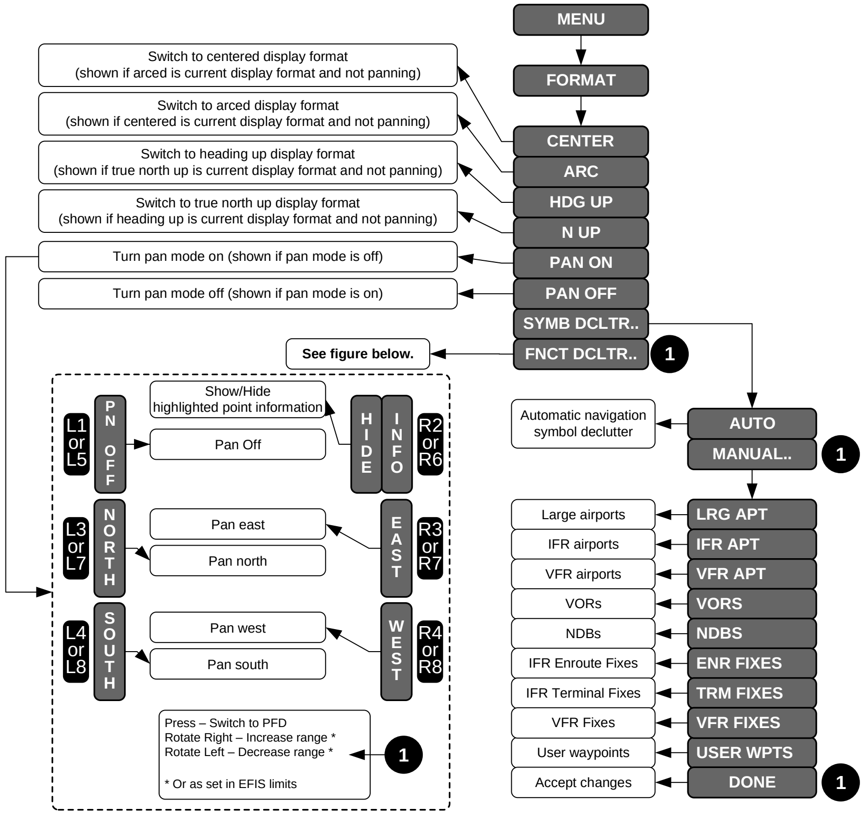


Figure 5-28: MFD Map Page Format Menu

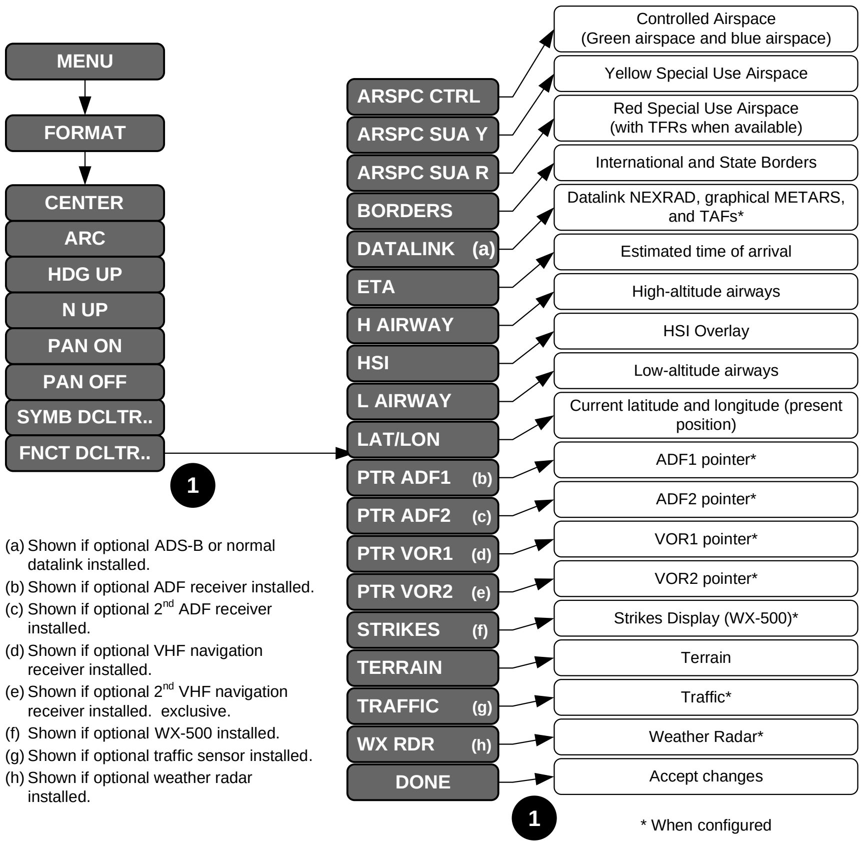


Figure 5-29: MFD Map Page Format Menu (Continued)

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

5.22.1.1. Changing MFD Map Orientation (PFD or MFD)

1) Press **MENU (R1)**. Then press **FORMAT (R8)**.
2) If in arc mode, push ❶ to enter **CENTER** to center display.
3) If in center mode, push ❶ to enter **ARC** to change back to ARC mode.
4) If in HDG UP mode, rotate ❶ to **N UP** and push to change display to North Up orientation.
5) To enter pan mode, rotate ❶ to **PAN ON** and push to enter.

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

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

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

5.22.1.2. Adding LAT/LON to MFD Map Page

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

2) Rotate ❶ to **FNCT DCLTR..** and push to enter.

3) Rotate ❶ to **LAT/LON** and push to select. Either press **EXIT (R1)** or rotate ❶ to **DONE** and push to enter.

5.22.2. 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)**.

5.22.3. MFD Symbol and Function Declutter Options

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

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

2) Rotate ❶ to **FNCT DCLTR..** and push to enter.

3) Rotate ❶ to **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** and push to select.

4) Rotate ❶ to **DONE** and push to enter, or press **EXIT (R1**) to save changes and exit menu.

5.22.4. MFD HSI Declutter (DCLTR) Menu

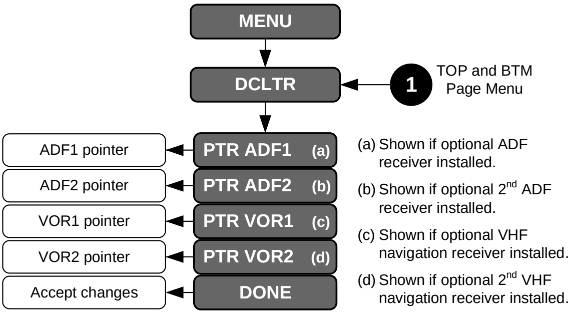


Figure 5-30: MFD HSI DCLTR Menu

5.22.4.1. MFD HSI Declutter (DCLTR) Menu (Step-By-Step)

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

2) Rotate ❶ to **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.

5.23. NAV LOG Page (PFD or MFD)

See Section 3 Display Symbology for more information.

5.23.1. 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.

5.24. 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 6 Quick Start Tutorial

Quick Reference Guide (DOC 64-000097-090B)

Begin by reading the Aircraft Flight Manual Supplement (AFMS) and EFIS Pilot Guide 64-000099-090B.

Knobs at the bottom of the IDU bezel are numbered 1-4 from the right side as noted. ❹ only controls panel or display lighting brightness. To adjust panel lighting (legends, knobs, inclinometer, and buttons), push and rotate ❹. To adjust display lighting (illumination of LCD display), rotate ❹ without pushing.

Power up the EFIS. The system performs a built-in test. If all tests pass, the system displays a screen identifying the database coverage. Press any button or push ❸, ❷, or ❶ to acknowledge. The system begins a two-minute countdown while awaiting sensor initialization. For the purpose of flight planning, etc., press any button or rotate or push ❸, ❷, or ❶ to override this countdown.

PFD Normal Mode

Press **BARO (R2).**

Rotate ❶ to proper setting and push to enter value or press **EXIT (R1)**.

Press D→ **(R4)** to enter a destination active waypoint. Without an active waypoint, the nearest airport is automatically selected.

If a change is necessary, rotate ❶ to the desired alpha or numerical character, push to confirm, and advance to the next position. Push to enter once until all five spaces have been either entered, skipped or viewed.

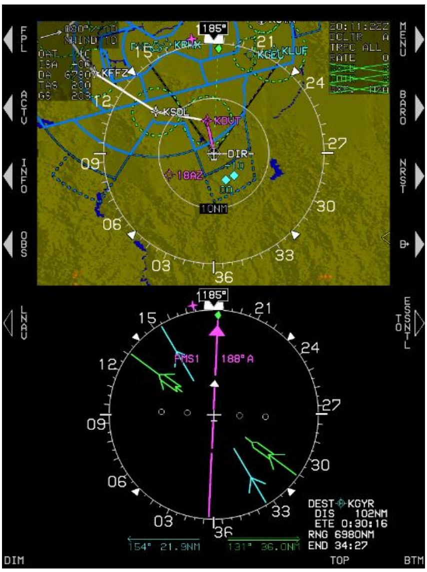
A magenta star waypoint bearing and a green, diamond-shaped track pointer symbol are displayed on the directional scale.

A direct route to the active waypoint is activated and appears as magenta tethered balloon on the PFI area. (Tether is not drawn if fix is not a ground location.)

Active waypoint information, including waypoint type and identifier; elevation or crossing altitude; path to active waypoint, and along-track distance are displayed below the analog AGL, analog G force, mini traffic, or mini map indicator, as configured.

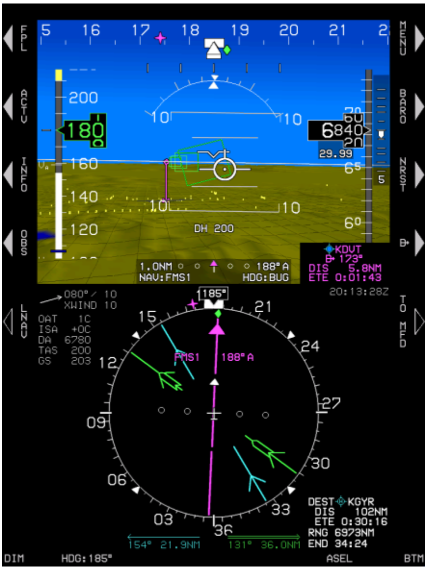
Indicated airspeed is on the left, heading is across the top, and altitude is on the right. VSI appears on the right side of the altitude tape. FMS/VLOC CDI is located on the bottom. Time-critical caution is displayed in the primary field of view.

MFD Normal Mode



Heading-up map with airspace and active waypoint information on the upper area.

The bottom area is showing the HSI page selection with FMS1 pointer in automatic waypoint sequencing along with VOR1 and VOR2 pointers showing relative bearings to associated navigation receivers and radial distance DME information on the bottom.



On MFD, press **TO ESSNTL (R5)** to display PFI on top and the last selected MFD mode on bottom. Press **TO MFD (R5)** to return to MFD pages on top and bottom.

Manual Termination Leg Management on PFD

A manual termination leg has been created within a procedure and waypoint sequencing is suspended.

Press **RESUME (L6)** to resume normal waypoint sequencing to next waypoint.

Flight Plans (Stored Routes)

Activate Flight Plan on PFD or MFD

1) Press **FPL (L1)**.

2) Push ❶ to **SELECT..** from list of stored flight plans.

3) Rotate ❶ to select desired flight plan and push to activate.

Create Flight Plan on PFD or MFD

1) Press **FPL (L1)**.
2) Rotate ❶ to **CREATE-EDIT..** and push to enter.
3) Rotate ❶ to **CREATE FLIGHT PLAN** and push to enter.
4) Press **ADD (R6)** to create first waypoint using ❶ to enter waypoints from beginning to end, or press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, **NRST USR (R7)**, or **AIRWAY (R8)** (when applicable) to select next waypoint, and push to enter.
5) Press **SAVE (R8)** to save flight plan.
6) Press **EXIT (R1)** to exit **CREATE FLIGHT PLAN** flight plan menu.

Waypoints

Create a User Waypoint on PFD or MFD

1) Press **MENU (R1)**.
2) Within 10 seconds, press **DESIG (L3)**. (Results are never seen in PFI area nor MAP if USER WPTS in symbol declutter menu is deselected.)

Edit a User Waypoint PFD or MFD

1) Press **FPL (L1)**.
2) Rotate ❶ to **CREATE-EDIT..** and push to enter.
3) Rotate ❶ to **EDIT USER WPT** and push to enter.
4) Rotate ❶ to highlight waypoint to edit and push to enter.
5) Edit waypoint. Press **SAVE (R7)** or **(R8)** to create new waypoint as the active waypoint and begin navigation guidance.
   a) If **SAVE (R7)** is pressed **EDIT WHICH USER WAYPOINT**, appears for further action, if none is desired, press **EXIT (R1)** to exit menu.
   b) If **(R8)** is pressed, a new active waypoint is created and navigation guidance begins. Press **EXIT (R1)** to exit menu.

Insert Waypoint to an Active Route (PFD or MFD)

1) Press **ACTV (L2)**.
2) Rotate ❶ to location on waypoint list where selected waypoint is to be inserted above.

3) Press **INSERT (R2)**.

4) Press **NRST APT (L2)**, **NRST VOR (L3)**, **NRST NDB (L4)**, **NRST FIX (R2)**, **NRST USR (R3)**, or **AIRWAY (R4)** (when applicable) and then:

   a) Rotate ❶ to make selection and then push to enter, or

   b) Use ❶ to enter waypoint identifier and then push to enter.

5) Press **SAVE (L1)** to save new active flight plan as another stored flight plan or press **EXIT (R1)** to save changes and exit active flight plan.

Add Waypoint to an Active Route on PFD or MFD

1) Press **ACTV (L2)**.

2) Rotate ❶ to end of active flight plan and one empty row below.

3) Press **ADD (R2)** then steps 4 and 5 as shown above.

Delete Waypoint from an Active Route on PFD or MFD

1) Press **ACTV (L2)**.

2) Rotate ❶ to highlight the waypoint to delete and then press **DELETE (R3)** to prompt **CONFIRM DEL WPT**. If part of a published procedure, press **DELETE (R3)** to prompt **CONFIRM DEL PROC**.

3) Push ❶ to **CONFIRM DELETE WPT** or **CONFIRM DELETE PROC**.

4) Press **SAVE (L1)** to save new active flight plan as another stored flight plan.

Omnibearing Selector Function

Automatic OBS if in Manual OBS (FMS OBS Only) on PFD or MFD

1) Press **OBS (L4)**.

2) Press **OBS AUTO (R4)**.

3) Push ❶ **OBS:AUTO** to enter.

Manual OBS if in OBS AUTO on PFD or MFD

1) With an active waypoint and FMS as the active nav source, press **OBS (L4)**. Ensure the active navigation source is FMS.

2) Press **OBS MANUAL (R4)** and then rotate ❶ to desired OBS value, or press **OBS SYNC (R3)** and push ❶ to enter. (This action suspends automatic waypoint sequencing.)

OBS Active Navigation Source Selection (Pilot or Co-Pilot PFD or MFD)

1) Press **OBS (L4)**.

2) Press **NAV FMS (L2) or NAV VLOC1 (L3), or NAV VLOC2 (L4)** to change the active navigation source.

3) If **VLOC1** or **VLOC2** are selected, rotate ➊ to select **OBS:###° (###°)** course and then push to enter. The active navigation source is indicated with an asterisk.

Approaches/Track

Select a VFR Approach on PFD or MFD

The active flight plan must contain an eligible airport for runway selection and VFR approach creation or user waypoint.

1) Press **ACTV (L2)**.

2) Rotate ➊ to desired airport or user waypoint and push to enter.

3) Rotate ➊ to **VFR APPR..** and push to enter.

4) Rotate ➊ to desired runway and push to enter. (For VFR approach to eligible user waypoint, this step is omitted.)

Change Runway during VFR Approach on PFD or MFD

This deletes the previous VFR approach and creates a new VFR approach to the selected runway.

1) Press **ACTV (L2)**.

2) Rotate ➊ to destination airport and push to enter.

3) Rotate ➊ to **VFR APPR..** and push to enter.

4) **PICK RW:** Rotate ➊ to select desired runway and push to enter.

5) Push ➊ to **CONFIRM REPLACE APPROACH**.

Select an IFR Approach on PFD or MFD

1) Press **ACTV (L2)**.

2) Rotate ➊ to highlight desired eligible airport and push to enter.

3) Rotate ➊ to **IFR APPR..** and push to enter.

4) **PICK APPR:** Rotate ➊ to desired approach and push to enter.

5) **PICK TRANS:** Rotate ➊ to desired transition and push to enter.

6) **PICK RW:** Rotate ❶ to desired runway and push to enter.

Change Runway on IFR Approach on PFD or MFD

This deletes the previous IFR approach and creates a new IFR approach to the selected runway.

1) Press **ACTV (L2)**.
2) Rotate ❶ to destination airport and push to enter.
3) Rotate ❶ to **IFR APPR..** and push to enter.
4) **PICK APPR:** Rotate ❶ to desired approach and push to enter.
5) **PICK TRANS:** Rotate ❶ to desired transition and push to enter.
6) **PICK RW:** Rotate ❶ to desired runway and push to enter.
7) Push ❶ to **CONFIRM REPLACE APPROACH**.

Create NRST ILS Approach on PFD or MFD

1) Press **NRST (R3)**.
2) Rotate ❶ to **ILS..** and then push to enter.
3) Rotate ❶ to desired airport (beginning with "ILS") and then push to enter.
4) ILS frequency is sent to NAV1 and NAV2 standby positions. Further pilot action is necessary to swap frequencies to respective active positions.

> **NOTE:**
>
> The heading bug is automatically activated to the current bug setting to act as a starting point for receiving vectors (with or without autopilot enabled). It is recommended to align the heading bug with the aircraft heading or set the heading bug to the assigned vector heading before pushing ❶ to confirm the selection.

5) Push ❶ to **CONFIRM ACTIVATE ILS**. (Previous active flight plan is deleted.)
6) A direct flight plan to the airport associated with the ILS is created.

7) If the heading bug is turned off, it is activated to current heading to act as a starting point for receiving vectors (with or without autopilot enabled.)

8) A vectors-to-final ILS approach to the ILS is activated.

9) Automatic HSI nav source switching to the VLOC1 pilot side and VLOC2 co-pilot side (if applicable) occurs.

10) With crossfill normal, both pilot side and co-pilot side VLOC1 and VLOC2 (regardless of active nav source selection), OBS settings are set to the associated localizer course. (With crossfill inhibited, this action only occurs on side where NRST ILS menu is activated.)

NOTE:

Any previous waypoints from the deleted active flight plan need to be added to the new NRST ILS active flight plan if necessary. (If an active flight plan existed, it is canceled once an NRST ILS is confirmed, and previous waypoints from the canceled active flight plan would have to be added to the new NRST ILS active flight plan.)

XFILL SYNC Operation

XFILL Sync Operation on PFD

(In a dual-sided system, crossfill is the normal default mode of operation.)

1) During crossfill inhibited operation, XFILL INHBT appears on the PFI in the lower left corner.

2) After the **XFILL INHBT** switch is pressed again, the pilot and co-pilot sides are not synchronized, XFILL ARM appears in lower left corner of both PFDs.

3) When the pilot and co-pilot sides are not synchronized, press **MENU (R1)** then **XFILL SYNC (L1)** to synchronize the pilot and co-pilot active flight plan parameters from the side where the button press occurred.

Section 7 IFR Procedures

7.1. 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.

7.2. 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]);

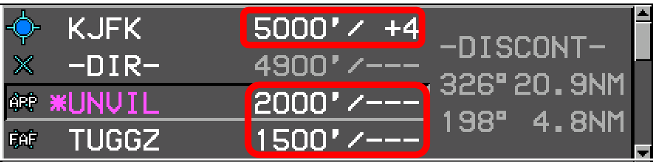
2) Symbol designating waypoint type and what type of procedure (if any) the waypoint is associated with;

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 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.

The active waypoint is designated by an asterisk and is magenta but turns amber (yellow) in the event of a GPS LON caution.

<table>
<tr><th colspan="2">Table 7-1: VNAV Altitudes and Offsets</th></tr>
<tr><th>Input Source</th><th>Color</th></tr>
<tr><td>Navigation database or manually entered</td><td>
</td></tr>
<tr><td>Computed automatically</td><td>
</td></tr>
<tr><td>Failed FMS source</td><td>
</td></tr>
</table>

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 NAV Log 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.

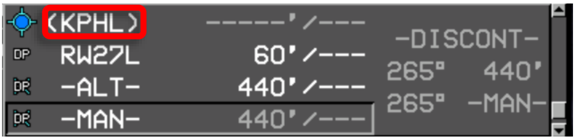


Figure 7-1: Suppressed Waypoint

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.

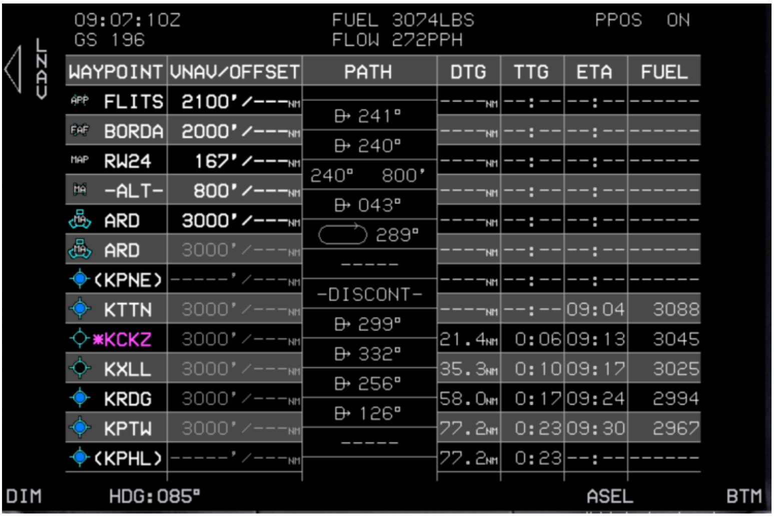


Figure 7-2: Active Flight Plan with Two Suppressed Waypoints

7.2.1. 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.

7.2.2. Waypoint

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 user 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 user to enter a manual VNAV altitude and offset for the selected waypoint. VNAV offsets are settable in nautical miles or kilometers in increments of 100 units. 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 user 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 user 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 user 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..**: This option is invalid if the selected waypoint is a holding pattern waypoint or SAR pattern exit waypoint. (Note: this forces the user to deactivate a manual holding pattern or SAR pattern prior to activating a VFR approach). 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 user 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.

5) **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.

8) **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.

9) **DP..:** This option is invalid if the selected waypoint is a holding pattern waypoint or SAR pattern exit waypoint. (This forces a user to deactivate a manual holding pattern or SAR pattern prior to activating an IFR approach). If selected waypoint is an airport with a DP, the user 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 user confirmation.

7.3. 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.

7.4. 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. ODPs are recommended for obstruction clearance and may be flown without ATC clearance, unless an alternate departure procedure (SID or radar vector) has been specifically assigned by ATC.

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.

7.5. 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). In order 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 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 in order 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 (race track, sector search, or orbit) and the pilot has not chosen to continue out of the SAR pattern (SUSPEND shown). (See SAR appendix.)

Where automatic waypoint sequencing is suspended due to reasons 1, 2, or 4 above, the EFIS automatically switches from TO operation to FROM operation when appropriate. If not suspended, automatic waypoint sequencing occurs upon the following conditions:

1) Bearing to the transition point (turn bisector for the fly-by waypoint, active waypoint for fly-over waypoint) is more than 90° from the current course (transition from "TO" to "FROM" operation);

2) Aircraft location is within one turn diameter (based upon current true Airspeed and 15° angle of bank) of the transition point; and

3) Aircraft heading is within 90° of the current course (generally pointed in the correct direction).

7.5.1. Highway in the Sky (Skyway)

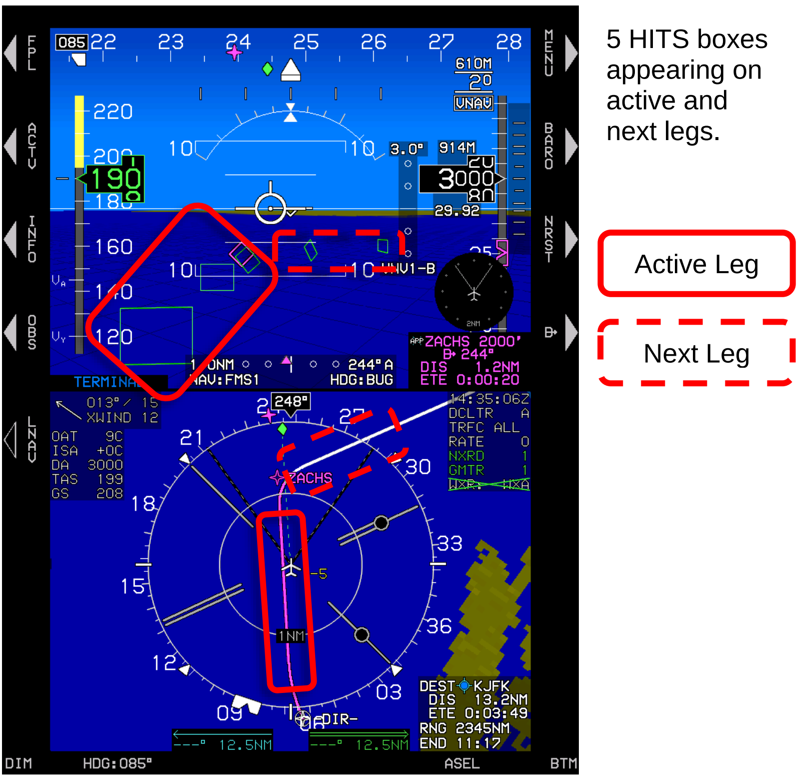


Figure 7-3: Highway in the Sky Five Boxes

When not decluttered, the EFIS displays the active navigation route or manual 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.)

Skyway boxes (when not user 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.

Table 7-2: 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		
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.	Always Solid

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.

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. The purpose of this symbology scheme, is to emulate an altitude pre-selector and provide guidance to climb or descend immediately as if receiving an assigned altitude from ATC. 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 higher of the following:

1) The dynamic climb angle emanating from the aircraft's present position (aircraft-referenced);

2) The dynamic climb angle emanating from the next waypoint VNAV altitude (geo-referenced forward); OR

3) The climb angle setting emanating from the previous waypoint VNAV altitude (geo-referenced backward).

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. VNAV climb guidance is shown in Figure 7-4, Figure 7-5, and Figure 7-6.

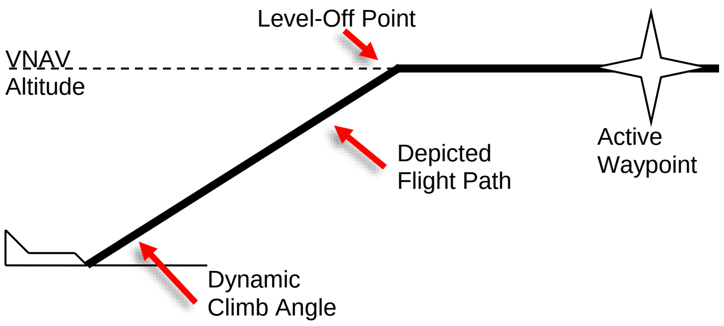


Figure 7-4: Highway in the Sky (Aircraft Referenced)

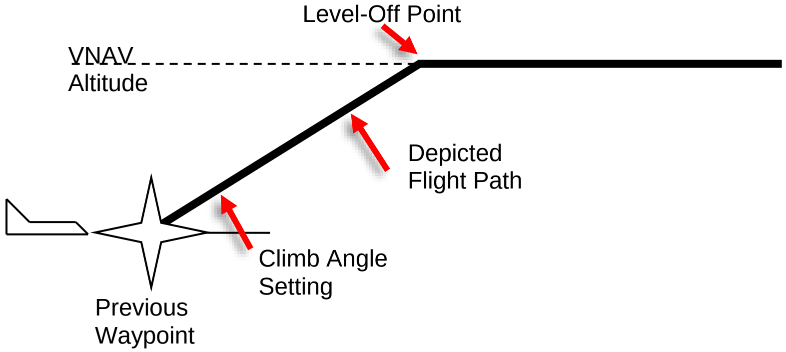


Figure 7-5: Highway in the Sky (Geo-Referenced Backward)

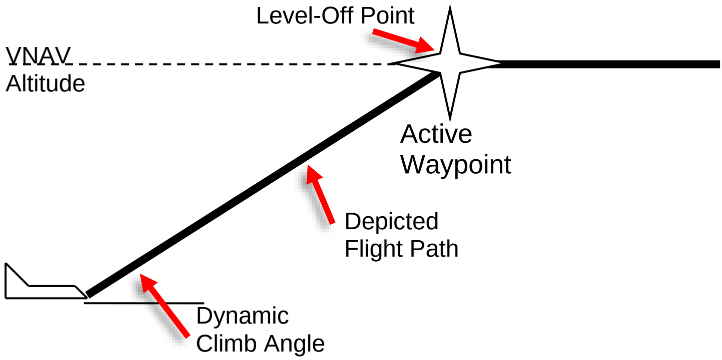


Figure 7-6: Highway in the Sky (Geo-Referenced Forward)

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 7-3.

Table 7-3: 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
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

Table 7-3: 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° Intermediate waypoints exist between FAF and MAP	Missed approach point location	Steepest descent angle based upon straight lines from FAF and subsequent inter-mediate 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.

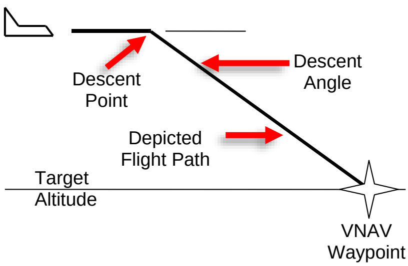
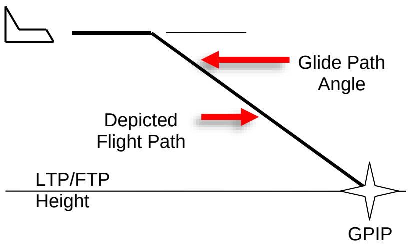
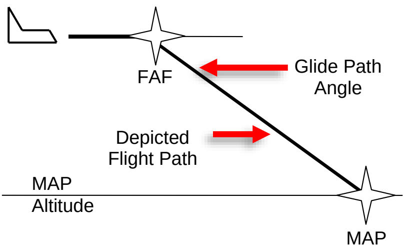
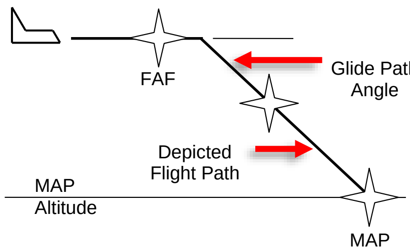
Because five boxes are shown, the descent point depiction is an anticipatory cue. Figure 7-7 depicts descent guidance and creates an easily understood, yet safe, VNAV paradigm to meet the VNAV requirements current guidance.

Figure 7-7: Highway in the Sky Final Approach Segments

The VNAV paradigm scheme is used to create 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 also 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.

Further, the paradigm is biased towards keeping the aircraft at the highest altitude possible for the longest period of time. 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.

Table 7-4: 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 

7.5.2. Waypoint Sequencing

When automatic waypoint sequencing is suspended due to reasons 1, 2, or 4 in § 7.5, the EFIS switches from "TO" to "FROM" operation when appropriate. If not suspended, automatic waypoint sequencing occurs in 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 in order 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 a fix segments comes from NavData®.

7.5.3. Fly-Over Waypoints

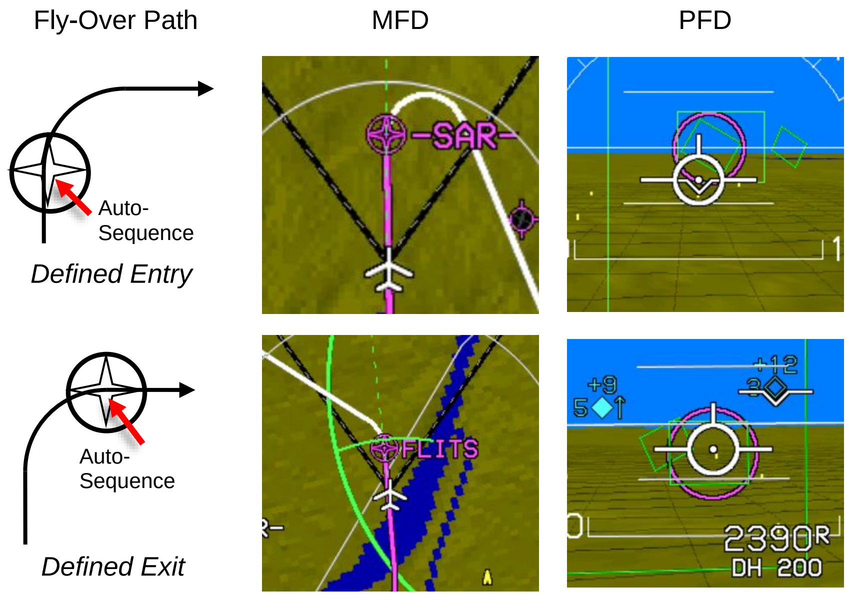


Figure 7-8: Fly-Over Waypoints

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.

7.5.3.1. 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 7-5).

7.5.3.2. Fly-Over with Defined Exit Heading

The following waypoints are fly-over with defined exit heading:

1) Waypoint exiting a discontinuity with the exception of phantom or DP reference waypoints;

2) Entry into procedure turn; and

3) First waypoint with the exception of phantom or DP reference waypoints; and

4) Entry into SAR pattern.

Table 7-5: 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.			

7.5.4. Fly-By Waypoints

Course to a 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 7-9).

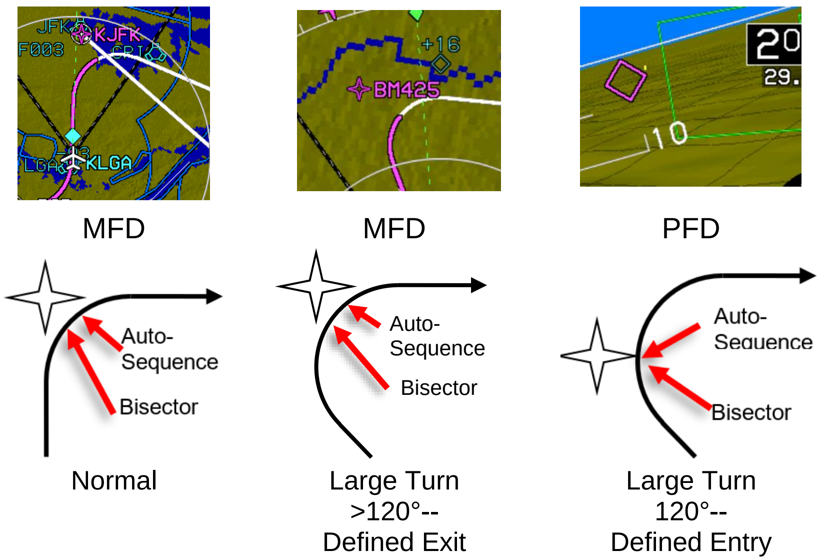


Figure 7-9: Fly-By Waypoints

> **NOTE:**
>
> Entry adjustments should be expected anytime a turn exceeds 120º. Turns greater than 120º should not be used in conjunction with RNP routes. (RNP standards specifically exclude such turns from RNP requirements.)

Table 7-6: 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.
	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.

Table 7-6: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint Entry	Waypoint Exit	# of Segments and Description
	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.
	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.
	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.
	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic or arc path from entry waypoint to exit waypoint.
	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.
	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.
	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.
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°).

Table 7-6: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint Entry	Waypoint Exit	# of Segments and Description
			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°). 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).

7.5.5. 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.

7.5.5.1. 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

7.6. Discontinuities

When the EFIS is unable to construct a smooth flight path, as described above 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 user 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.

7.6.1. 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.

7.7. Direct-To

The EFIS generates a WGS-84 geodesic path to a designated "To Fix". It is intended for the aircraft to capture this path without S-Turning, and without undue delay as follows:

1) A phantom waypoint is created at the current aircraft location.

2) Waypoints prior to the phantom waypoint are automatically decluttered from the flight plan.

3) The phantom waypoint is designated a fly-over defined entry heading waypoint where the entry heading is current aircraft track.

7.8. 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.

7.8.1. 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 9 Appendix for limitations on Earth's magnetic flux horizontal field.)

AHRS Free/"D.G."—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/"D.G."—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.

7.8.2. 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 3 Display Symbology for true north mode symbology examples.

7.9. GPS Altitude

WGS-84 ellipsoid altitude received from the GPS/SBAS is converted to geodetic (MSL) altitude using the EGM 2008 geoidal database.

7.10. 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.

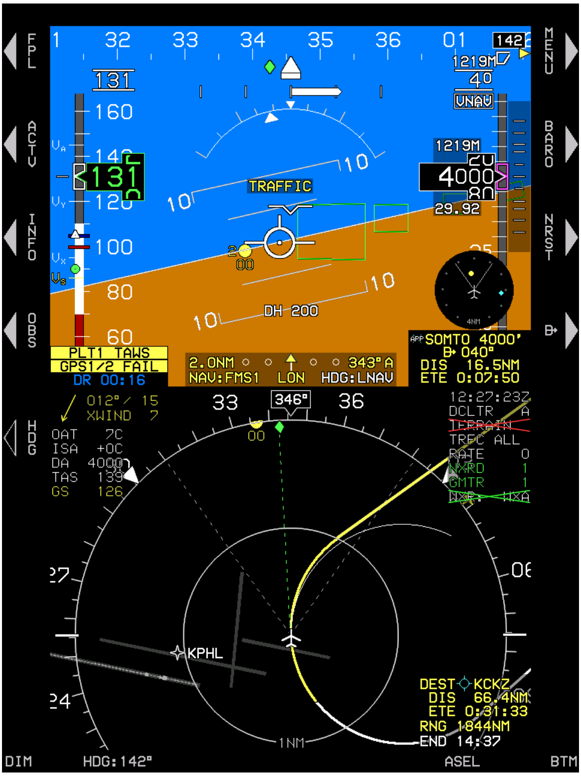


Figure 7-10: Dead Reckoning

7.11. 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.

7.12. 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 user to navigate to and from the parallel offset as required.

Figure 7-11: Parallel Offset PTK+/PTK ENTRY

Figure 7-12: Parallel Offset PTK-/PTK ENDING

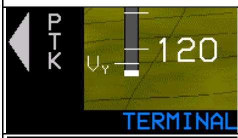
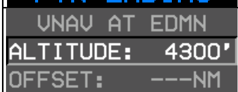
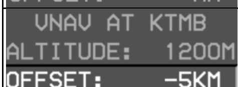
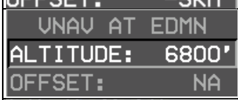
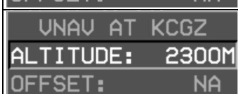
The EFIS provides guidance to parallel tracks at a selected offset distance. When executing a parallel offset, the navigation mode and all performance requirements of the original route in the active flight plan are applicable to the offset route. The EFIS provides for entry of offset distance in increments of 1 NM/KM, left or right of course, and is capable of offsets of at least 20 units Offset mode is indicated with an advisory flag, e.g., PTK = L 20NM or 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.

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 7-7: Parallel Offsets Symbols and Description

Symbol	Description	
	Distance in NM	Parallel offset has been created and has a designated ending waypoint.
	Distance in KM	
	Designated ending waypoint of parallel offset	
PTK = R 3NM	Distance in NM	Parallel track advisory indicating offset track 3 NM/3KM to the right of host route.
PTK = R 3KM	Distance in KM	
	**PTK (L4)** appears when the active route is eligible for a parallel offset.	
PTK ENDING	Approaching end of parallel offset waypoint	
	Altitude in feet and distance in NM	VNAV altitude is possible with an offset of distance before or after the waypoint.
	Altitude in meters and distance in KM	
	Altitude in feet	VNAV altitude input is possible but not an offset of a distance before or after the waypoint.
	Altitude in meters	
	The absence of **PTK (L4)** indicates a parallel offset is not allowed for the reasons stated above.	
	Indicates each waypoint is a part of the parallel offset.	

7.13. 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.

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.

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.

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.

7.14. 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 7-8: Default GPS/SBAS Navigation Modes	
Navigation Mode	**Annunciation**
En route	None
Terminal	TERMINAL
LNAV Approach	LNAV APPR
LNAV/VNAV Approach	LNV/VNV APPR
LP Approach	LP APPR
LPV Approach	LPV APPR
VFR Approach	VFR APPR
Departure	TERMINAL

Table 7-9: 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; and within 30NM of the active runway; and on the Final Approach Segment, the FAWP is the active waypoint or within 2NM of the FAWP; and bearing to FAWP is within 45° of final approach segment track (treated as a mode entry criteria); and The 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; and within 30NM of the active runway; and on the Final Approach Segment, the FAWP is the active waypoint or within 2NM of the FAWP; and if the FAWP is the active waypoint or within 2NM of the FAWP: The bearing to FAWP is within 45° of the final approach segment track (treated as a mode entry criteria); and

Table 7-9: Default Navigation Modes Based Upon Region of Operation	
Default Navigation Mode	**Definition of Region (All distances are always in NM units)**
	the 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 the bearing to the active runway/user waypoint is within 45° of the final approach segment track (treated as a mode entry criteria); and the 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.

7.15. GPS/SBAS CDI Scale

Table 7-10: Summary of Changes In Cross-Track FSD

	To En Route	**To Terminal**	**To Approach**
	Distances are always in NM units		
From En route		Change from ±2 NM FSD to ±1 NM FSD over a distance of 1 NM; start transition when entering terminal mode.	
From Terminal	Change from ±1 NM FSD to ±2 NM FSD over a distance of 1 NM; start transition when entering en route mode.		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		Change to ±1 NM	
From 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.	

NOTE:

The sensitivity change from ±0.3NM to ±1NM can take as long as 30 seconds to provide a smooth transition for autopilots.

7.15.1. 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 105°)

4) NAV: VOR2/LOC2

7.15.2. Alerting Scheme for LNAV/VNAV Procedures

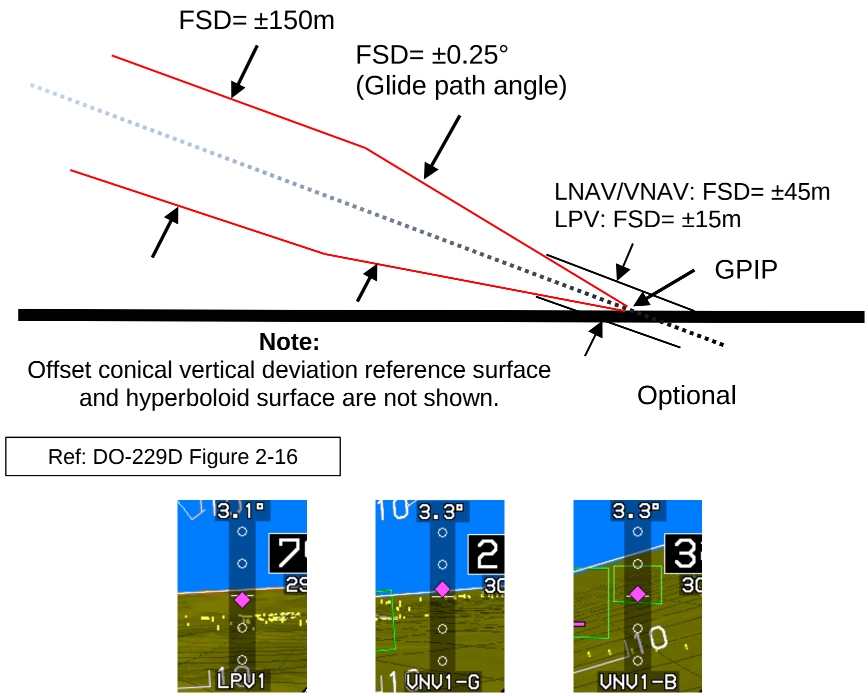


Figure 7-13: Vertical Deviation Indicator Linear Deviation

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 7-13.

7.15.3. Alerting Scheme for LPV/LP Procedures

During normal operation with an 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 the track in vertical and lateral dimensions (only lateral for LP.)

The linear lateral scale limits of the CDI for the LNAV approach procedure.

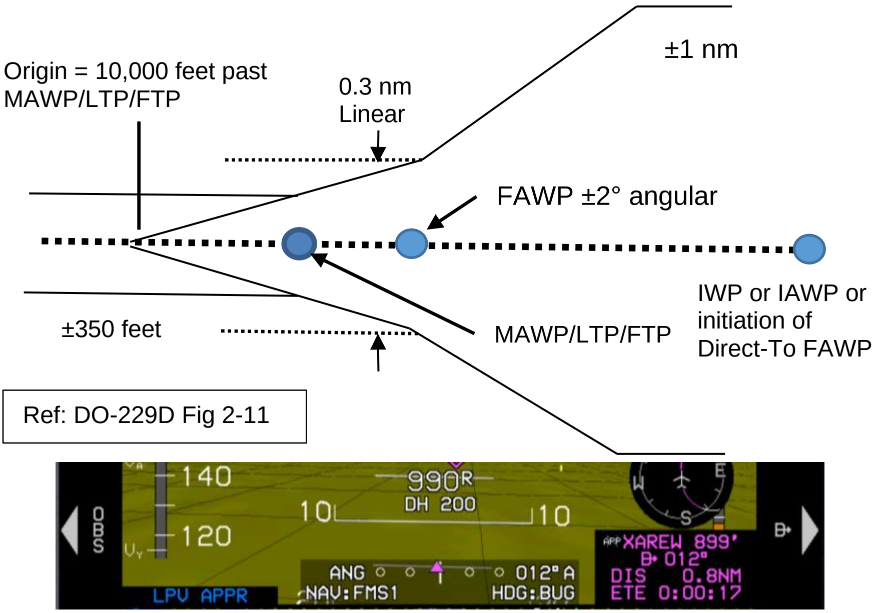


Figure 7-14: FSD Lateral Deviation Indicator Linear Deviation (not VTF Approach)

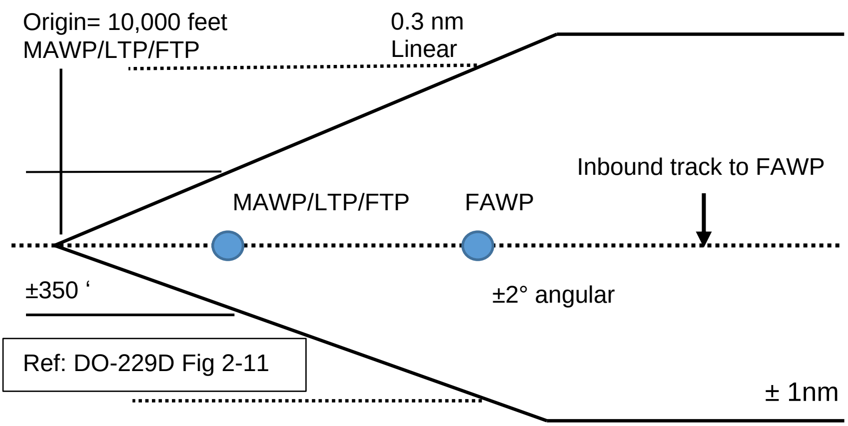


Figure 7-15: FSD Lateral Deviation Indicator Linear Deviation VTF Approach

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:
   a) 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.

7.16. 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.

7.16.1. 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.

7.16.2. VTF IFR Approach

The user may select a VTF IFR approach, indicating the user 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.

7.16.3. VTF VFR Approach

The user 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 7-16, 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 RW08L is activated.

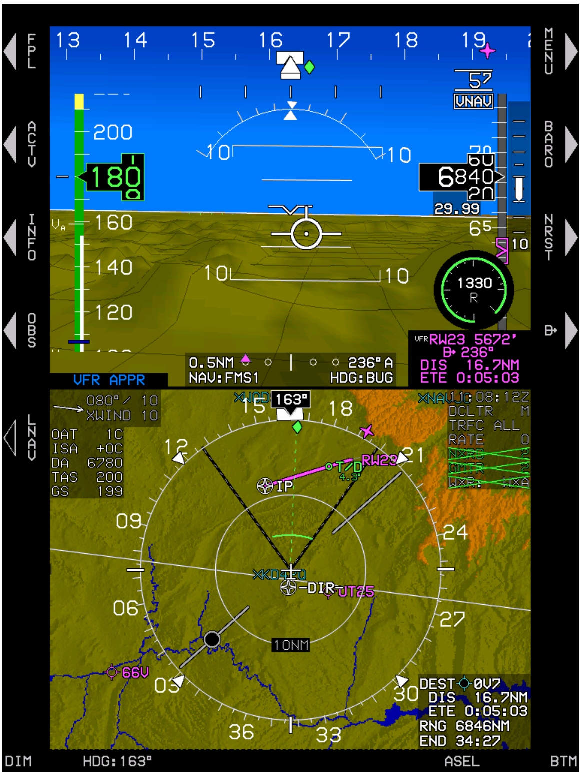


Figure 7-16: VTF VFR Approach

7.17. 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 7-11: RNP Order of Precedence

Navigation Mode	Annunciations	Conditions
Manual RNP (Manually set between 0.1NM and 15NM)	RNP: 1.6M ANP: 0.1	Navigation mode is RNP, and manually entered RNP is used to determine CDI FSD, LON and LOI alerting. Manual RNP overrides all other modes.

Table 7-11: RNP Order of Precedence

Navigation Mode	Annunciations	Conditions
Manual RNP on Final Approach Segment		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.
Automatic RNP (Retrieved from Navigation Database)		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.
Automatic RNP on Final Approach Segment		
CDI shows RNP navigation mode, and automatically retrieves the RNP value to determine CDI FSD, LON alerting, and LOI alerting.		

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.

7.17.1. 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 is latched until no longer in an approach mode.

Figure 7-17: Automatic RNP Mode

7.18. Missed Approach and Departure Path Definition

Once on the final approach segment, the user 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 initiated before crossing the MAWP, the EFIS switches to FROM mode at the MAWP and continues on the same course.

If the user 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.

7.19. Loss of Navigation Monitoring

Table 7-12: Loss of Integrity Caution Monitoring

Mode of Flight	HAL	Time to Alert
RNP: 0.10A RNP: 15.0A (See Note 1)	As manually set or automatically retrieved	10 Seconds (RNP< 2NM) 30 Seconds (otherwise)
En route	2 NM	30 Seconds
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
Note 1: Only applicable prior to 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

7.19.1. Faults Menu

Use the Faults menu to distinguish the cause of a LON caution. Table 7-13 explains conditions and caution termination for each mode of flight.

Table 7-13: 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.	Latched 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.
LNAV Approach mode LNAV APPR	Upon passing the FAWP, flag is latched 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, LON/VERT LON flags are latched 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 Note1)
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.

Table 7-13: Summary of Faults Menu

Mode of Flight	Conditions	Caution Termination
Note 1: 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.		

7.19.2. 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 7-14: Loss of Integrity Caution Monitoring

All distances are always based on NM.

Mode of Flight	HAL	Time to Alert
RNP: 0.10A RNP: 15.0A (See Note 1) *	As manually set or automatically retrieved	10 Seconds (RNP<2NM) 30 Seconds (otherwise)
En route	2 NM	30 Seconds
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

*Requirements only apply to sequencing FAWP; meeting loss of integrity criteria after sequencing the FAWP is defined as a Loss of Navigation (LON).

Note 1: Only applicable before sequencing FAWP. Meeting loss of integrity criteria after sequencing the FAWP is defined as LON.

7.20. 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.) (Increments of 1 unit 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.

7.21. 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:

1) Standard Instrument Departure (DP)
2) VFR Approach to User Waypoint
3) Standard Terminal Arrival Route (STAR)
4) ILS Instrument Approach
5) ILS Instrument Approach with Manual Termination Leg
6) LOC Back Course Instrument Approach
7) RNAV (GPS) Instrument Approach to LP Minima
8) RNAV (GPS) Instrument Approach to LPV Minima
9) RNAV (RNP) Instrument Approach to RNP 0.3 DA
10) NRST ILS Instrument Approach
11) VOR/DME Instrument Approach

12) ILS or LOC RWY XX Instrument Approach with Missed Approach Flown to Alternate Fix

7.21.1. 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) Rotate ❶ to desired airport and push to enter.

3) Rotate ❶ to **DP..** and push to enter.

4) Rotate ❶ to desired DP. Push to enter.

5) Rotate ❶ to desired runway. Push to enter. Press **EXIT (R1)** to exit active menu.

6) ATC issues radar vectors to assigned route as published in the DP text notes.

7) Press **ACTV (L2)**, edit active flight plan accordingly. Press **EXIT (R1)** to exit active menu.

8) Push ❶. Rotate to **NAV LOG** and then push to enter. View first portion and then rotate ❶ to view remainder of NAV Log, if necessary.

7.21.2. 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 5 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.

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 ➊ to **CREATE-EDIT..**, and then push to enter.

6) Rotate ➊ to **EDIT USER WPT** and then push to enter.

7) Rotate ➊ to desired waypoint and then push to enter.

8) Rotate ➊ and push to sequence all five spaces to create desired name for user waypoint and 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 **(R8)** to save changes and begin navigation guidance to user waypoint and automatically return to EDIT WHICH USER WPT: menu.

10) If **(R8)** is pressed followed by **EXIT (R1)** to exit EDIT WHICH USER WPT: menu, press **ACTV (L2)** to open active flight plan.

11) Push ➊ to open list of available options for the user waypoint.

12) Rotate to **VFR APPR..**, and then push to enter.

13) Push ➊ to accept the use of the desired waypoint or press **EXIT (R1)**.

14) Rotate ➊ 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.)

16) If desired, press **MENU (R1)**, press **BUGS (R2)**, and then press **VNAV CDA (R4)**. Push ➊ to enter **DCND ANG..**, rotate ➊ to desired angle of descent, and then push to enter.

17) 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.

7.21.2.1. For VFR Flight Planning

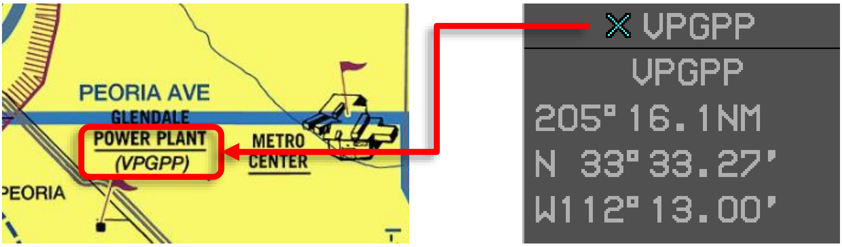


Figure 7-18: VFR Waypoint

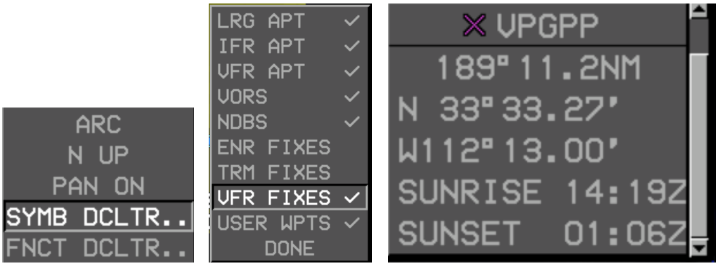


Figure 7-19: Map Format Options

7.21.3. 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 rotate ❶ to highlight arrival airport and push to enter. Rotate ❶ to **STAR..** and push to enter.

2) **PICK STAR:** Rotate ❶ to desired STAR. Push to enter.

3) **PICK TRANS:** Rotate ❶ to desired transition. Push to enter. *= Most logical transition from avenue of arrival.

4) **PICK RW:** Rotate ❶ to desired runway and 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 push ❶ to enter (see § 7.21.5).

6) Push ❶ and rotate to **NAV LOG**. Push to enter to view first portion and then rotate ❶ to view remainder of NAV Log if necessary.

7.21.4. ILS Instrument Approach (Step-By-Step)

1) Press **ACTV (L2)**. Rotate ❶ to desired airport and push to enter.

2) Rotate ❶ and select **IFR APPR...** Push to enter.

3) **PICK APPR:** Rotate ❶ to desired instrument approach with matching 5-digit channel number from instrument approach chart and then push to enter.

4) **PICK TRANS:** Rotate ❶ to transition (* indicates most logical from current position). Push to enter.

5) **PICK RW:** Rotate ❶ to assigned runway for landing and then push to enter. (Colors selected runway light gray). Press **EXIT (R1)** to exit active menu.

6) 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.

7.21.5. ILS Instrument Approach with Manual Termination Leg (Step-By-Step)

See § 7.6.1 for details on manual termination legs.

1) Activate ILS as described in § 7.21.4. 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.

7.21.6. LOC Back Course Instrument Approach (Step-By-Step)

1) Press **ACTV (L2)**. Rotate ❶ to airport active waypoint. Push to enter.

2) Rotate ❶ to **IFR APPR..** and push to enter.

3) **PICK APPR:** Rotate ❶ to desired LOC Back Course procedure and push to enter.

4) **PICK TRANS:** Rotate ❶ to desired transition (* indicates most logical from current position). Push to enter.

5) **PICK RW:** Rotate ❶ to 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 rotate ❶ to the FAF then **(R4)** and 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.

9) 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.

10) Rotate ❶ to set back course bearing and push to enter. This results in proper sensing of back course CDI indications.

11) 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.

12) Passing the MAWP, nav source automatically switches to FMS (as configured) and CDI color changes from cyan to magenta.

13) 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.

7.21.7. RNAV (GPS) Instrument Approach to LP Minima (Step-By-Step)

1) Select desired airport and desired **IFR APPR..** as described above.

2) **PICK TRANS:** Rotate ❶ to desired transition (* indicates most logical from current position). Push to enter.

3) **PICK RW:** Rotate ❶ to desired runway. Push to enter.

4) Rotate ❶ to desired waypoint in active flight plan, then press D→ **(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 replaced 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.

7.21.8. 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.

2) ATC issues radar vector to fly HDG 300° to XXXXX**.** Rotate ❸ to **300°** and then push to enter.

3) ATC now issues clearance direct XXXX and cleared for RNAV XXXXX approach. Press **ACTV (L2)**, rotate ❶ to FAF, and then press D→ **(R4)**.

4) Push ❶. **WAYPOINT** appears. Push ❶ to accept waypoint with no changes or press **EXIT (R1)**.

5) Inside of FAF, LPV APPR indicates the GPS mode of operation.

6) Press **MISS (L5)** for immediate missed approach or **ARM (L6)** to arm the missed approach leg.

7) Past the MAWP, NAV source remains FMS and scale automatically changes to 0.3NM FSD.

8) 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.

9) 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.

7.21.9. 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 XXXX and cleared for RNAV XXXXX approach.

3) Press **ACTV (L2)**, rotate ❶ to XXXX, press D→ **(R4)**, and then push ❶ to continue.

4) Push ❶. **WAYPOINT** appears. Push ❶ to accept as a waypoint with no further action or press **EXIT (R1)**.

5) Inside of FAF, LPV APPR indicates the GPS mode of operation.

6) Press **MISS (L5)** for immediate missed approach or **ARM (L6)** to arm the missed approach leg.

7) 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.

8) 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.

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.

7.21.10. 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) Rotate ❶ to highlight desired airport with "ILS" on the left. Push to enter.
3) Push ❶ to **CONFIRM ACTIVATE ILS**. (See Section 6 Quick Start Tutorial 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 created.
    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 D→ **(R4)** then push ❶ to enter a direct route with navigation guidance to FAF.
5) To set published minimums, see Section 5 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 rotate to **HSI** and 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) On short final GPS mode automatically switches to LNAV APPR and replaced 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.

7.21.11. 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 push ❶ to enter.

3) Push ❶. **WAYPOINT** appears. Push ❶ to accept waypoint with no changes or press **EXIT (R1)**.

4) Set EFIS to display VOR pointers and DME bearing and distance symbology (see Section 5 Menu Functions and Step-By-Step Procedures for more information).

5) To set published minimums, see Section 5 Menu Functions and Step-By-Step Procedures.

6) 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.

7) 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: This is the default approach type and is selected when none of the above selections are made. There are no prerequisites for selecting LNAV. Ensure the required OBS navigation source is selected for the approach type conducted.

7.21.12. ILS or LOC RWY XX 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 and the active flight plan is opened. ❶ is rotated to one position past the end of the active flight plan and **INSERT (R2)** is pressed; and XXXXX entered with ❶ and pushed to enter.

1) Insert XXXXX waypoint in active flight plan. Push ❶ to enter.

2) Press **ACTV (L2)** and rotate ❶ to **XXXXX** and push to enter.

3) Rotate ❶ to **HOLD..** and push to enter.

4) Create published holding pattern at XXXXX. Rotate/push ❶ through the process and push to enter. Observe XXXXX is in correct position in active flight plan after XXXXX.

5) En route to the (FAF) for the ILS RWY ## observe where XXXXX is located on the MAP.

6) 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**.**

7) Verify active flight plan has holding pattern entered as published and is depicted correctly.

8) 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 8 Terrain Awareness Warning System

8.1. Terrain Awareness Warning System (TAWS) Functions

The IDU provides TSO-C151b TAWS functionality. The following description is for a TAWS Class A, B, and C depending on aircraft configuration and external sensors/switches. Warning functions provided by TAWS are as follows. See Section 2 System Overview for additional information on system warning, caution, and advisory alerts.

> **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.

Table 8-1: TAWS Functions Provided by the EFIS

Aircraft Type	Airplane				Airplane
	RG + F	RG	FG + F	FG	
TAWS Class	**A**	**A**	**A**	**A**	**B or C**
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

1) Terrain Display: Terrain and obstacles on PFI and Map page (see Sections 3 Display Symbology and 5 Menu Functions and Step-By-Step Procedures).

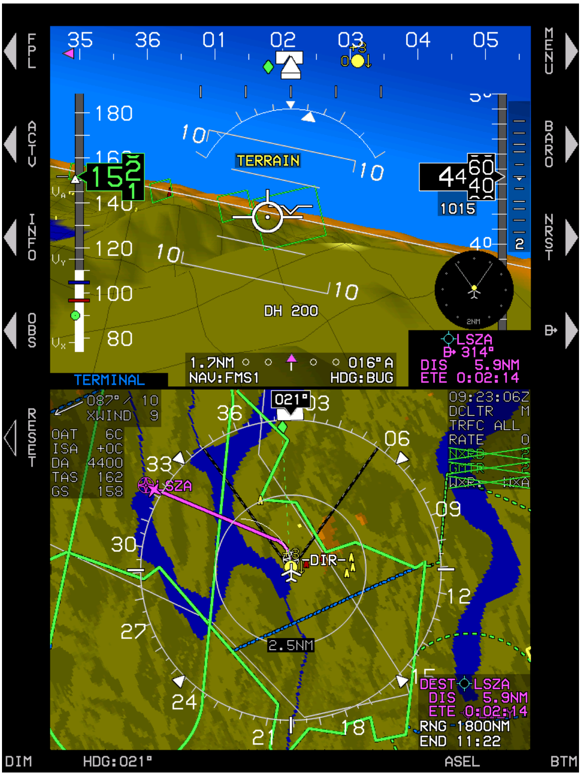


Figure 8-1: Terrain Display

2) Forward Looking Terrain Awareness (FLTA): Alerts to hazardous terrain or obstructions in front of the aircraft.

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.

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.

8.2. Forward Looking Terrain Alert (FLTA) Function

Figure 8-2: FLTA INHBT

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

8.2.1. FLTA Modes

FLTA mode is either slaved to the GPS/SBAS navigation mode or set automatically based upon default mode logic.

8.2.2. 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 user 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 user 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.

8.2.3. 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. Values are always represented in NM for distances, and feet for altitude regardless of speed units setting in EFIS limits. 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.

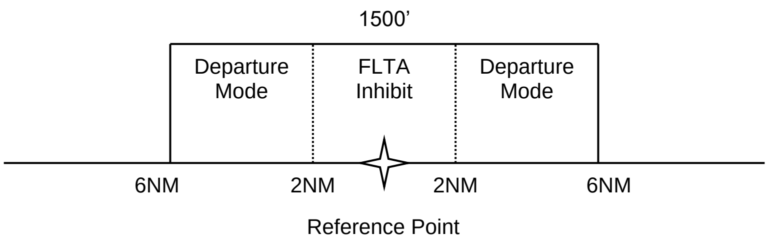


Figure 8-3: Default FLTA INHBT

2) Other Modes: For other default FLTA modes, reference point for automatic FLTA inhibiting and mode envelope is the nearest runway threshold or user waypoint with a defined approach bearing. TAWS continuously searches all runway thresholds at the nearest three airports to determine the nearest runway threshold. TAWS performs a search for the nearest three airports and 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.

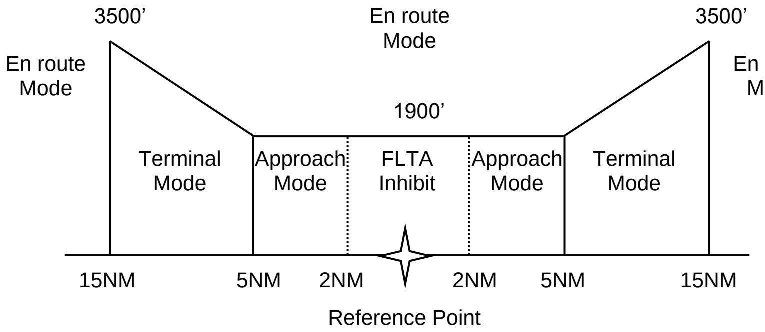


Figure 8-4: FLTA INHBT Mode Areas

8.2.4. 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 8-2: 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 or Climbing Flight 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

Table 8-2: FLTA Search Envelope

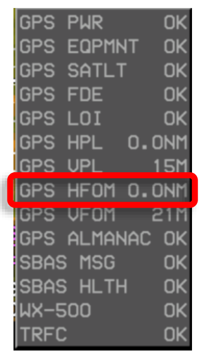
Envelope	Parameter
En route Mode Descending RTC	Class A & B: 500 feet Class C: 200 feet
Terminal Mode Descending RTC	Class A & B: 300 feet Class C: 200 feet
Approach Mode Descending RTC	100 feet
Departure Mode Descending RTC	100 feet
Level-Off Rule	Class A & B: 20% of vertical speed Class C: 10% of vertical speed Additional value used to expand level-off leading for descending flight reduced required terrain clearance (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 8-3.

Table 8-3: 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		
Approach Mode	10° change		0.3NM
Departure Mode			



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 8-5: Faults Menu HFOM Value

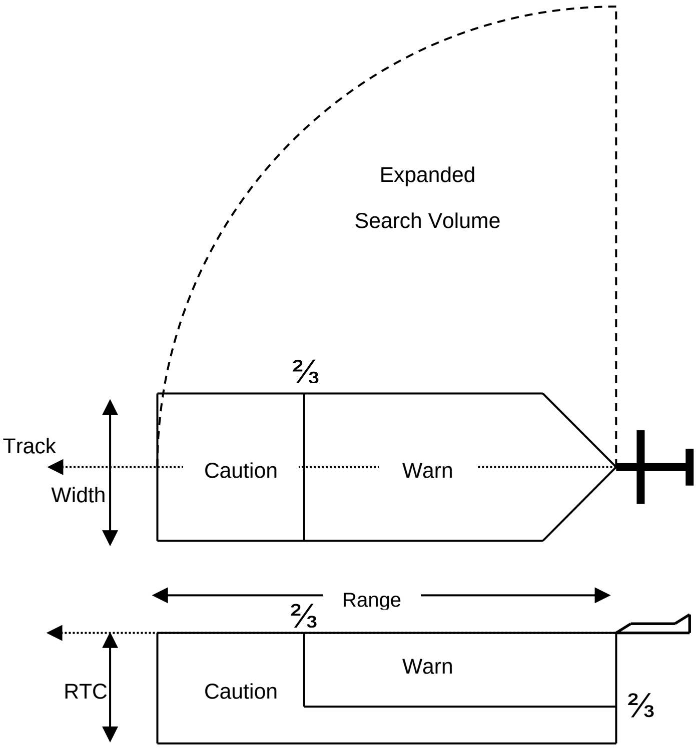


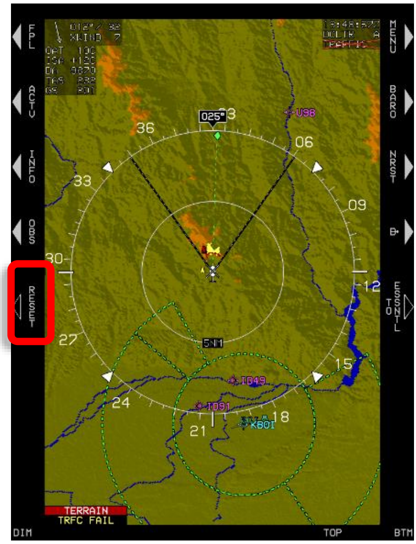
Figure 8-6: FLTA Search Volume

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. The amount of delay is reduced linearly with increased bank angle so at 30° of bank there is no delay time. Delaying is intended to reduce nuisance-search volume expansions when experiencing bank angle excursions due to turbulence.

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.

8.2.5. FLTA Alerts and Automatic Popup

PFD IDU #1



Transmit-Enabled MFD in Full Map page

Figure 8-7: Popup Mode

When terrain or obstructions fall within the FLTA search envelope, an FLTA warning is generated. Terrain rendering is enabled when an FLTA warning is initiated or upgraded as follows:

1) On PFD screen, terrain rendering is enabled;

2) On Map page, terrain rendering is enabled only if TAWS Inhibit is not enabled.

In addition, when an FLTA warning is initiated or upgraded, an automatic popup 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 outer ring derived range e.g. twice range setting) set to:

   a) When using nautical mile scale:

      i) 10NM (groundspeed > 200 knots);

ii) 5 NM (groundspeed ≤ 200 knots and groundspeed > 100 knots); or

iii) 2NM (groundspeed ≤ 100 knots).

b) When using the kilometers scale:

i) 20KM (groundspeed > 200 knots);

ii) 10KM (groundspeed ≤ 200 knots and groundspeed > 100 knots); or

iii) 5KM (groundspeed ≤ 100 knots).

After the popup mode is engaged, the pilot may change any setting automatically changed by the popup mode. In addition, any open menus are closed as a **RESET (L5)** appears for 20 seconds to reset the previous screen configuration with one button press. Popups 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.

8.3. 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 0.5º less than the lower of:

1) a straight line from the FAF to approach runway threshold; or

2) 3º emanating from the approach runway threshold.

The intent is to eliminate errors which might occur if the flight crew selects the incorrect active runway.

When the aircraft descends below the threshold, a PDA warning is generated (Figure 8-8). The 3D location of the "approach runway threshold" is based upon the missed approach location and the active runway elevation.

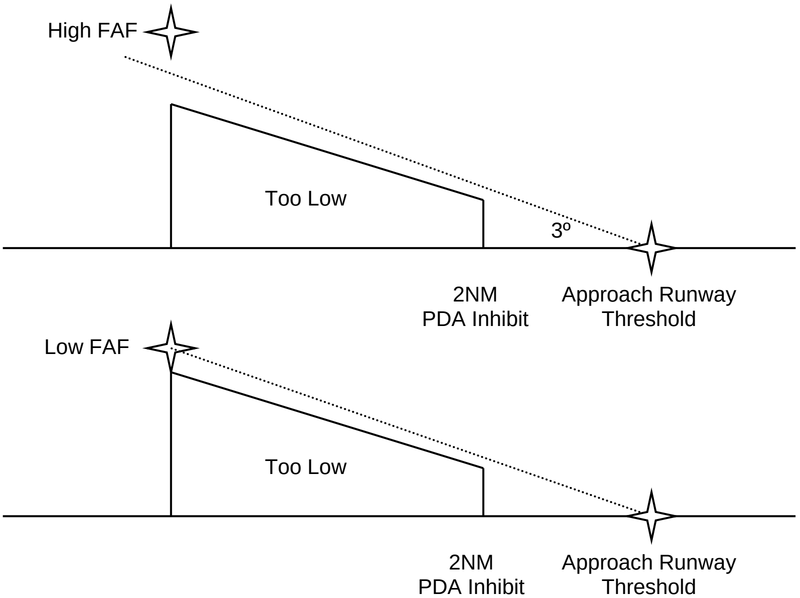


Figure 8-8: PDA Alert Threshold

8.4. 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 8-4: GPWS Mode 1 Alerts

AGL Altitude (ft.)	
Caution Threshold	**Warning Threshold**
SINK RATE SINK RATE	PULL UP PULL UP

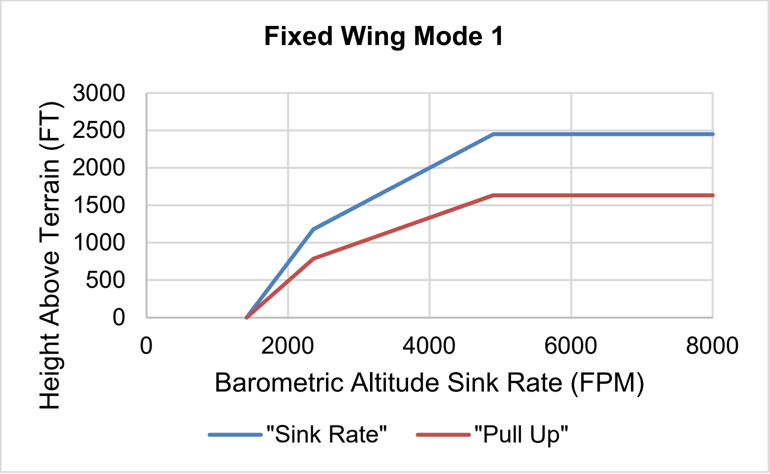


Figure 8-9: Fixed Wing GPWS Mode 1

8.5. 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). AGL rate filtering 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 8-5.

Table 8-5: 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 $\leq$ 500 ft or Airspeed $\leq V_{FE}$

When GPWS Mode 2 envelope is pierced, a GPWS Mode 2 caution or warning is generated.

Table 8-6: GPWS Modes 2A Alerts				
Caution Threshold		**Warning Threshold**		
TERRAIN	TERRAIN	PULL UP	PULL UP	

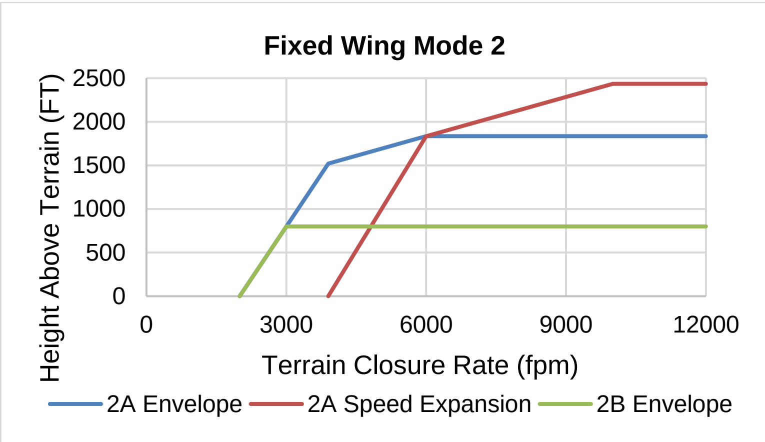


Figure 8-10: Fixed Wing GPWS Mode 2

8.6. 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”

Figure 8-11: GPWS Mode 3 Warning (Sink Rate after Takeoff or Missed Approach)

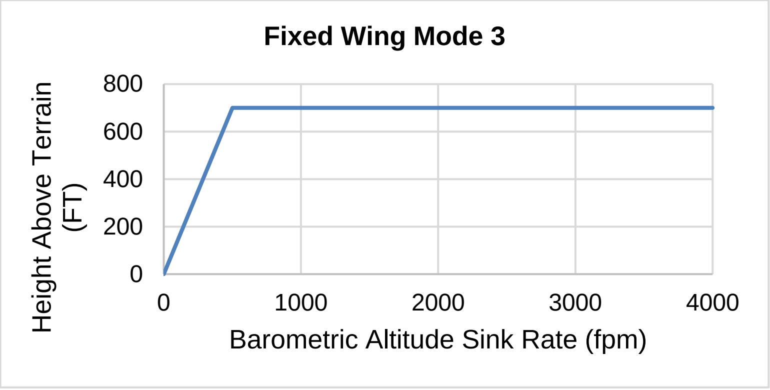


Figure 8-12: Fixed Wing GPWS Mode 3

8.7. 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 follows.

Table 8-7: 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
Fixed gear with defined landing flaps position	Not Applicable	Flaps not in landing configuration
Fixed gear		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 8-8: GPWS Mode 4 Alerts

Mode	Region	Caution Flag	Single Audible Alert
4A	Low-Speed		“Too Low Gear”
	High-Speed		“Too Low Terrain”
4B	Low-Speed		Landing gear up: “Too Low Gear” Landing gear down: “Too Low Flaps”
	High-Speed		“Too Low Terrain”

Table 8-9: GPWS Mode 4 Envelopes

Mode	Region	Speed (KIAS)	AGL Altitude (ft.)
4A	Low-Speed	< 182.5	500
	High-Speed	≥182.5	Lesser of: 800
4B	Low-Speed	< 138.75	150
	High-Speed	≥ 138.75	Lesser of: 800

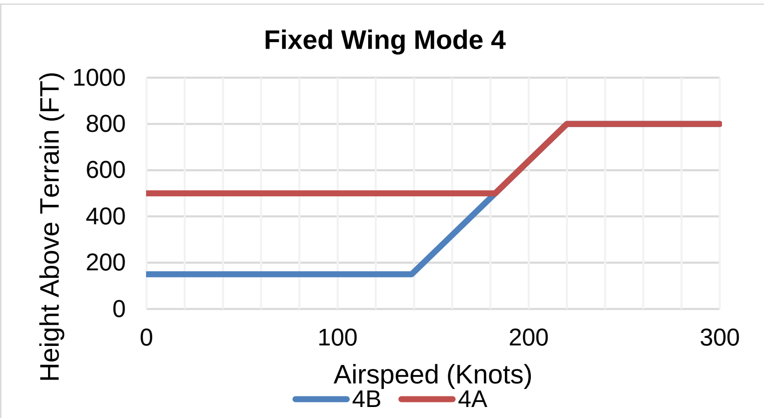


Figure 8-13: Fixed Wing GPWS Mode 4

8.8. 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 8-10: GPWS Mode 5 Alerts

Caution Threshold	Warning Threshold
GLIDESLOPE GLIDESLOPE	GLIDESLOPE GLIDESLOPE

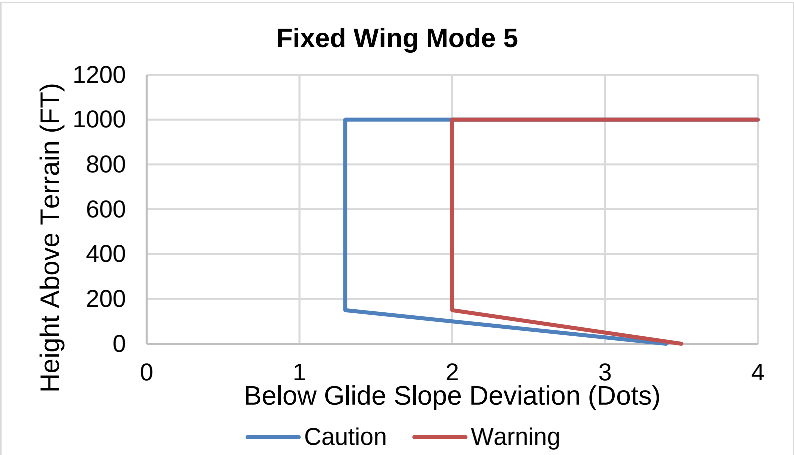


Figure 8-14: Fixed Wing GPWS Mode 5

8.9. 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.

8.10. 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 system limits, landing gear position are the source.

6) Flap Position Sensor. As configured in the system limits, flap position is the source.

7) TAWS Inhibit Switch. As configured in the system limits, used for manual inhibiting of TAWS alerting functions. Gives an indication of actuation (e.g., toggle/rocker or pushbutton with indicator light and TAWS INHBT in lower left corner of PFI area of PFD).

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 system limits, momentarily activated to inhibit GPWS Mode 5 function.

Table 8-11: 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	✓	✓	✓	✓	

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

8.11. TAWS Basic Parameter Determination

Fundamental parameters used for TAWS functions are as defined in Table 8-12.

Table 8-12: Airplane 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 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. A temperature correction is applied when a reporting station elevation is determined and outside air temperature is valid. 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

Table 8-12: Airplane TAWS Basic Parameters Determination

Parameter	Source	Notes
		active 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 3 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: 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.

Table 8-12: Airplane TAWS Basic Parameters Determination

Parameter	Source	Notes
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) The built-in test at system initialization does not determine the navigation database to be corrupt.

8.12. TAWS Automatic Inhibit Functions (Normal Operation)

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.

8.12.1. TAWS Automatic Inhibit Functions (Abnormal Operation)

The following 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 8-13.

Table 8-13: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Display	FLTA	PDA	GPWS Mode 1	GPWS Mode 2	GPWS Mode 3	GPWS Mode 4	GPWS Mode 5	500' Wake-Up
GPS/SBAS (H)	AC Position	Inhibit	Inhibit	Inhibit						
TD	Terrain Elev.	Inhibit	Inhibit							
ILS	Glide Slope Dev.								Inhibit	
MSL	MSL Altitude	Inhibit	Inhibit	Inhibit						
GPS/SBAS (H) + RADLT	AC Position, AGL	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Table 8-13: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Display	FLTA	PDA	GPWS Mode					500' Wake-Up
					1	2	3	4	5	
GPS/SBAS (V) + ADC	MSL Altitude, VSI	Inhibit	Inhibit	Inhibit	Inhibit		Inhibit			
TD + RADLT	Terrain Elev. AGL	Inhibit	Inhibit		Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
MSL + RADLT	MSL Altitude, AGL	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC + RADLT	MSL Altitude, VSI, AGL ALT	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

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. The 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. RALT 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. The indication is PLT1 TAWS PLT2 TAWS or CPLT1 TAWS CPLT2 TAWS in the absence of other failures. (For example, caution flags represent two displays per side.)

8.12.2. 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 popup 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.

8.13. TAWS Selections on PFD

PFD Declutter menu includes three option possibilities for TAWS:

1) SVS TAWS

2) SVS BASIC

3) None

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

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.

With SVS TAWS selected, the PFI area 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. The slope between adjacent terrain pixels in an increasing longitude direction determines shade used.

The following figures show possible scenarios, including “None,” where the aircraft pierces the TAWS FLTA terrain envelope, and SVS TAWS is enabled for the safest possible warning alert condition.

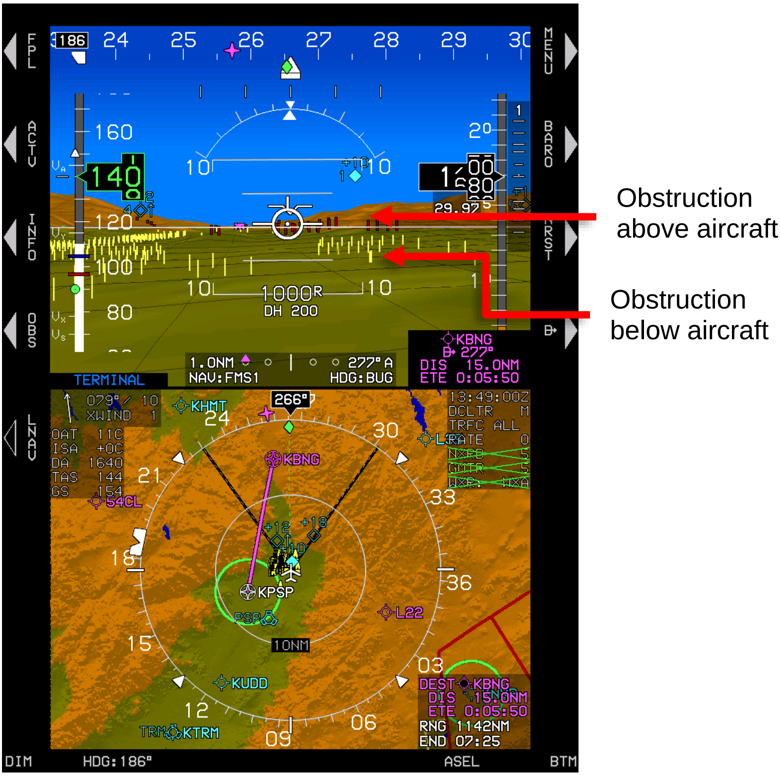


Figure 8-15: PFD SVS TAWS Option and Obstructions

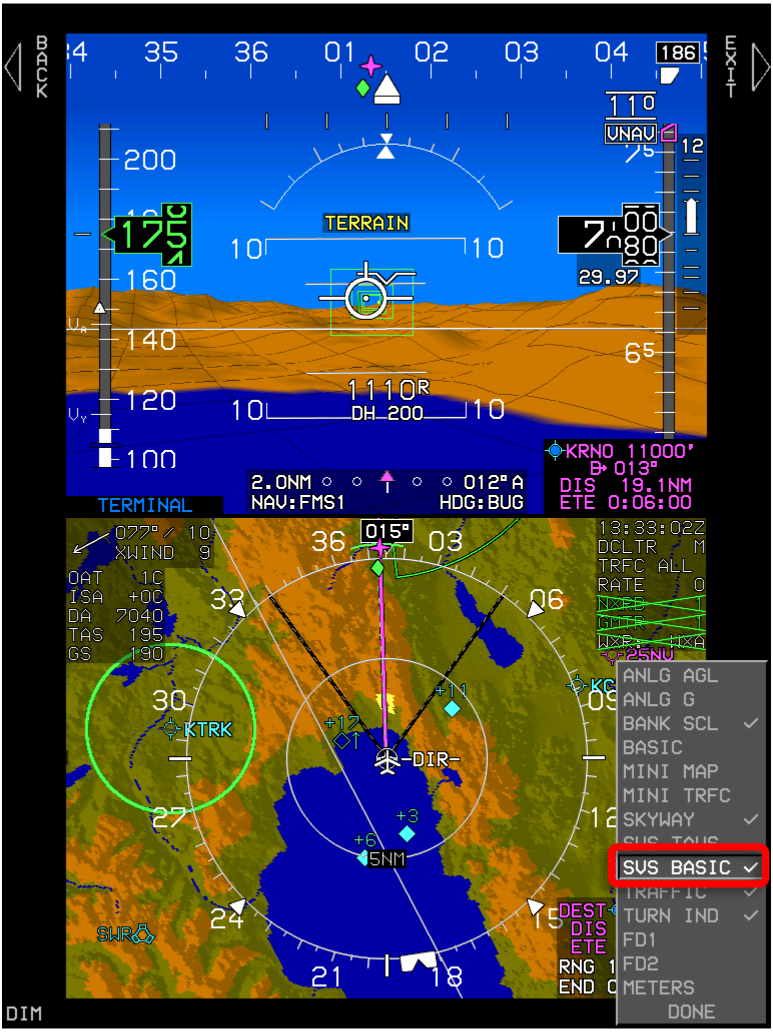
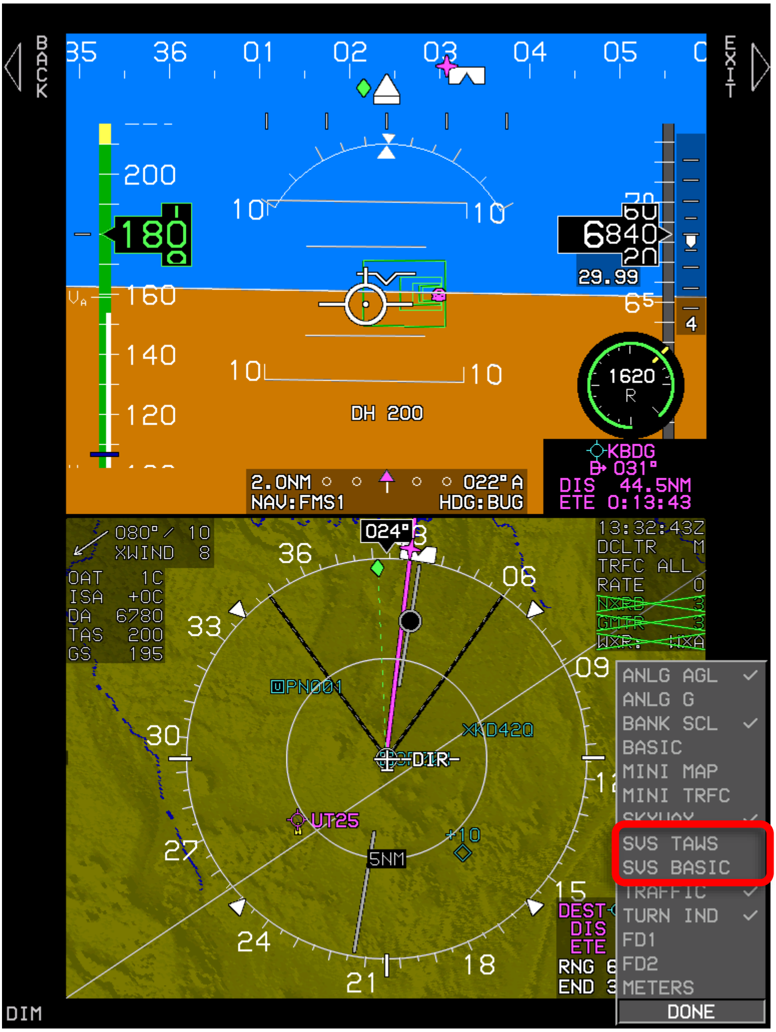


Figure 8-16: PFD SVS BASIC Option

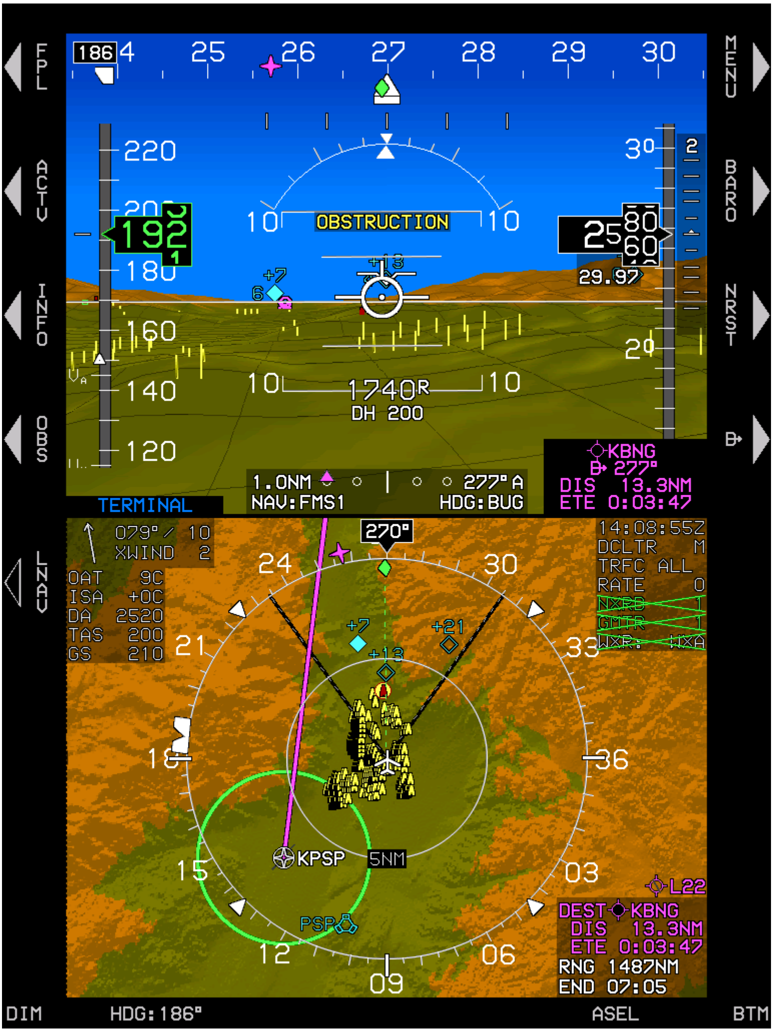
TAWS FLTA Terrain Caution: Amber (Yellow)
TAWS FLTA Terrain Warning: Red

Figure 8-17: PFD SVS TAWS Option



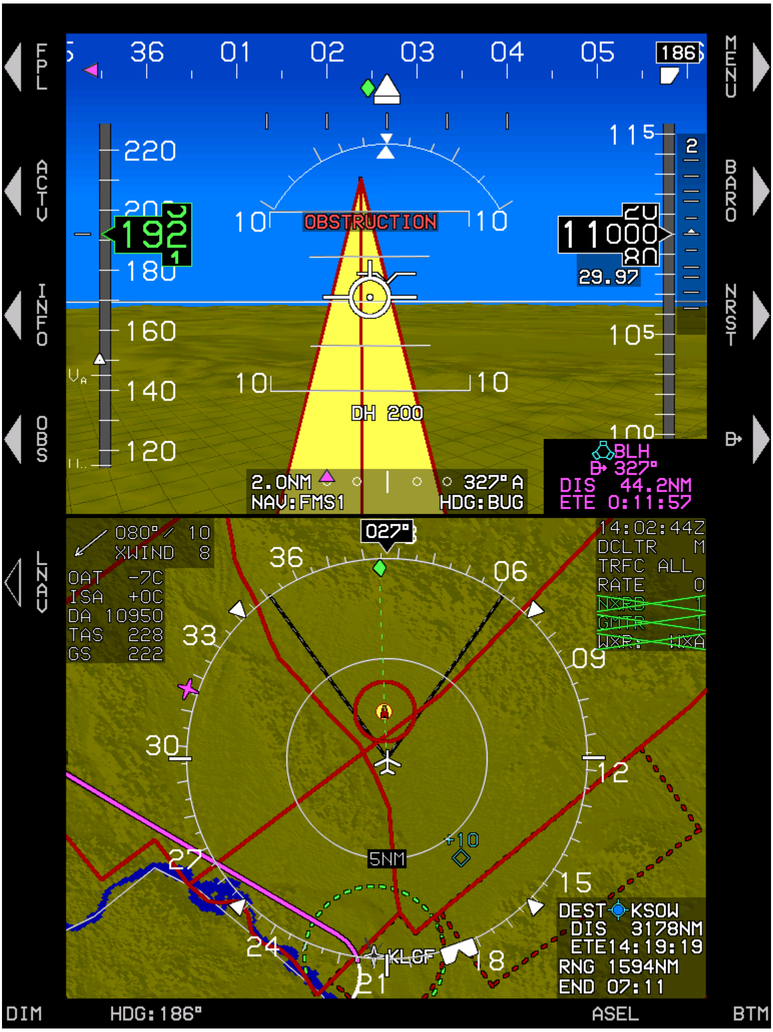
SVS TAWS and SVS BASIC deselected

Figure 8-18: PFD SVS non-TAWS perspective



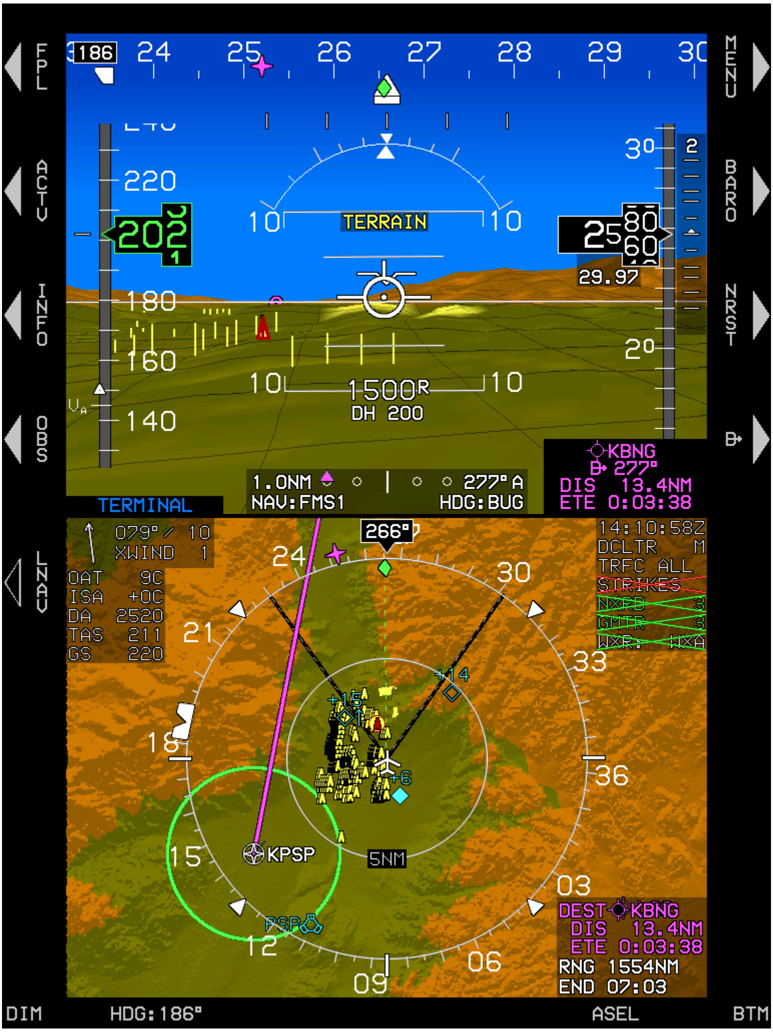
Obstruction within TAWS FLTA caution envelope with an audible alert, “Caution Obstruction, Caution Obstruction.” Obstruction symbols flash.

Figure 8-19: PFD Obstruction Caution



Obstruction within TAWS FLTA warning envelope with an audible alert, “Warning Obstruction, Warning Obstruction.”
Obstruction symbols flash.

Figure 8-20: PFD Obstruction Warning



If SVS TAWS and SVS BASIC were not checked and the aircraft pierced the TAWS FLTA Terrain envelope, the EFIS automatically enables SVS TAWS. TERRAIN takes precedence over OBSTRUCTION.

Figure 8-21: Automatic PFD Terrain Caution

Section 9 Appendix

9.1. 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.

9.2. 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.

9.3. 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 9-1.

Table 9-1: 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 in Table 9-2.

Table 9-2: 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 = 25’
   Allowable Instrument Error #2 = 25’

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 the sum of the above allowable errors:
   Altitude Miscompare Threshold = 110'

9.4. 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 9-3.

Table 9-3: 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

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

Table 9-3: Airspeed Error

Allowable installed system error is added on top of the instrument error and these values are derived from the regulations in Table 9-4.

Table 9-4: 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.

9.5. 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.

9.6. 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 or 20 hours are logged at a one-second interval.

Data logging files contain recordings of flight and engine parameters of up to five hours each from the previous five system operations. During system operation, flight and engine parameters are recorded every one second.

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 USB door, and insert USB flash drive. Power up, and select **Download LOG Files** to create a “\log” directory on the USB flash drive and copy the data logging files into the directory.

CAUTION:

Always install a valid USB flash drive in the IDU before activating any GMF to avoid erroneous failure indications or corruption of the IDU.

9.6.1. 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 “LOG00.dat” thru “LOG04.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.

9.6.2. 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 four flights 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, and 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 9-5.

Table 9-5: Log File Values	
Category	Value
NORMAL	0
ADVISORY	1
CAUTION	2
WARNING	3

9.7. 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.

9.7.1. 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 USB flash drive. This option is useful for fleet operations where multiple aircraft fly the same routes.

2) Routes are stored on USB flash drive 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 on the USB flash drive as “USER.DAT.”

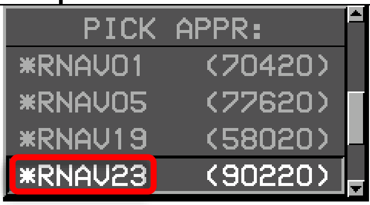
9.7.2. Upload Routes and User Waypoints

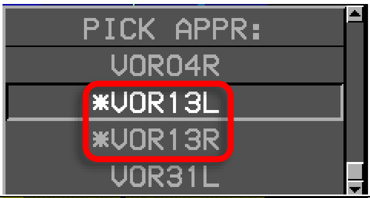
Select **Upload Routes and User Waypoints** from GMF to copy all routes and user waypoints from a USB flash drive to the IDU. Use this option in conjunction with the “Download Routes and User Waypoints” option to upload the same routes and user waypoints in multiple aircraft.

9.7.3. Delete Routes and User Waypoints

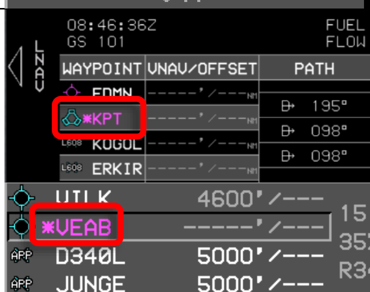
When corrupted routes cause the IDU to continually reboot, select **Delete Routes** on the Ground Maintenance page to remove all routes and the user waypoint file (USER.DAT) from the IDU.

9.8. Summary of Asterisk Symbology in Pilot Guide

<table>
<tr><th colspan="2">Table 9-6: Summary of Asterisk Symbology Use</th></tr>
<tr><th>Examples of Asterisk Locations</th><th>Meaning of Asterisk Use</th></tr>
<tr><td>


Examples include “VOR or GPS RWY…” or “RNAV (GPS) RWY…”


</td><td>Approaches noted by an asterisk (*) before the approach procedure label may use GPS/SBAS for navigation.</td></tr>
<tr><td>


</td><td>Transition most likely selected due to avenue of arrival. (Not all instrument procedures include a transition.)</td></tr>
<tr><td>


</td><td>In addition to the magenta color, asterisk designates the active leg.</td></tr>
<tr><td>


</td><td>Asterisk designates the nearest end point.</td></tr>
</table>

9.9. USB Flash Drive Memory Limitations

When powering up the IDU with a USB flash drive inserted and "Error: No updater files found on a USB drive" displays, the USB flash drive is likely, not acceptable for loading or transferring data.

1) Ensure the USB flash drive with required files is properly connected.
2) Try again after reboot.
3) Press any button to continue.
4) Try a different USB flash drive.

NOTE:

USB flash drive must be formatted as FAT16 or FAT32.

If the flash drive is not recognized, try another source.

Traffic

T 1. Traffic Symbology

PFD traffic is drawn using the hidden surface removal techniques of the terrain and obstruction rendering so that traffic behind terrain appears to be so.

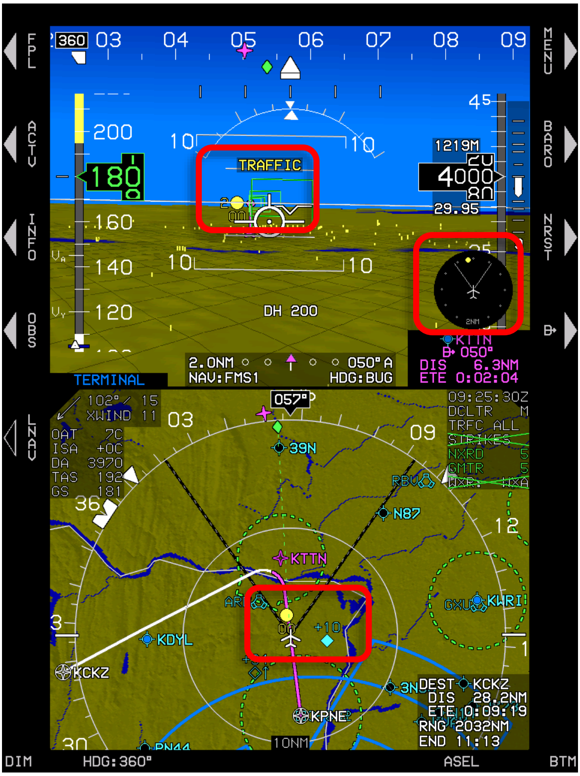


Figure T-1: Traffic Symbology (PFD)

Traffic is displayed using standard traffic symbols as defined in Table T-1 and Table T-2.

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 altitude in feet or meters (in hundreds of units) depending on the "Speed Units" system limit setting.

Table T-1: Traffic Symbology

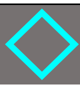
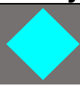
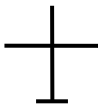
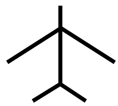
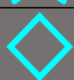
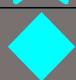
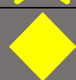
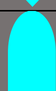
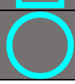
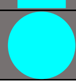
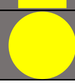
Type Traffic	Symbology			
TCAS-I, TCAS-II, and TIS-A	 Other Traffic	 Proximate Advisory	 Traffic Advisory (Flashing)	 Resolution Advisory (Flashing)
Ownship Symbol	Airplane w/o M_{MO} 		Airplane with M_{MO} 	

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 Traffic (TCAS-I/II, TAS, and TIS-A	Off-scale	Half-symbols
TA Traffic (no bearing)	N/A	Displayed with text
OT and PA traffic (no bearing)		Not displayed
OT and PA Traffic	Beyond 6 NM/11KM	
TAS or TIS-A Sensor	Within 200'/61M of ground	

OT and PA traffic is altitude-filtered in accordance with pilot-selected filters as defined in Table T-4. All values are altitudes in feet or meters depending on “Speed Units” system limit setting, and VSI rates are in fpm.

Table T-4: 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.
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.

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-2: Traffic Pop-Ups (PFI Area)

T 1.1. Mini Traffic

Distance in NM

Distance in KM

Figure T-3: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.

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-5 depending on EFIS limits settings.

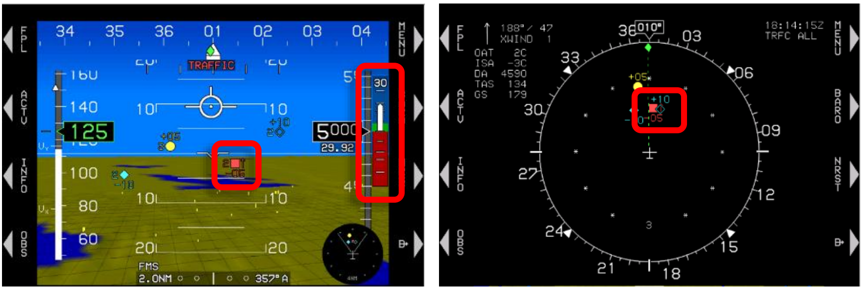
Table T-5: Mini Traffic Map Scale

Distance in NM			Distance in KM		
2	4	6	3	6	10

Display of 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 1.2. TCAS-II Traffic Resolution Advisory Indicator

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 PFD

RA MFD Traffic Page

Figure T-4: TCAS-II RA Indication

T 2. Dedicated Traffic Page

When selected, a traffic page is available based roughly on the appearance of a TCAS display and has the following elements.

T 2.1. MFD Page Menu

TRAFFIC: Shows the Traffic page.

PFD or MFD Bottom Traffic Page

MFD Top Traffic Page

Figure T-5: Traffic Page Access (PFD or MFD)

When MFD is full map, selecting the Traffic page on the top or bottom area changes the configuration to Traffic on the selected area and the other area returns to its last configured page.

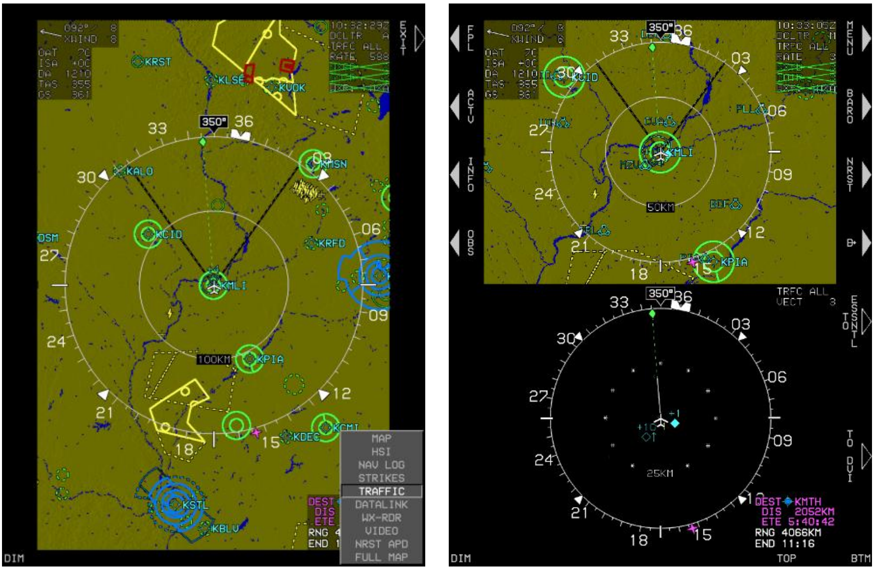


Figure T-6: Traffic Page (MFD Full Map)

T 2.2. PFD First-Level Menu

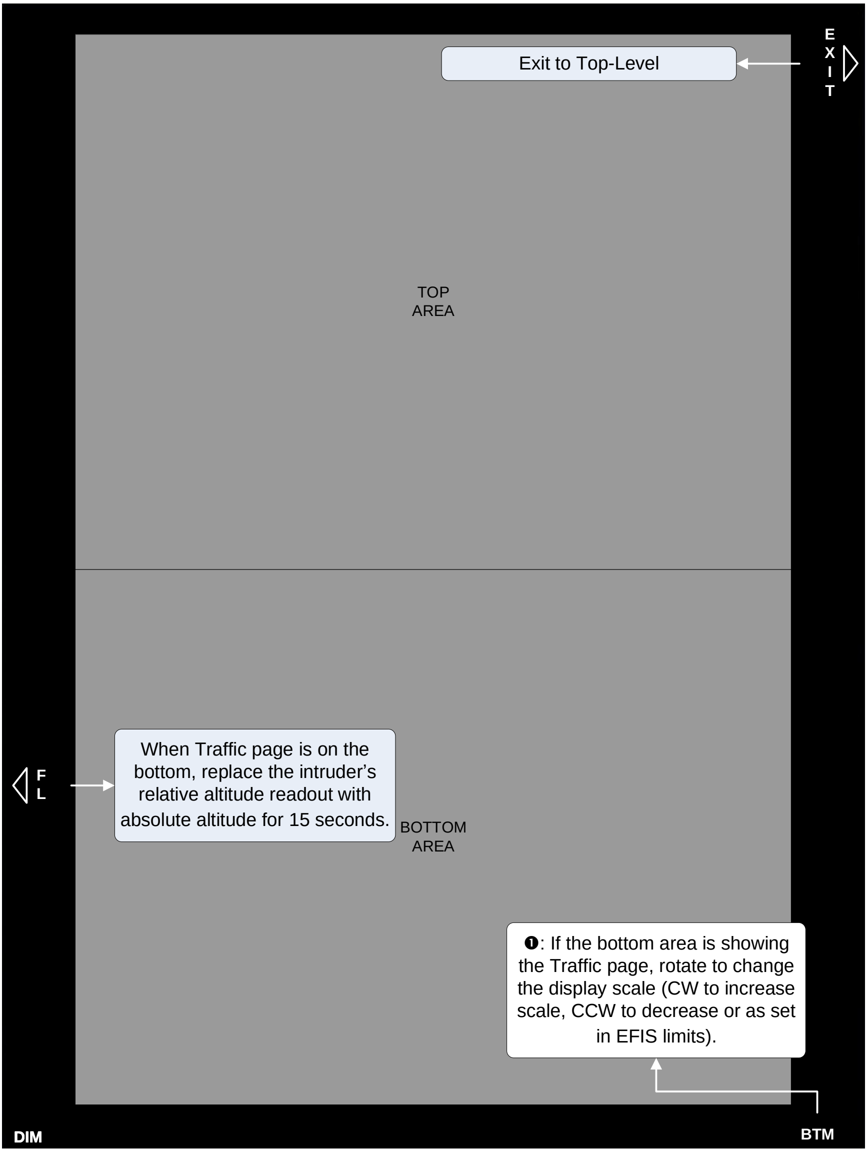


Figure T-7: PFD First-Level Menu

T 2.3. MFD (Normal Mode) First-Level Menu

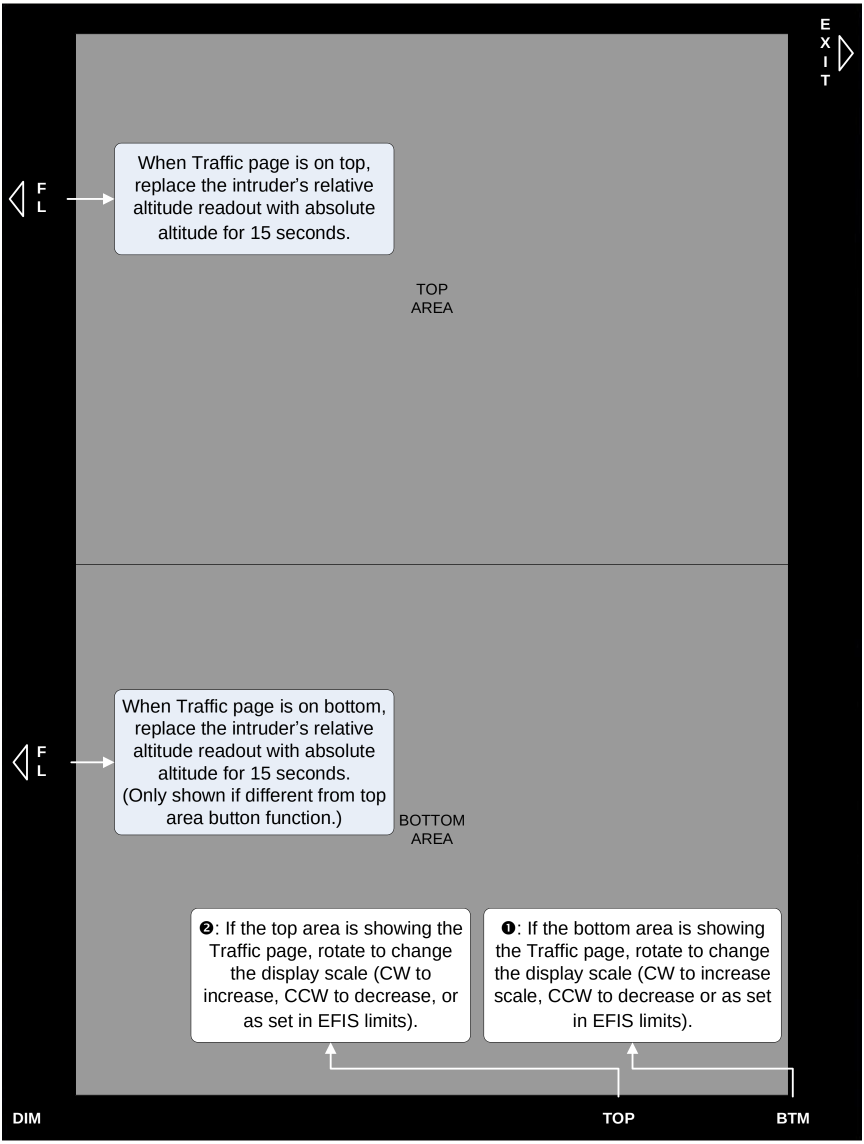


Figure T-8: MFD (Normal Mode) First-Level Menu

T 2.4. 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.

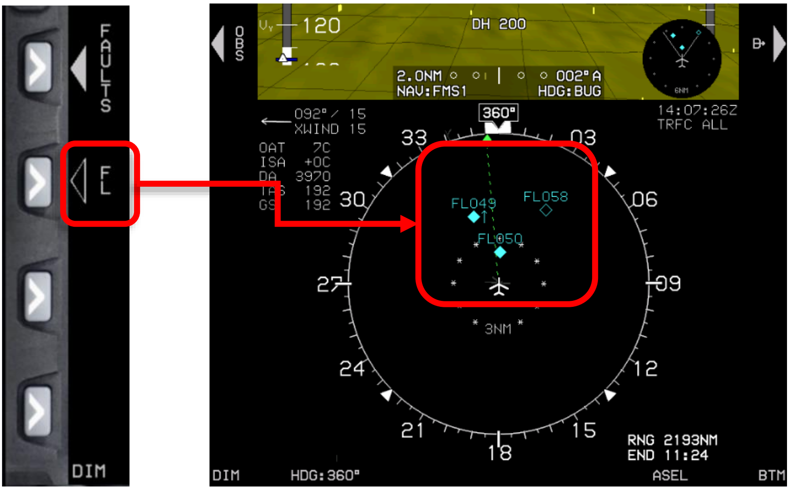


Figure T-9: Flight Level Option

T 2.5. Traffic Page Screen Range

The TCAS range ring is centered on the ownship symbol to help the user judge range to displayed symbols. All distances represent the distance from the ownship symbol to the compass rose.

Table T-6: Traffic Page Range

Range in NM					Range in KM				
5	10	20	50	100	10	20	50	100	200

T 2.6. MFD Traffic Format Menu

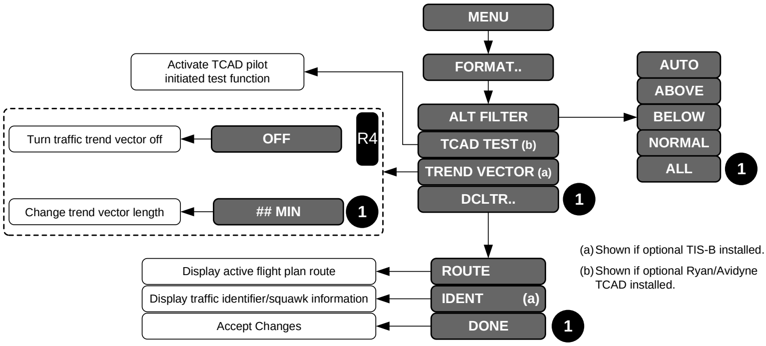


Figure T-10: MFD Traffic Format Menu

T 2.7. Traffic Page (Step-By-Step) (PFD or MFD)

1) On the PFD, push ❶ and rotate to **TRAFFIC** and push to enter.
2) Traffic page scale is adjustable by rotating ❶ to select radius (see Table T-6).
3) On MFD, rotate ❷ (top) or ❶ (bottom) to **TRAFFIC** and push to enter.
4) On the MFD, press **MENU (R1)**, within 10 seconds press **FORMAT (R4)** or **(R8)** to format the Traffic page on top or bottom.
5) On the MFD, push ❶ to **enter ALT FILTER..** push to enter to set altitude filters.
6) Push ❶ to accept **AUTO** altitude filtering.
7) Rotate ❶ to **ABOVE** and push to accept altitude filtering.
8) Rotate ❶ to **BELOW** and push to accept altitude filtering.
9) Rotate ❶ to **NORMAL** and push to accept altitude filtering.
10) Rotate ❶ to **ALL** and push to accept altitude filtering.
11) Rotate ❶ to **TCAD TEST** and push to enter. (TCAD/TAS (RS-232) Ground operations only.)
12) Repeat step 4 and rotate ❶ to **DCLTR..** and then push to enter.
13) Push ❶ to select or deselect to show route on Traffic page.
14) To save changes and exit menu, rotate ❶ to **DONE** and push to enter or press **EXIT (R1)**.

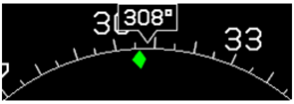
T 2.8. Traffic Display Format

Figure T-11: Traffic Display Format

The traffic display uses a centered display format with the ownship symbol (Table T-1) 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.

T 2.9. Compass Rose Symbols

Compass rose symbols are as specified in Section 3 Display Symbology.



Normal Mode

True North Mode

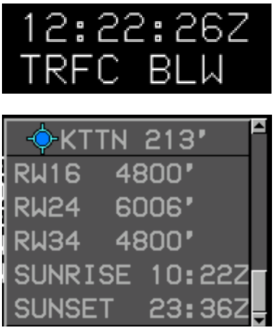
Figure T-12: Traffic Page Compass Rose Symbols

> **NOTE:**
>
> The track pointer, lubber line, and altitude capture predictor arc, are not displayed when ground speed is less than 30 knots.

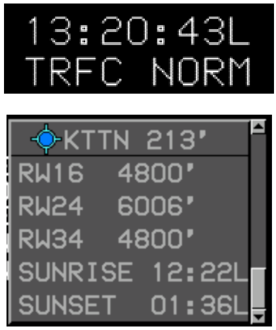
<table>
<tr><th colspan="2">Table T-7: Traffic Page Examples</th></tr>
<tr><td>
</td><td>If a target altitude is set and not captured, an altitude capture predictor arc is displayed on the lubber line at a point corresponding with predicted climb or descent distance (based on current VSI).</td></tr>
<tr><td>
</td><td>A top of descent symbol is shown at the point where a VNAV descent is predicted to commence.</td></tr>
<tr><td>
</td><td>A magenta, star-shaped waypoint pointer is displayed on the heading scale at a point corresponding with the active waypoint and turns amber (yellow) in the event of GPS LON caution.</td></tr>
</table>

T 2.10. Clock and Options

The following are displayed in the upper right corner of traffic page.



Zulu Time



Local Time

Figure T-13: Clock and Options

Table T-8: 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 2.11. Fuel Totalizer/Waypoint Distance Functions

As defined in Section 3 Display Symbology.

Distance in NM

Distance in KM

Figure T-14: Fuel Totalizer/Waypoint Distance Functions

T 2.12. Air Data and Ground Speed

As defined in Section 3 Display Symbology. See Section 2 System Overview for EFIS limits options for speed units.

Speed in Knots Altitude in Feet   Speed in Km/h Altitude in Meters

Figure T-15: Air Data and Ground Speed

> **NOTE:**
>
> Wind information is not shown when indicated airspeed is in the noise range of less than 30 knots, when the aircraft is in the ground mode, or when the AHRS is in DG mode.

T 3. PFD Declutter (DCLTR) Menu

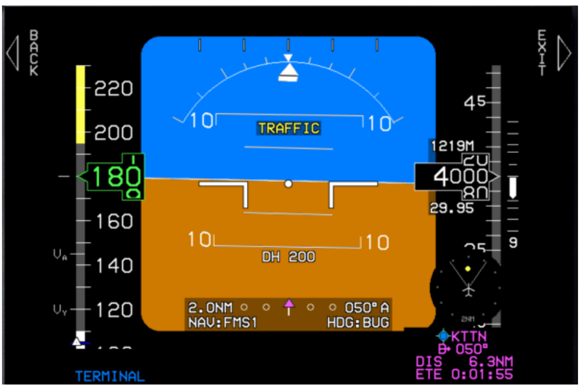


Figure T-16: Basic Mode Mini Traffic

Upon activating the PFD declutter menu, a list of declutter items is shown (see Table T-9). User decluttering is automatically overridden (PFD traffic shown) while an RA or TA is active.

Table T-9: 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.”

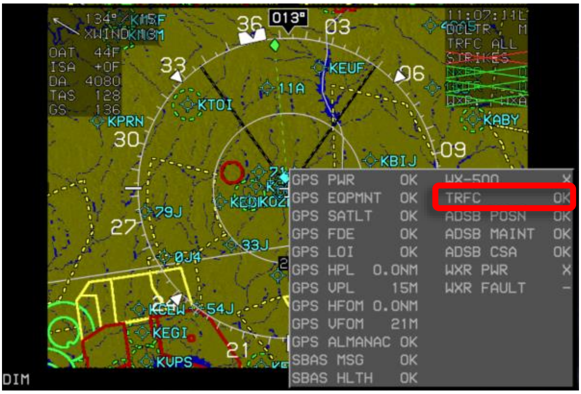


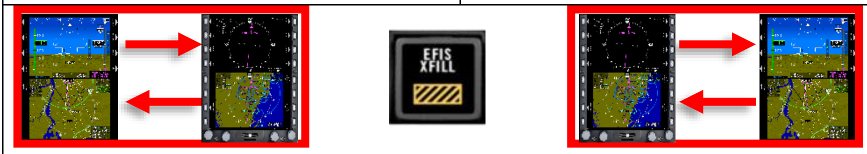
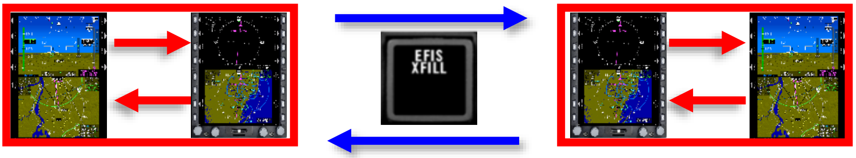
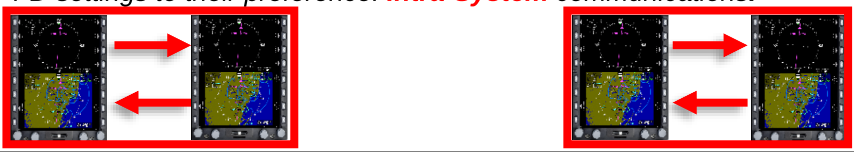
Figure T-17: Menu Faults Status

T 5. Menu Synchronization

Section 5 Menu Functions and Step-by-Step Procedures for additional information.

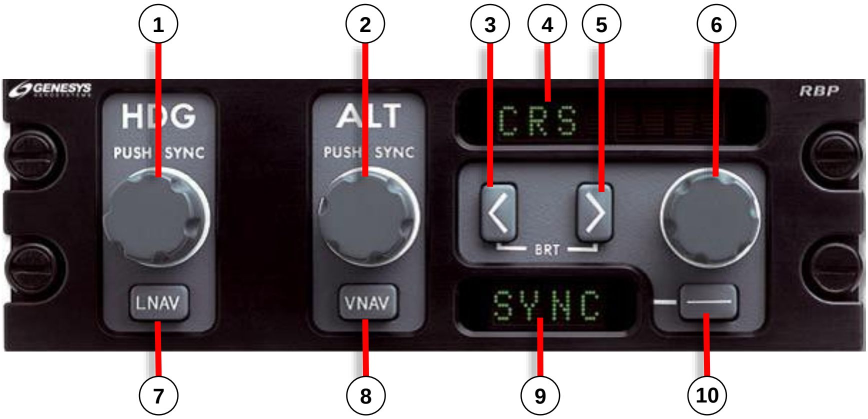
Table T-10: Menu Synchronization	
Menu Parameter	**Notes**
*The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited. **Intra-System** or **Inter-System** communications.*	

Table T-10: Menu Synchronization

Menu Parameter	Notes
 	
TCAS-II control parameters	
Traffic Filter Setting	
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



1) Increase/decrease HDG bug – Push to synchronize to current heading	2) Increase/decrease target altitude – Push to synchronize to current altitude
3) Moves through "Set" options – press both arrows simultaneously to place into brightness dimming mode	4) Main display – Indicates course, bug, angle, height, and minimums to be set with multifunction knob
5) Moves through "Set" options – Press both arrows simultaneously to place into brightness dimming mode	6) Multifunction Knob – Increase/decrease value indicated in main display, and adjust lighting when in dimming mode
7) LNAV – Switches autopilot roll steering between LNAV and HDG sub-modes (N/A with DFCS installed)	8) VNAV – Switches autopilot pitch steering between VNAV and target altitude sub-modes (N/A with DFCS installed)
9) Option display – Toggles function value in main display	10) Set Option button – Toggles function displayed in option display (also exits brightness dimming mode)

Figure RBP-1: Remote Bugs Panel

The Remote Bugs Panel (RBP) promotes ease of operation while minimizing pilot workload complexity by providing dedicated controls for frequently used bugs and controls for setting IDU parameters as defined in Table RBP-1.

The heading (HDG) and altitude (ALT) knobs behave similarly as the knobs on the IDU (see Section 5 Menu Functions and Step-By-Step Procedures for HDG and ALT knob description).

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.

Table RBP-1: Remote Bugs Panel (RBP)

Button/Knob	Function	Rotate	Push Knob or Press Button
HDG Knob	Heading Bug	Increase or decrease	Synchronize to current heading
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.) Not applicable to installations without an autopilot or installations with a fully-integrated digital autopilot (i.e., Genesys/S-TEC DFCS) because there are no HDG or LNAV sub-modes in those integrations.
ALT Knob	Altitude Bug	Increase or decrease target altitude	Synchronize to current altitude
VNAV Button (With autopilot enabled)	VNAV	N/A	S-TEC DFCS: Turn off any preselected target altitude bug EFIS with VNAV Sub-Mode: Turn off target altitude bug to allow for entering VNAV sub-mode. (Only active when **VNAV** appears on EFIS.) This function is not applicable to installations

Table RBP-1: Remote Bugs Panel (RBP)			
Button/Knob	**Function**	**Rotate**	**Push Knob or Press Button**
			without an autopilot or installations with a fully-integrated digital autopilot (Genesys/S-TEC DFCS) because there are no VNAV sub-modes with those integrations.
Function Active Nav Course			
Multifunction Knob	GPS Course	Increase or decrease	If a manual GPS exists: (not in automatic OBS) Synchronize to current bearing to active waypoint.
Multifunction Knob	VLOC1 VLOC2	Increase or decrease	Synchronize nav source course to the 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.
Multifunction Knob	ADF1 ADF2	Increase or decrease	Synchronize ADF1 or ADF2 course to the current bearing to the station
Preview NAV Course			
Multifunction Knob	VLOC1 VLOC2	Increase or decrease	Synchronize nav source course to the current bearing to the station if NAV1 or NAV2 receiver is coupled to VOR; or synchronize the VLOC1 or VLOC2 course to current aircraft heading if NAV receiver is coupled to LOC.
Multifunction Knob	ADF1 ADF2	NA	Synchronize ADF1 or ADF2 course to the current bearing to the station

Table RBP-1: Remote Bugs Panel (RBP)

Button/Knob	Function	Rotate	Push Knob or Press Button
Multifunction Knob	VLOC1 VLOC2	NA	Synchronize the VLOC1 or VLOC2 course to the current bearing to the station if Nav receiver is coupled to VOR; or Synchronize the VLOC1 or VLOC2 course to the current aircraft heading if NAV receiver is coupled to LOC.
Multifunction Knob	Airspeed Bug	Increase or decrease	Synchronize to current airspeed
Multifunction Knob	Vertical Speed Bug		Synchronize to current VSI
Multifunction Knob	Climb Angle Set		Set to 3°
	Descent Angle Set		
Multifunction Knob	Decision Height Bug		Set to 200’ or 50M AGL
Multifunction Knob	Minimum Altitude Bug		Synchronize to current altitude
Set Option “---“ Button	GPS Course	N/A	When selected NAV source is GPS, changes OBS mode (Manual or Automatic)
Set Option “---“ Button	Active NAV Course		No function
Set Option “---“ Button	Preview Nav Course		
Set Option “---“ Button	VOR 1 Course		
Set Option “---“ Button	VOR 2 Course		
Set Option “---“ Button	Airspeed Bug		Toggle on or off
Set Option “---“ Button	Vertical Speed Bug		
Set Option “---“ Button	Climb Angle Setting		No function
Set Option “---“ Button	Descent Angle Setting		

Table RBP-1: Remote Bugs Panel (RBP)			
Button/Knob	**Function**	**Rotate**	**Push Knob or Press Button**
Set Option "---" Button	Decision Height Bug		Toggle on or off
Set Option "---" Button	Minimum Altitude Bug		
Arrow Buttons	Function Scroll	N/A	Move through "Set" options. Press both arrow buttons simultaneously to place into dimming mode.

Main Message

Option Message

Figure RBP-2: Main and Option Messages (with LNAV/VNAV sub-modes)

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 (If Nav receiver coupled to VOR) NAV LOC1 (If NAV receiver coupled to LOC) NAV BC1 (If NAV receiver coupled to LOC BC)	Current VLOC1 Course setting (degrees)
VLOC2	NAV VOR2 (If Nav receiver coupled to VOR) NAV LOC2 (If NAV receiver coupled to LOC) NAV BC2 (If NAV receiver coupled to LOC BC)	Current VLOC2 Course setting (degrees)
ADF1	NAV ADF1	Current ADF1 Course setting (degrees)
ADF2	NAV ADF2	Current ADF2 Course setting (degrees)

Table RBP-3: Main and Option Messages - Preview NAV Course Function		
Selected Preview Nav Source	**Main Message**	**Option Message**
VLOC1	PRV VOR1 (If Nav receiver coupled to VOR) PRV LOC1 (If NAV receiver coupled to LOC) PRV BC1 (If NAV receiver coupled to LOC BC)	Current VLOC1 Course setting (degrees)
VLOC2	PRV VOR2 (If Nav receiver coupled to VOR) PRV LOC2 (If NAV receiver coupled to LOC) PRV BC2 (If NAV receiver coupled to LOC BC)	Current VLOC2 Course setting (degrees)
ADF1	PRV ADF1	Current ADF1 Course setting (degrees)
ADF2	PRV ADF2	Current ADF2 Course setting (degrees)

Table RBP-4: 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)

Table RBP-4: Main and Option Messages - Other Functions

Function	Main Message	Option Message
VLOC1 Course	CRS VOR1 (If Nav receiver coupled to VOR) CRS LOC1 (If NAV receiver coupled to LOC) CRS BC1 (If NAV receiver coupled to LOC BC)	Current VLOC1 Course setting (degrees)
VLOC2 Course	CRS VOR2 (If Nav receiver coupled to VOR) CRS LOC2 (If NAV receiver coupled to LOC) CRS BC2 (If NAV receiver coupled to LOC BC)	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)

Table RBP-4: Main and Option Messages - Other Functions

Function	Main Message	Option Message
Minimum Altitude Bug	MIN ALT	ON (If minimum altitude bug is OFF) OFF (If minimum altitude bug is ON)

NOTE:

If NAV PREVIEW is enabled in EFIS limits, the following RBP functions are available:

1) Active Nav Course

2) Preview NAV Course (If preview source is not set to OFF)

If NAV PREVIEW is not enabled in EFIS limits, 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.

WX-500 Lightning Strikes

S 1. WX-500 Data

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 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

S 1.1. Symbology

The user may select with Strikes overlay on PFI or MFD Map page in arc or centered mode in NM or KM distances.

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 is displayed out to an equal distance in all directions.

Figure S-1: Lightning Symbols

Strikefinder markings are aligned with either magnetic north or true north depending upon the status of the true north selection. When the AHRS is in DG mode, "DG" appears to the right of the ownship symbol.

Airplane w/o M_{MO} Airplane with M_{MO}

Figure S-2: Ownship Symbol

S 2. Dedicated Strikes Page

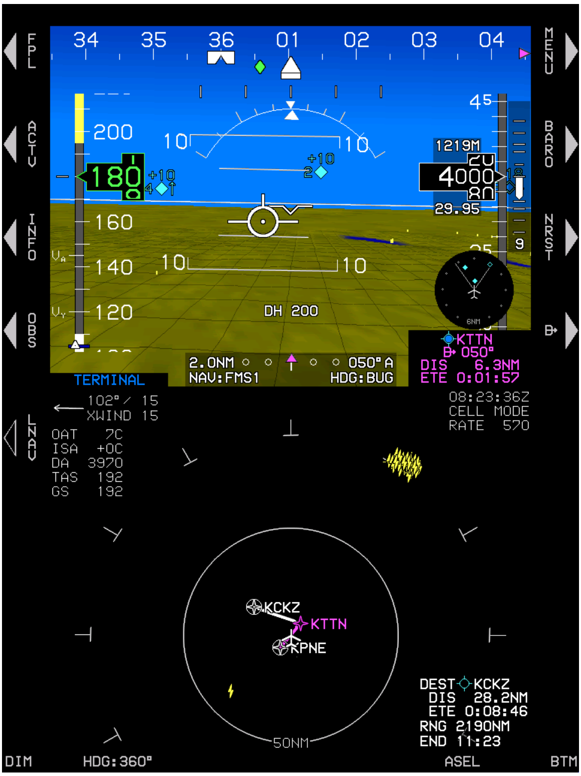


Figure S-3: PFD with Strikes Page on Bottom

S 2.1. MFD Page Menu

STRIKES: Shows the strikes page.

S 2.1.1. MFD Strikes Page (Step-By-Step)

1) On the PFD, push ❶ or on the MFD push ❶ or ❷, and then rotate to **STRIKES** and push to enter.
2) If ❶ is pushed, and **STRIKES** is selected, the Strikes page appears on the bottom and Map on the top.
3) When the MFD is full map, push ❷ and select **STRIKES** to display Strikes page on top and Map page on the bottom

S 2.2. Strikes Page Screen Range

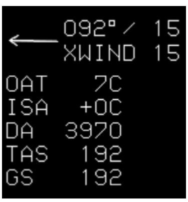
A range ring is centered upon the ownship symbol to help judge range to displayed symbols.

Table S-2: Lightning Page 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

S 2.3. Air Data and Ground Speed

See Section 2 System Overview for EFIS limits options for speed units.



Speed in Knots
Altitude in Feet

Speed in Km/h
Altitude in Meters

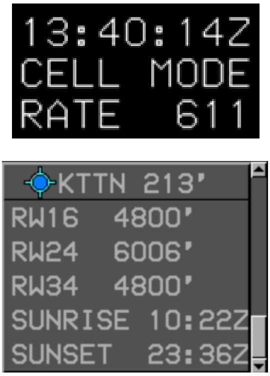
Figure S-4: Air Data and Ground Speed in Upper Left Corner

S 2.4. Clock and Options

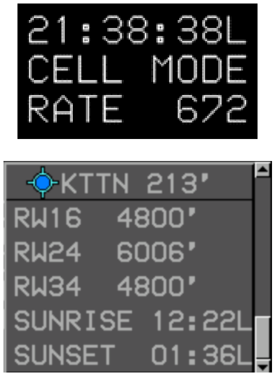
The following are displayed in the upper right corner of the page:

1) Zulu Time or Local Time: As specified in Section 3 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
	 18:26:30L ~~STRIKES~~
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).

Figure S-6: Active Flight Plan Path/Manual Course/Runways

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 LON caution. The strikes page displays airport runways in correct relationship and scale to the ownship symbol.

S 2.6. Fuel Totalizer/Waypoint Distance Functions

As defined in Section 3 Display Symbology.

Distance in NM

Distance in KM

Figure S-7: Fuel Totalizer/Waypoint Distance Functions

S 2.7. PFD First-Level Menu

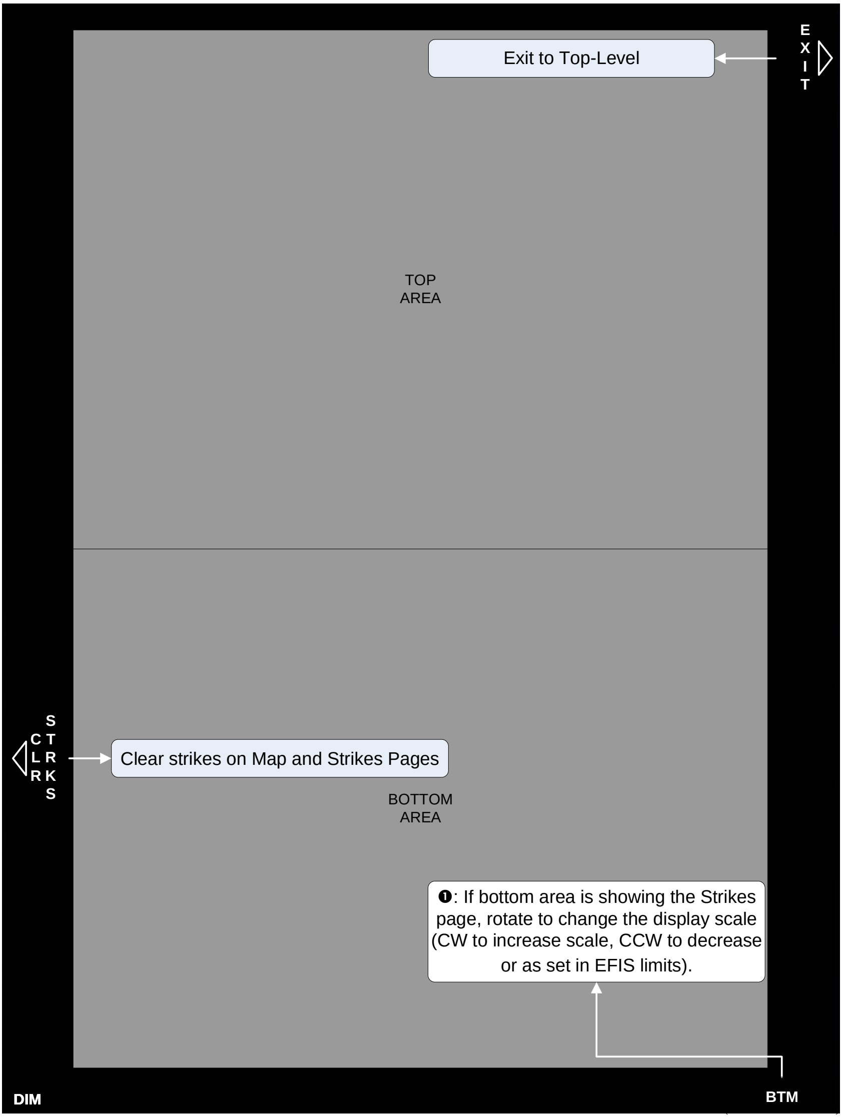


Figure S-8: PFD First-Level Menu

S 2.8. MFD (Normal Mode) First-Level Menu

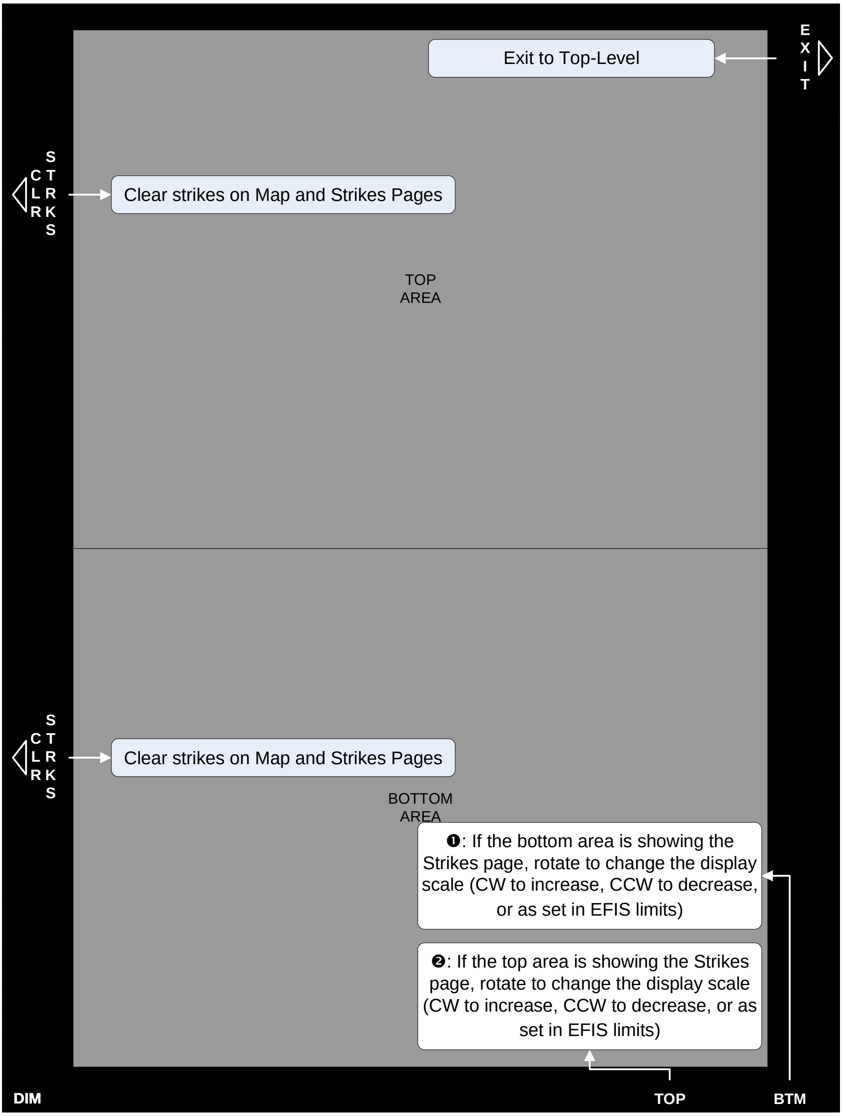


Figure S-9: MFD (Normal Mode) First-Level Menu

S 2.9. Strikes Format Menu

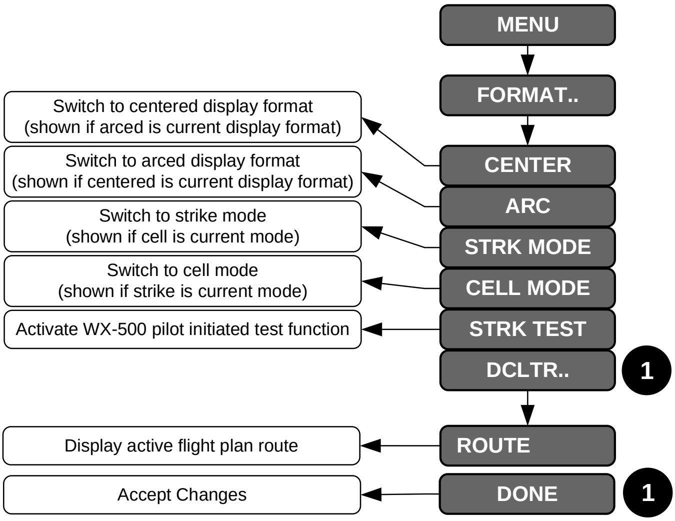


Figure S-10: Strikes Format Menu

S 3. MFD Fault Display Menu

Loss of communications with the WX-500 is indicated by an “X” replacing the “OK”.

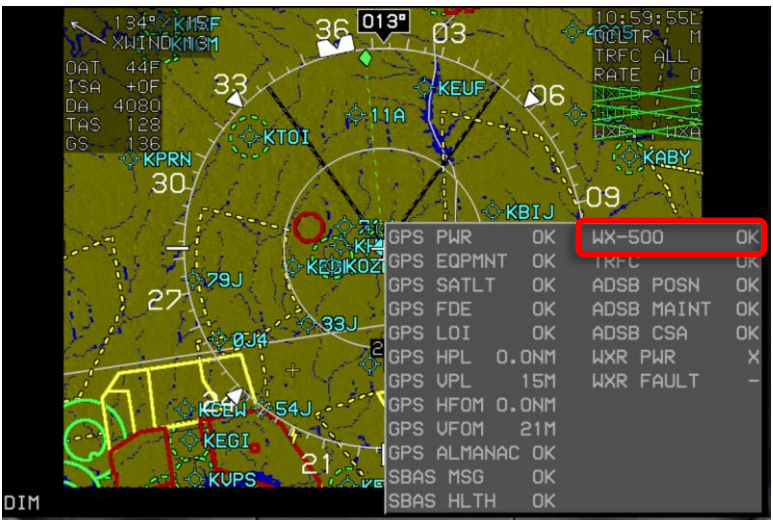
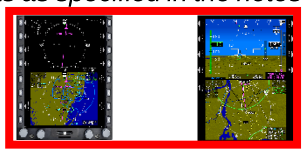


Figure S-11: MFD Fault Display Menu

S 4. Menu Synchronization

Section 5 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.

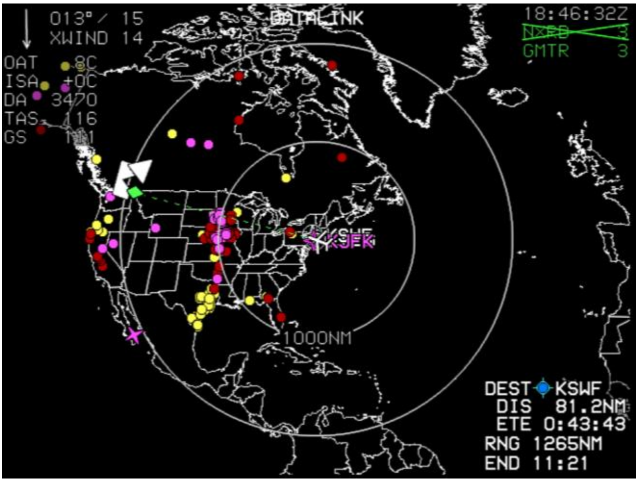


Figure D-1: Datalink Symbology with G METAR On

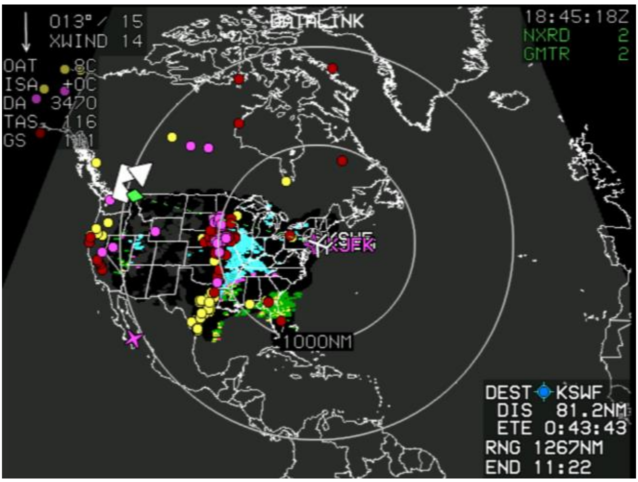
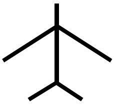
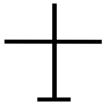
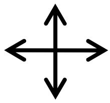
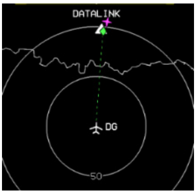


Figure D-2: Datalink Symbology with NEXRAD On

D 1.1. Ownship Symbol

Table D-1: Ownship Symbols

Airplane with MMO	Airplane w/o MMO	Pan Mode
		



When not panning with AHRS in the DG mode, “DG” appears right of the ownship symbol. The datalink page is always displayed in a north-up orientation with a boundary circle in place of the compass rose. If not in pan mode, the ownship symbol is aligned with the aircraft heading.

Figure D-3: Datalink Symbology Ownship Symbol

D 1.2. 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 1.3. Datalink Orientation

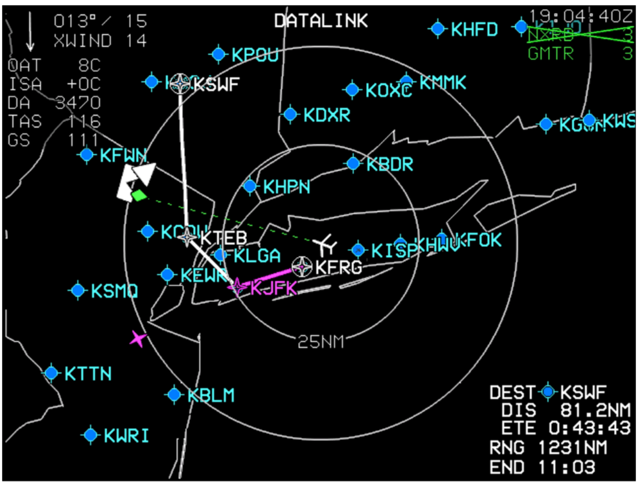


Figure D-4: Datalink Page Orientation

Datalink is always displayed in a North-Up orientation. The page has a boundary circle instead of a compass rose and a “DATALINK” label above the boundary circle, and if not in pan mode, the ownship symbol is aligned with the aircraft heading

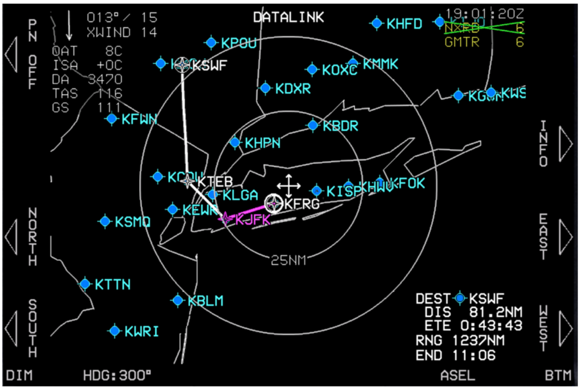


Figure D-5: Datalink Page Pan Mode

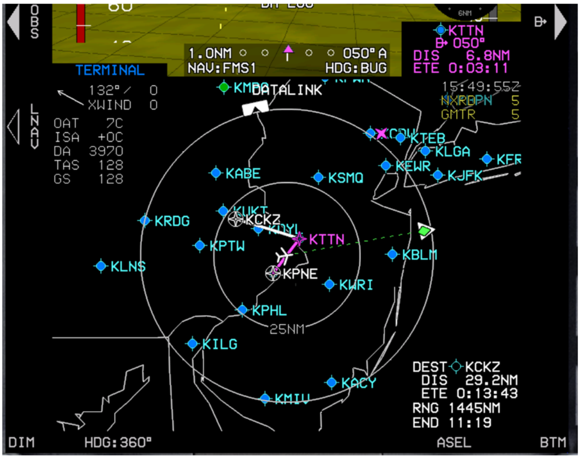


Figure D-6: Datalink Page Active Flight Plan

D 1.4. ADS-B Data

ADS-B data products are available to be individually selected for display as defined in Table D-2.

Table D-2: 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 1.4.1. NEXRAD Data

NEXRAD data is displayed in correct relationship as colored regions of precipitation using the coloring convention in Table D-3.

Table D-3: 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 on the Map page. Display of NEXRAD data is inhibited during active FLTA alerts.

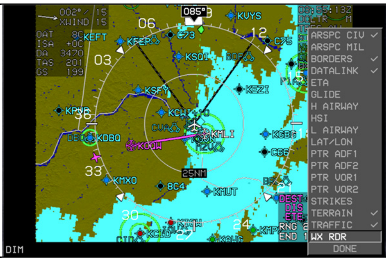
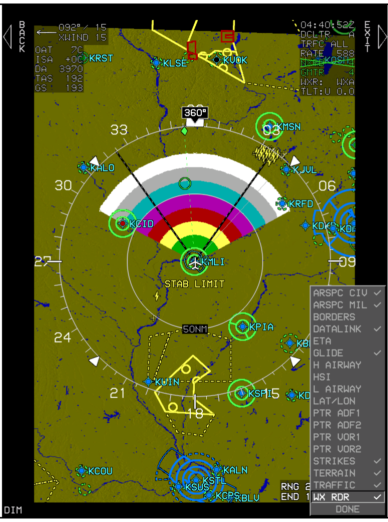
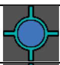
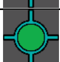
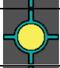
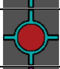
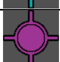
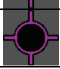
Table D-4: NEXRAD Decluttered by WX-RDR	
	PFD with Map page on bottom with Datalink selected for overlay.
	PFD with Map page on bottom with Datalink and WX-RDR selected for overlay.
	MFD Full Map page with Datalink selected for overlay.

Table D-4: NEXRAD Decluttered by WX-RDR	
	MFD Full Map page with Datalink and WX-RDR selected for overlay.

D 1.4.2. Graphical METARS

Graphical METARs (G METARS) are displayed in correct relationship to the ownship symbol as a large color-filled within the circular part of the associated airport symbol as in Table D-5 at ranges defined in Table D-6. Graphical METARs are also displayed in the menu system “nearest airport,” “nearest weather,” and “info” functions.

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

Range		Display
NM	KM	
50	100	All G METARs with Airport symbol and ID
100	200	All G METARs with Airport symbol
200	500	All G METARs
500	1,000	VFR G METARs are decluttered
1,000	2,000	VFR and MFVR G METARs are decluttered.
2,000	4,000	

Table D-6: G METARS Range

D 1.4.3. Graphical Weather Conditions/Textual METAR/TAF

Graphical weather conditions data are displayed in the menu system "info" function as large colored squares per the convention in Table D-7.

Table D-7: 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.

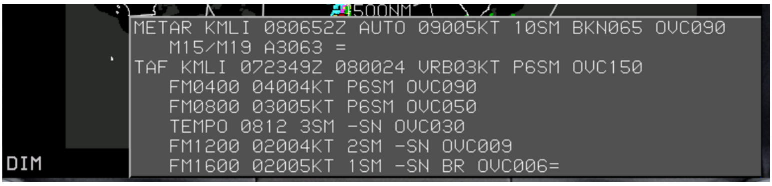


Figure D-7: METAR and TAF Report for KMLI

D 2. Top-Level Menu Automatic Pop-Up Function Descriptions

See Section 5 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 Locations

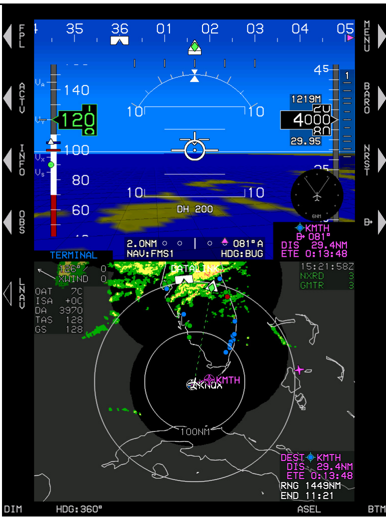
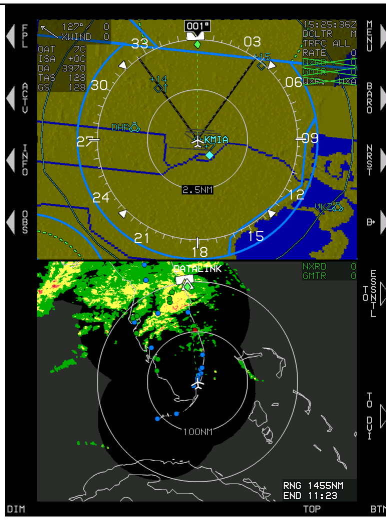
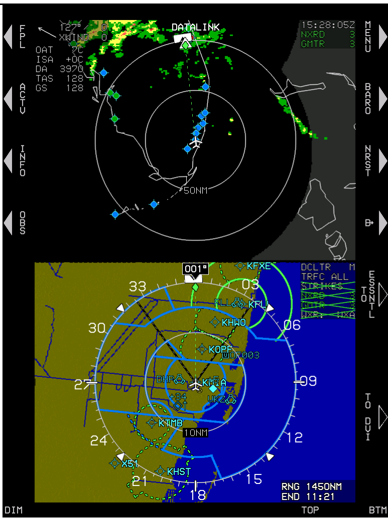
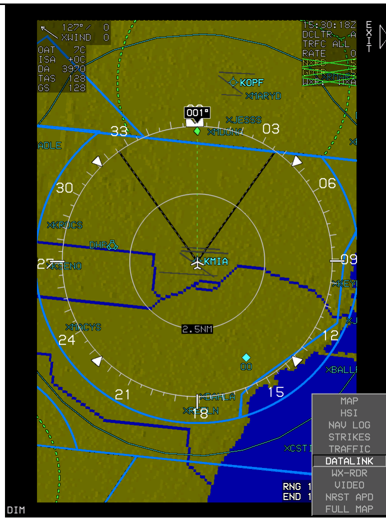
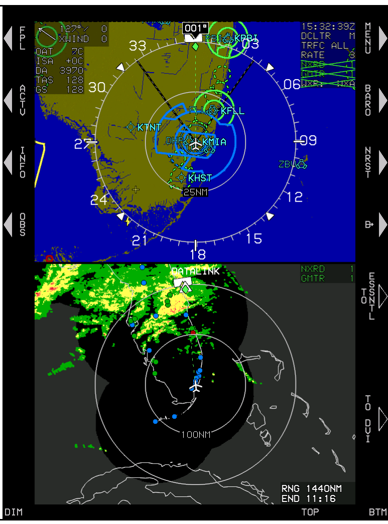
<table>
<tr><th colspan="2">Table D-8: Datalink Page Locations</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>PFD Bottom area only</td><td>MFD Bottom area</td></tr>
</table>

Table D-8: Datalink Page Locations

 MFD Top area	 MFD with Full Map page and selecting Datalink page
	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 3.3. Datalink Page Legend

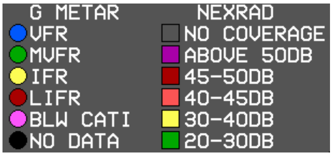


Figure D-8: ADS-B Datalink Legend

D 3.4. 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 3 Display Symbology.

D 3.5. Clock and Options

The following are displayed in the upper right corner:

1) Zulu or Local Time: As in Section 3 Display Symbology.

2) Datalink Weather Status: When status of NEXRAD, graphical METARs, displayed as in Table D-9.

Zulu Time

Local Time

Figure D-9: Clock/Options

Table D-9: 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	"NXRD ##" in green. ## is age in minutes. NEXRAD shown.	"GMTR ##" in green. ## is age in minutes. G METARS shown.

Table D-9: Datalink NEXRAD Status

Condition	Status Annunciation: *NEXRAD	Status Annunciation: Graphical METAR
display). "Show Full Sensor Status" enabled.		
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 display). "Show Full Sensor Status" enabled.	"NXRD ##" in red. ## is age in minutes. "NXRD ##" overlaid with green "X" NEXRAD not shown.	"GMTR ##" in red. ## is age in minutes. "GMTR ##" overlaid with green "X" 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 3.6. Datalink Page Screen Range

When selected, the screen ranges in Table D-10 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.

Table D-10: 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
1,000	2,000	2,000	4,000

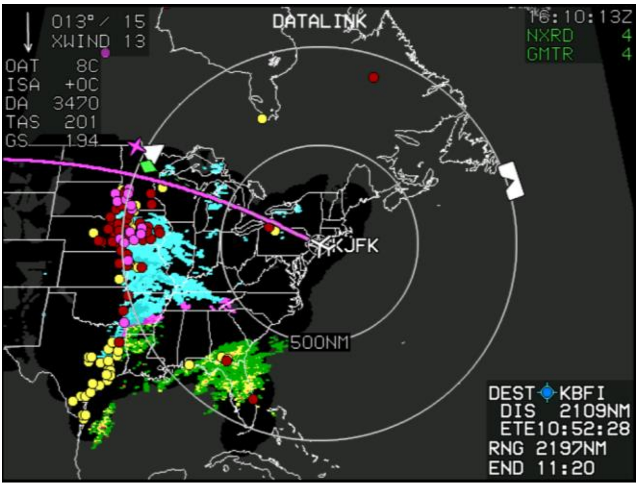
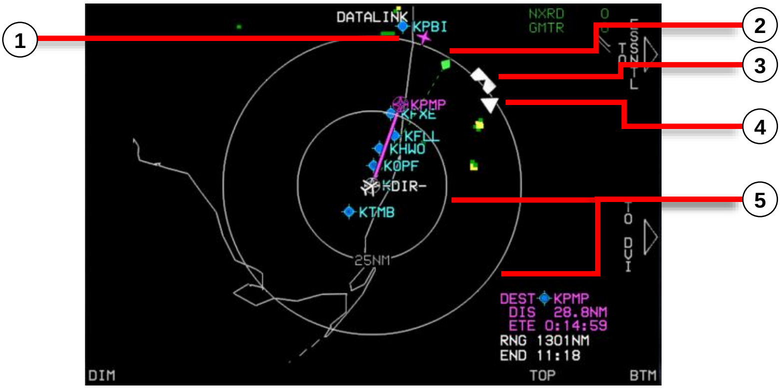


Figure D-10: Datalink Page Screen Range

D 3.7. Boundary Circle Symbols

A white triangular heading pointer aligned with the longitudinal axis of the ownship symbol appears on the boundary circle with a green diamond-shaped track pointer aligned with the aircraft's track across the earth. A green dashed lubber line connects the center of the aircraft symbol and the track pointer.



1) Waypoint Bearing Pointer
2) Track Pointer and Lubber Line
3) Heading Bug
4) Heading Pointer
5) Boundary Circles

Figure D-11: Boundary Circle Symbol

If a target or VNAV altitude is set and not captured, an altitude capture predictor arc is displayed on the lubber line at a point corresponding with predicted climb or descent distance (based upon current VSI). The track pointer, lubber line, and altitude capture predictor arc are not displayed when ground speed is less than 30 knots. A user-settable heading bug appears on the boundary circle. A magenta, star-shaped waypoint pointer is displayed on the boundary circle at a point which corresponds with the active waypoint. The waypoint pointer turns amber (yellow) in the event of GPS LON caution. Boundary circle symbols are not drawn when in pan mode.

D 3.8. Active Flight Plan Path/Manual Course/Runways

See Section 3 Display Symbology for more details.

D 3.9. Borders

National and United States state borders are drawn in white in correct relationship to the ownship symbol.

D 4. MFD Datalink Format Menu

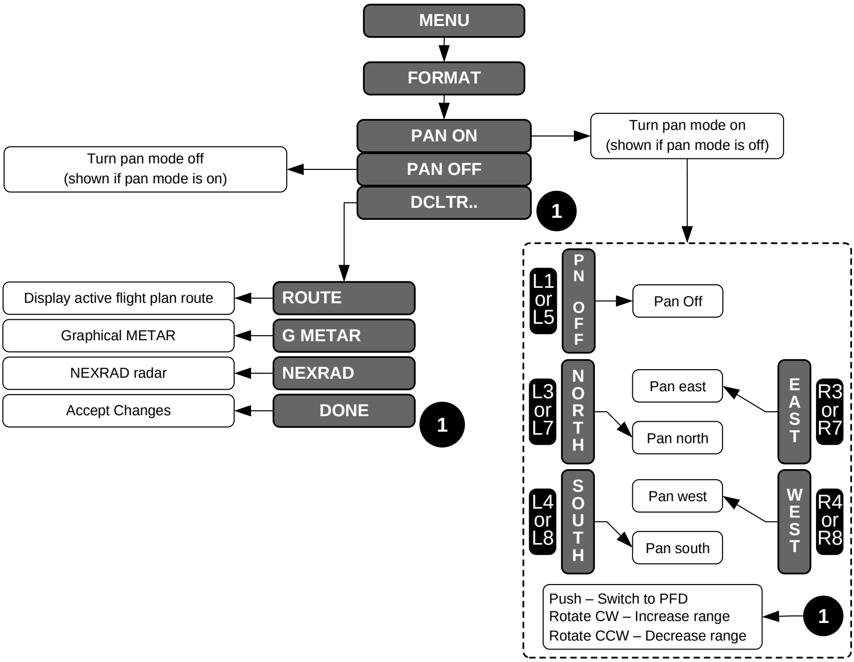


Figure D-12: MFD Datalink Format Menu

D 4.1. MFD Datalink Page Format Menu (Step-By-Step)

1) Push ❶ **BTM** or ❷ **TOP** and rotate to **DATALINK** and push to enter. Bottom area for the following examples.
2) Press **MENU (R1)**, within 10 seconds press **FORMAT (R8)** to format Datalink page.
3) Either push ❶ to enter **PAN ON** or rotate to **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) Rotate ❶ to 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 push ❶ to turn off the panning and exit menu.

9) Repeat step 3 and select **DCLTR..** and push ❶ to enter.

10) Rotate ❶ to select **ROUTE** and push to enter.

11) Push ❶ again to deselect **ROUTE**.

12) Rotate ❶ to select **G METAR** and push to enter. Push ❶ again to deselect **G METAR**.

13) Repeat step 3 and select **DCLTR..** and push ❶ to enter.

14) Rotate ❶ to select **NEXRAD** and push to enter.

15) Push ❶ again to deselect **NEXRAD**.

D 4.2. Formatting Map Page on PFD OR MFD

1) To overlay and display datalink information on the map, return to the Map page and press **MENU (R1)**, within 10 seconds, press **FORMAT (R8)**.

2) Rotate ❶ to **FNCT DCLTR..** and push to enter.

3) Rotate ❶ to **DATALINK** and push to enter.

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

D 4.3. MFD Datalink NRST Airport INFO (Step-By-Step) PFD or MFD

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

2) Press **NRST (R3)**. Push ❶ to open nearest airport list. Rotate ❶ to highlight desired airport, press **INFO (L3).**

3) Press **WX LGND (L2)** for the weather legend to appear; OR

4) Press **EXPND WX (L3)** to view G METARS and TAF reports. Time of observation is contained within text.

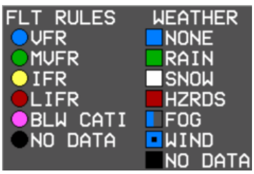


Figure D-13: NRST Airport WX LGND

D 4.3.1. MFD Full Map Page (Step-By-Step)

1) Push ❶ and rotate to **FULL MAP** and push to enter.

2) To format the Full Map page, press **MENU (R1)**, within 10 seconds, press **FORMAT (R4)**, and then rotate ❶ to **FNCT DCLTR..** then push to enter.

3) Rotate ❶ and push to select or deselect desired functions, then rotate to **DONE** and 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 5. MFD Fault Display Menu

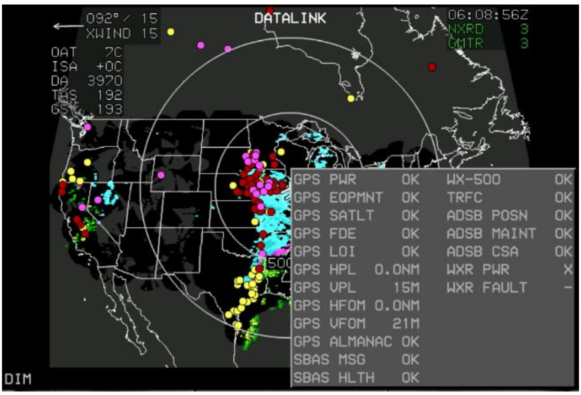
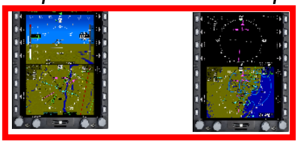
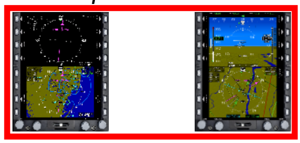


Figure D-14: FAULTS Menu with ADS-B Status

Upon selecting the MFD 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 6. Menu Synchronization

Section 5 Menu Functions and Step-by-Step Procedures for additional information.

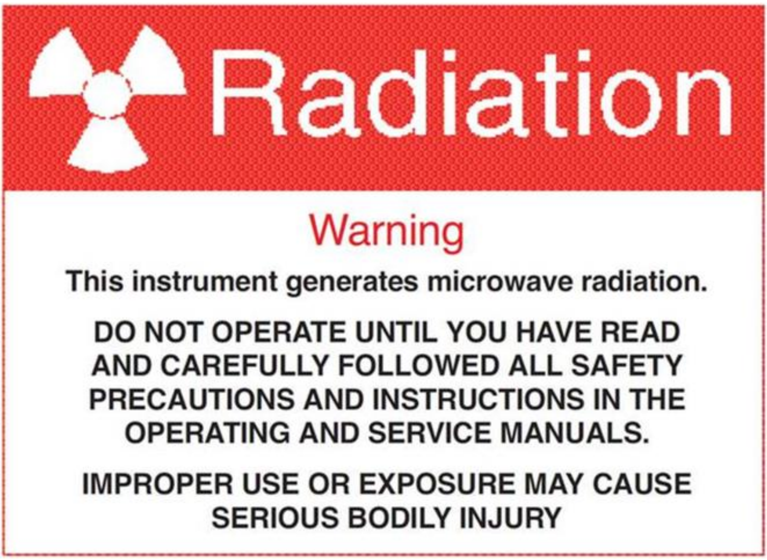
<table>
<tr><th colspan="2">Table D-11: Menu Synchronization</th></tr>
<tr><th>Menu Parameter</th><th>Notes</th></tr>
<tr><td colspan="2">The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom MFD areas as specified in the notes.
 </td></tr>
<tr><td>MFD Datalink Page Settings</td><td>Independent between top and bottom MFD areas</td></tr>
</table>

Weather Radar

WX 1. Weather Radar

This Weather Radar appendix is primarily for the Honeywell RDR-2100 installed with no external control panel. The EFIS controls the WX RDR via the EFIS PFD bottom display or MFD in the top or bottom area. Since there is only one RDR-2100 installed in the aircraft, only one display area at a time can show the WX RDR menu.

WARNING:



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.

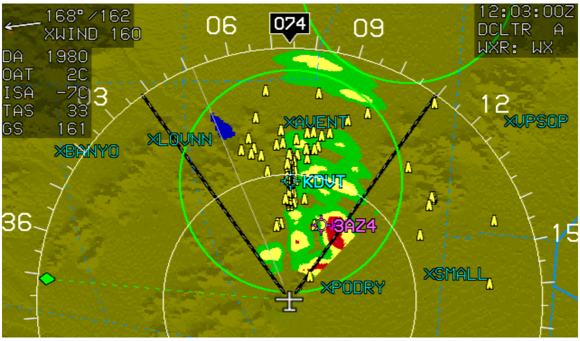


Figure WX-1: Weather Radar on Map Page

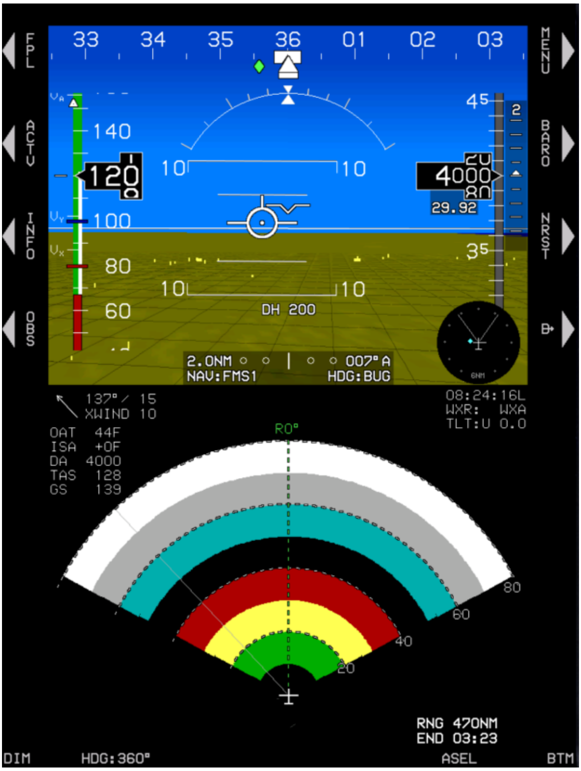


Figure WX-2: PFD Weather Radar Page on Bottom

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 3 Display Symbology) unless inhibited during active FLTA alerts.

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 weather radar type, 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

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.

When weather radar is selected, Datalink NEXRAD is automatically deselected. Weather radar return data is also inhibited:

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.

WX 2. Weather Radar Page

WX 2.1. MFD Page Menu

WX-RDR: Shows the Weather Radar page.

WX 2.2. First-Level Menu Descriptions

WX RDR (R7): If a Weather Radar page is displayed on the PFD, activates the Weather Radar menu for controlling Honeywell RDR-2000/2100.

WX RDR (R3): If a Weather Radar page is displayed on top area of the MFD, activates the Weather Radar menu for controlling Honeywell RDR 2000/2100.

DCLTR (R8): On the Weather Radar page in horizontal profile mode, activates Weather Radar Declutter menu. **ROUTE** toggles active flight plan route.

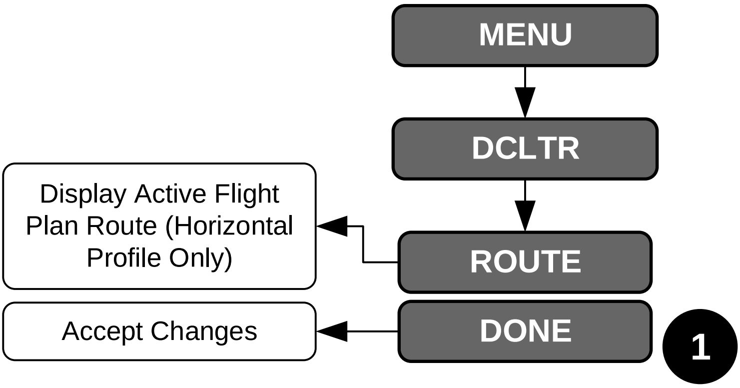


Figure WX-3: WX RDR Declutter (DCLTR) Menu

WX 2.3. Weather Radar Page Menu

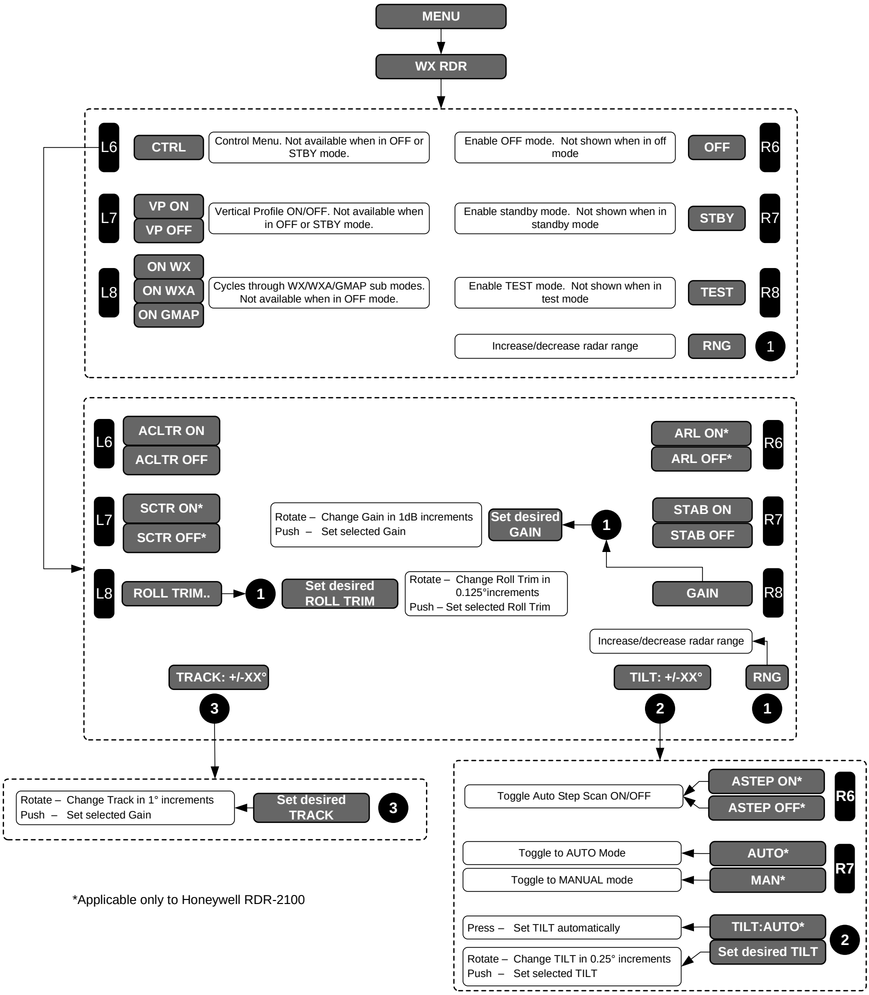


Figure WX-4: WX RDR Page Menu

Upon selecting WX RDR menu in the WX RDR page when weather radar type is RDR-2100 without external RCP installed, the following list appears:

1) **OFF (R6)**: Turns off Weather Radar.

2) **CTRL (L6)**: Activates a list to control live parameters as follows:

    a) **ACLTR ON/OFF (L6)**: Toggles anti-clutter on and off.

b) **ASTEP ON (R6)**: Toggles auto step scan on and off. Begin by adjusting tilt to +15° or -15°.

c) **ARL ON/OFF (R6)**: Toggles automatic range limit on and off.

d) **SCTR ON/OFF (L7)**: Toggles sector scan on and off.

e) **STAB ON/OFF (R7)**: Toggles stabilization mode on or off.

f) **ROLL TRIM (L8)**: Changes roll trim in increments of 0.125° between +3.875° and -4.000°.

g) **GAIN (R8)**: Change radar gain in increments of 0.5 dB between 0-31.5 dB.

h) **TRACK ❸**: Rotate CW to increase and CCW to decrease changes in track in increments of 1° in the following limits settings:

i) Scan width 80° (+/- 40°)

ii) Scan width 90° (+/- 45°)

iii) Scan width 100° (+/- 50°)

iv) Scan width 120° (+/- 60°)

i) **TILT ❷**: Toggles tilt mode between auto tilt (RDR-2100 only) and manual tilt. Also toggles auto-step-scan on and off. When in manual tilt mode, changes tilt angle in increments of 0.25°.

j) **RNG ❶**: See § WX 2.5.

3) **STBY (R7)**: Toggles WX RDR to standby mode, press **ON WXA (L8)** to turn on WX RDR.

4) **TEST (R8)**: Toggles radar into test mode, press **ON WX (L8)** to return to normal operation.

5) **ON WX/WXA/GMAP (L8)**: Toggles WX ON, WXA, or GMAP.

6) **VP ON/OFF (L7)**: Toggles vertical profile on and off. (When VP is off, horizontal profile is on. See § WX 2.4.

7) **RNG**:

a) ❷: On an MFD (IDU #2, #3, or #4) operating in Normal mode, if the top area is showing the Weather Radar page, rotate to change the display range (rotation direction depends on EFIS limits settings).

b) ❶: On a PFD or MFD operating in Normal mode, if the bottom area is showing the Weather Radar page, rotate to change the display range (rotation direction depends on EFIS limits settings).

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 2.3.1. Managing RDR-2100 Weather Radar Menus (PFD) (Step-By-Step)

1) On PFD, push ❶ and rotate to **WX-RDR** and push to enter.
2) Press **MENU (R1)**, within 10 seconds press **WX RDR (R7)**.
3) Press **OFF (R6)** to enable OFF mode.

NOTE:

Turn off weather radar menu if no longer showing WX-RDR page.

4) Press **STBY (R7)** to enable standby mode.
5) Press **TEST (R8)** to enable test mode.
6) While in STBY mode, press **ON WX (L8)** to return radar to ON mode.
7) Current mode status is displayed in upper right corner of radar page. Press **VP ON (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.

8) Press **ON WXA (L8)** to enable Weather-alert sub-mode.
9) Press **ON GMAP (L8)** to enable ground map sub-mode. (Annunciated in upper right corner.)
10) Press **ON WX (L8)** to resume normal weather radar mode of operation.

11) Rotate 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.

WX 2.3.2. Managing RDR-2100 Weather Radar Menus (PFD) ACLTR, SCTR, and Roll Trim (Step-By-Step)

1) Repeat step 2 above and press **CTRL (L6)** to enter radar control menu. (Not shown when in OFF or STBY mode.)

2) Press **ACLTR ON (L6)** to toggle anti-clutter on and off.

3) Press **SCTR ON (L7)** to toggle sector scan on and off.

4) Press **ROLL TRIM (L8)** and then rotate ❶ to desired roll trim angle (increments of 0.125°) and push to enter.

WX 2.3.3. Managing RDR-2100 Weather Radar Menus (PFD) ASTEP, MAN/AUTO, TILT, Angle and GAIN (Step-By-Step)

1) Repeat step 2 above and press **CTRL (L6)**, to enter radar control menu. (Not shown when in OFF or STBY mode.)

1) Push ❷ to open the Tilt menu.

2) Press **ASTEP ON (R6)** to toggle on and off. (Auto step scan is entered initially by adjusting the tilt to ±15°.)

3) Press **MAN (R7)** or **AUTO (R7)** to toggle between either sub-modes.

4) Rotate ❷ to set tilt angle between ±15°. Set angle is annunciated above ❷.

5) When in tilt auto mode, annunciation is above ❷ and in the upper right corner.

6) Press **ASTEP ON (R6)** or **ASTEP OFF (R6)** to toggle antenna tilt to sequentially step in 4° increments. (Auto step scan is entered initially by adjusting the tilt to ±15°.)

7) Press ❷, **BACK (L1)**, or **EXIT (R1)** to exit out of Tilt sub-mode.

8) Repeat step 2 from § WX 2.3.1, press **CTRL (L6)** to enter track sub-mode.

9) Push ❸ and rotate or begin by rotating to set new track angle in 1° increments between limits set in EFIS limits. Read new track in two places. Push to enter.

10) Press **GAIN (R8)** to open gain menu and rotate ❶ to change gain in 0.5 dB increments. Push to set selected gain value.

WX 2.3.4. Managing RDR-2100 Weather Radar Menus (MFD) (Top Area) (Step-By-Step)

1) To open WX RDR page in top area, push ❷ and rotate to **WX-RDR** and push to enter.

2) Press **MENU (R1)** and then press **WX RDR (R3)**.

3) Press **CTRL (L2)** to open WX RDR menus. (Not shown when in OFF or STBY mode.)

4) Press **ACLTR ON (L2)** to toggle anti-clutter on and off.

5) Press **SCTR ON (L3)** to toggle Sector Scan on and off.

6) Press **ROLL TRIM (L4)** and then rotate to ❶ desired roll trim angle (increments of 0.125°) and push to enter.

NOTE:

It is a design feature to retain most of the WX RDR menus in the top area with this configuration of the WX radar.

7) Press **ARL ON (R2)** to toggle automatic range limit on and off.

8) Press **STAB ON (R3)** to toggle Stabilization mode on or **STAB OFF (R3)** to toggle off.

9) Push ❷ or rotate to open Tilt menu and then press **MAN (R7)** or **AUTO (R7)** to toggle between sub-modes.

10) In manual mode, rotate ❷ to set tilt angle between ± 15°. Set angle is annunciated above ❷ and in the upper right corner.

11) Press **ASTEP ON (R6)** or **ASTEP OFF (R6)** to toggle antenna tilt to sequentially step in 4° increments. (Auto step scan is entered initially by adjusting the tilt to ±15°.)

12) Press **BACK (L1)** to return to **WX RDR** menu or **EXIT (R1)** to exit menu.

13) From within the **WX RDR** menu press **GAIN (R4)** to open gain menu and then rotate ❶ to adjust.

14) Rotate ❶ to change gain in 0.5 dB increments between +0.0 dB to -31.5 dB. Push to set selected gain value.

15) Push ❸ and rotate or begin by rotating to set new track angle in 1° increments between limits set in EFIS limits.

WX 2.3.5. Managing RDR-2100 Weather Radar Menus (MFD) (Bottom Area) (Step-By-Step)

1) Push ❶, rotate to **WX-RDR,** and push to enter. Press **MENU (R1)** and then **WX RDR (R7)**, within 10 seconds to open WX RDR options.

2) Press **OFF (R6)** to enable OFF mode.

3) Press **STBY (R7)** to enable standby mode. (This option not shown when in standby mode.)

4) Press **TEST (R8)** to enable test mode. (This option not shown when in TEST mode.)

5) Press **ON GMAP**, **ON WX**, or **ON WXA (L8)** to enable ground map, weather, or weather alert sub-modes.

6) Press **VP ON (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.

7) Press **CTRL (L6)** to open WX RDR menus. (Not shown when in OFF or STBY mode.)

8) Rotate ❶ to alter range of weather radar from 5.00NM to 320NM. Rotation direction dependent upon EFIS limits setting. Range rings are on the right side of the arc.

9) Press **STBY (R7)** to enable standby mode.

WX 2.3.6. Managing RDR-2100 Weather Radar Menus (MFD) (BTM Area) ARL, TILT, ASTEP, and ROLL TRIM (Step-By-Step)

1) Press **ARL OFF (R2)** to toggle automatic range limit option between OFF and ON.

2) Push ❷ and rotate or rotate to open Tilt menu and then press **MAN (R7)** to place enter tilt mode. This action toggles off AUTO sub-mode.

3) Push ❷ and rotate or rotate tilt angle between ± 15°. Set **TILT** angle is annunciated above ❷ and in upper right corner.

4) Press **ASTEP ON (R6)** or **ASTEP OFF (R6)** to toggle antenna tilt to sequentially step in 4° increments. (Auto step scan is entered initially by adjusting the tilt to ±15°.)

5) Press **BACK (L1)** or **EXIT (R1)** to exit out of tilt sub-mode.

6) In the **CTRL** menu, push ❸ and rotate or begin by rotating to set new track angle in 1° increments between limits set in EFIS limits. Read new track in two places. Push ❷ to enter or press **BACK (L1)** to exit from track sub-mode.

7) Press **ROLL TRIM (L8)** to enter roll trim sub-mode.

8) Press **ROLL TRIM (L8)** and then rotate to ❶ desired roll trim angle (increments of 0.125°) and push to enter or press **BACK (L1)** or **EXIT (R1)** to exit menu.

WX 2.3.7. Managing RDR-2100 Weather Radar Menus (MFD) (BTM Area) SCTR, ACLTR, TRACK ANGLE, and ROUTE (Step-By-Step)

1) Press **SCTR ON (L7)** to toggle Sector Scan on and off.

2) Press **ACLTR ON (L6)** to toggle anti-clutter on and off.

3) Push ❸ and rotate or begin by rotating to set new track angle in 1° increments between limits set in EFIS limits.

4) Push to enter and clear track sub-menu or press **BACK (L1)** or **EXIT (R1)** to exit menu.

5) Press **MENU (R1)** and then press **DCLTR (R8)**. Rotate ❶ to **ROUTE** and push to toggle on and off. Rotate to **DONE** and push to enter or press **EXIT (R1)** to exit declutter sub-menu.

NOTE:

If the WX-RDR page is opened in both top and bottom areas, the top area is the dedicated priority display for WX-RDR menus.

WX 2.3.8. Managing RDR-2000 Weather Radar Menus (PFD) (Step-By-Step)

1) Push ❶ and rotate to **WX-RDR** and push to enter.
2) Press **MENU (R1)** then press **WX RDR (R7)**.
3) Press **OFF (R6)** to turn off RDR-2000.
4) Press **STBY (R7)** toggles **WX RDR** to **STBY** mode, press **ON WX (L8)** to turn on RDR-2000.
5) Press **TEST (R8)** to enable test mode.
6) Press **ON GMAP (L8)** to enable ground map sub-mode.
7) Press **VP ON (L7)** to toggle between horizontal and vertical modes.
8) Press **CTRL (L6)** to open WX RDR menus. (Not shown when in OFF or STBY mode.)
9) Press **STAB OFF (R7)** to toggle stabilization sub-mode **STAB ON** and **STAB OFF**. Annunciation is found in upper right corner.
10) Press **GAIN (R8)** to open gain menu and adjust (increments of 0.5 dB) with ❶.

WX 2.3.9. Managing RDR-2000 Weather Radar Menus (PFD) ROLL TRIM, and, ACLTR (Step-By-Step)

1) Press **ROLL TRIM (L8)** and then rotate to ❶ desired roll trim angle (increments of 0.125°) and push to enter or press **BACK (L1)** or **EXIT (R1)** to exit menu.
2) Press **ACLTR ON (L6)** to toggle anti-clutter on and off.
3) Push to enter and clear track sub-menu or press **BACK (L1)** or **EXIT (R1)** to exit menu.
4) Press **ROLL TRIM (L8)** and then rotate to ❶ desired roll trim angle (increments of 0.125°) and push to enter or press **BACK (L1)** or **EXIT (R1)** to exit menu.
5) Push ❷ and rotate or rotate to open tilt menu. Rotate to desired tilt angle between ± 15°. Set angle is annunciated above ❷ and in upper right corner with “D” for down ° and “U” values. For up, push to enter or press **BACK (L1)** or **EXIT (R1)** to exit menu.
6) Push to enter or press **BACK (L1)** or **EXIT (R1)** to exit menu.

WX 2.3.10. Managing RDR-2000 Weather Radar Menus (MFD) (Step-By-Step)

The MFD weather radar menu for the RDR-2000 MFD is the same as for the RDR-2100 with the exception of fewer menu options as described § WX 2.3.8 for the RDR-2000 PFD.

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.

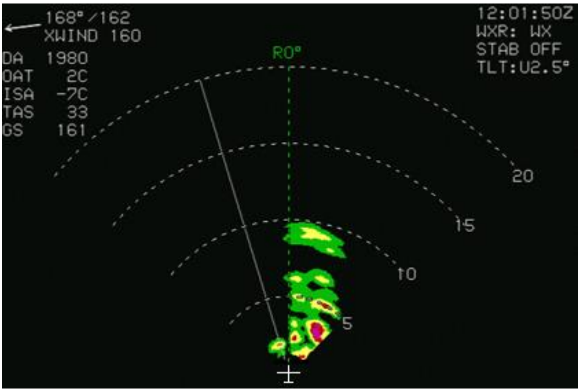


Figure WX-5: Radar Image in Arc Format

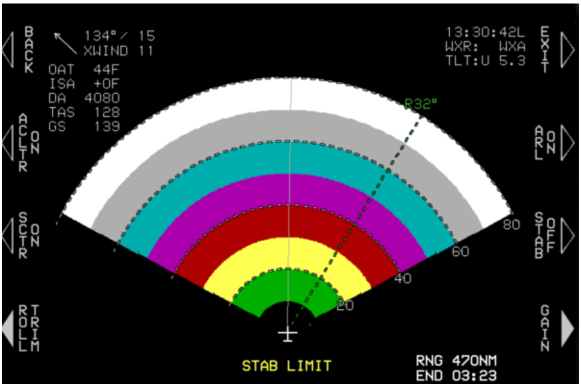


Figure WX-6: Radar Image in Arc Format (STAB LIMIT)

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.

Table WX-2: Weather Radar Page Vertical Profile Altitude References			
Distance in NM	**Vertical Profile Altitude**	**Distance in KM**	**Vertical Profile Altitude**
5NM	±7.5 X 1,000’	10KM	±2.5 X 1,000M
10NM	±15 X 1,000’	20KM	±5 X 1,000M
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

To select vertical profile depiction, use the weather radar control menu (see § WX 2.3). The EFIS ensures at least one weather radar-enabled page is showing the weather radar page prior to entering into profile depiction and disables profile depiction if the pilot sets the pages for no weather radar page on any weather radar-enabled page. The purpose is to maximize the availability of weather radar information on the Map page, which only shows a horizontal depiction and disables profile depiction, if the weather radar mode is set to off or standby via radar control panel.

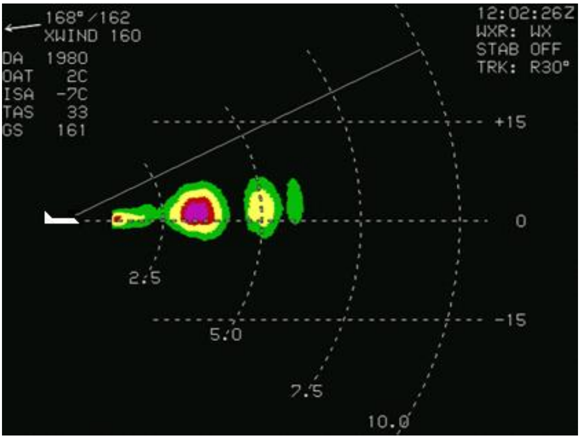


Figure WX-7: Radar Image in Profile Depiction

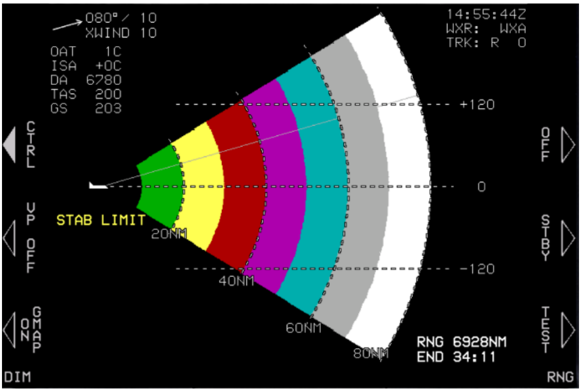


Figure WX-8: Radar Image in Profile Depiction (STAB LIMIT)

WX 2.5. Weather Page Screen Range

Weather page screen range is user-selectable with either ❷ or ❶ (RDR-2000 or RDR-2100 weather radar types) or a control panel directly attached to the weather radar receiver-transmitter.

❷: On an MFD operating in Normal mode, if the top area is showing the Weather Radar page, rotate ❷ to change the display scale (CW to increase, CCW to decrease, or as set in EFIS limits).

❶: On a PFD or MFD operating in Normal mode, if the bottom area is showing the Weather Radar page, rotate ❶ to change the display scale (CW to increase scale, CCW to decrease or as set in EFIS limits.)

Weather page screen range is displayed NM of KM distances depending on EFIS limits settings, as a series of equidistant dashed arcs centered on the ownship symbol to help judge range to the displayed weather radar returns. For most 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 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 ranges in Table WX-3 are available (all distances represent the distance from the ownship symbol to the outer dashed arc.)

Table WX-3: Weather Radar Page Range

Range (NM)	Range (KM)	RDR-2000	RDR-2100	RDR-1600
0.5	1			✓
1	2			✓
2	4			✓
5	10	✓	✓	✓
10	20	✓	✓	✓
20	40	✓	✓	✓
40	80	✓	✓	✓
80	160	✓	✓	✓
160	320	✓	✓	✓
240	480	✓	✓	✓
320	640		✓	
✓ indicates range is available				

WX 2.6. 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.

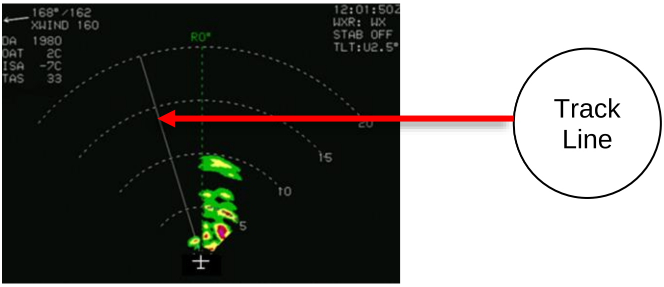


Figure WX-9: Radar Track Line

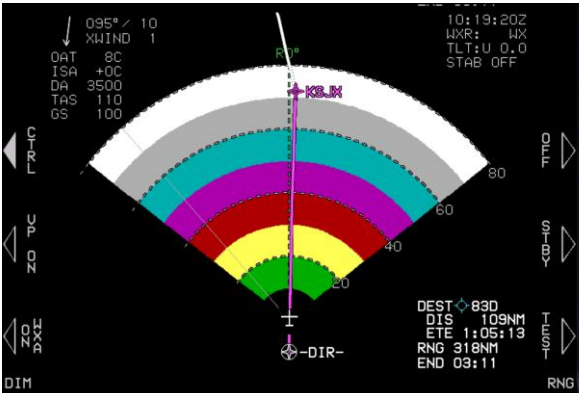


Figure WX-10: Radar Track Line with Menus

WX 2.7. Active Flight Plan Path/Manual Course/Runways

The active flight plan path (when selected), waypoints, and manual course appear, when the weather radar page is showing horizontal depiction. The weather radar page displays airport runways, when the weather radar page is showing horizontal depiction.

When the Weather Radar page is showing horizontal depiction, the EFIS displays airport runways.

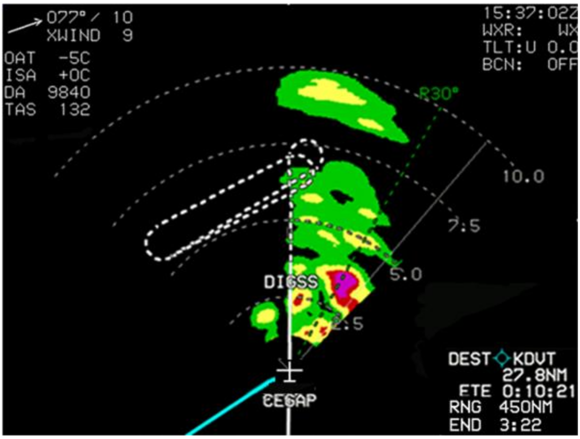


Figure WX-11: Radar Active Flight Plan

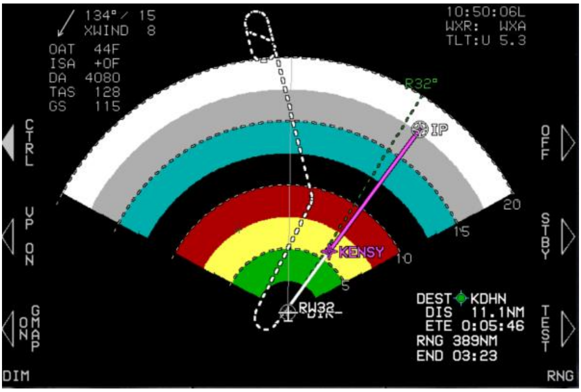


Figure WX-12: Radar Active Flight Plan with Menus

WX 2.8. Air Data and Ground Speed

Wind in Knots
Speed in Knots
Altitude in Feet

Wind in M/S
Speed in km/h
Altitude in Meters

Figure WX-13: Air Data and Ground Speed

Air data is displayed in upper left corner of the weather radar page as specified in Section 3 Display Symbology. See Section 2 System Overview for EFIS Limits Options for Speed Units.

WX 2.9. Waypoint Distance

Displayed as specified in Section 3 Display Symbology.

WX 2.10. Clock/Options

The following are displayed in the upper right corner:

1) Zulu or Local Time: As in Section 3 Display Symbology
2) Weather Radar Mode Annunciation: As in Table WX-4 and Table WX-5.

Zulu Time Local Time

Figure WX-14: Radar Clock/Options

Table WX-4: RDR 2100 Applicability

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: RDR 2100 Mode Annunciation

Annunciation	Conditions
Overlaid with Red X	Weather radar mode is off or not defined. Cooling fault condition exists. Attitude or range fault condition exists. 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 “X” or green “X”.; Mode not standby or forced standby; and Weather radar indicates stabilization is OFF

Table WX-5: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
TGT ALERT (Target Alert)	Mode annunciation not overlaid with a red “X 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. A “REACT” 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 “X” or green “X”. 2) Mode not standby or forced standby; and 3) Radar not in vertical profile depiction.
TRK:L## (TRACK)	Weather Radar Track Annunciation (RDR-2000/2100 only) A weather radar track annunciation appears to indicate 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:

Table WX-5: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
	Mode annunciation not overlaid with a red "X"; or green "X". Mode not standby or forced standby; and Radar in vertical profile sub-mode (Profile depiction).
"GN:SXXDB," "GN:CAL," or "GN:MAX" (GAIN)	A weather radar gain annunciation is provided to indicate 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 "X" or green "X". Mode not standby or forced standby; and In an RDR-2000/2100 installation, the weather radar mode is Ground Map. In an RDR-1600 installation, the weather radar mode is any search modes.

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:

When using EFIS menu system for RDR-2### 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:

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 descriptions of failure descriptions.

WX 3.1. Fuel Totalizer/Waypoint Distance Functions

Fuel totalizer and waypoint distances are displayed in the lower right corner of the Weather Radar page.

Distance in NM

Distance in KM

Figure WX-15: Radar Fuel Totalizer/Waypoint Distance Functions

WX 4. Menu Synchronization

See Section 5 Menu Functions and Step-By-Step Procedures for more information.

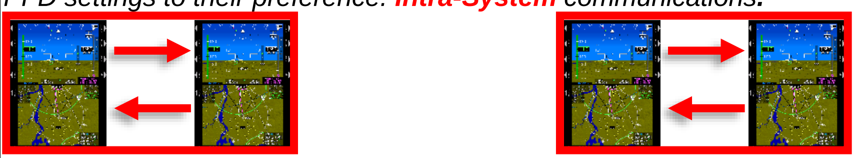
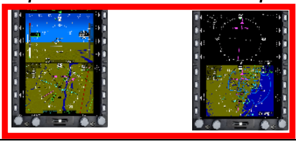
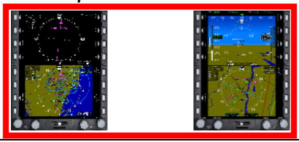
<table>
<tr><th colspan="2">Table WX-6: Menu Synchronization</th></tr>
<tr><th>Menu Parameter</th><th>Notes</th></tr>
<tr><td colspan="2">The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence. Intra-System or Inter-System communications.
</td></tr>
<tr><td>WX RDR Control Menu parameters</td><td>Used to synchronize certain RDR-2### 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-2### 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:

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 two controllers. 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 Input 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.

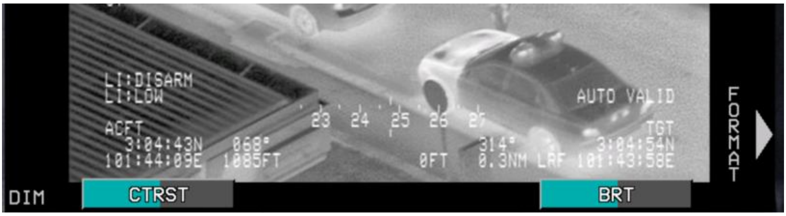
When no video signal is detected, the video input page is black and NO VIDEO IMAGE AVAILABLE is displayed in white on the center of the page. To aid in diagnosing problems with undetected video signals, the following annunciations may also be displayed:

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, rotating the knob changes the zoom level (clockwise to increase, counterclockwise 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, rotating the knob changes the zoom level (clockwise to increase, counterclockwise to decrease) or as set in EFIS limits.

V 1.2. MFD 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

Figure V-1: PFD Page First-Level Video Control

V 1.3. MFD Page Format Menu

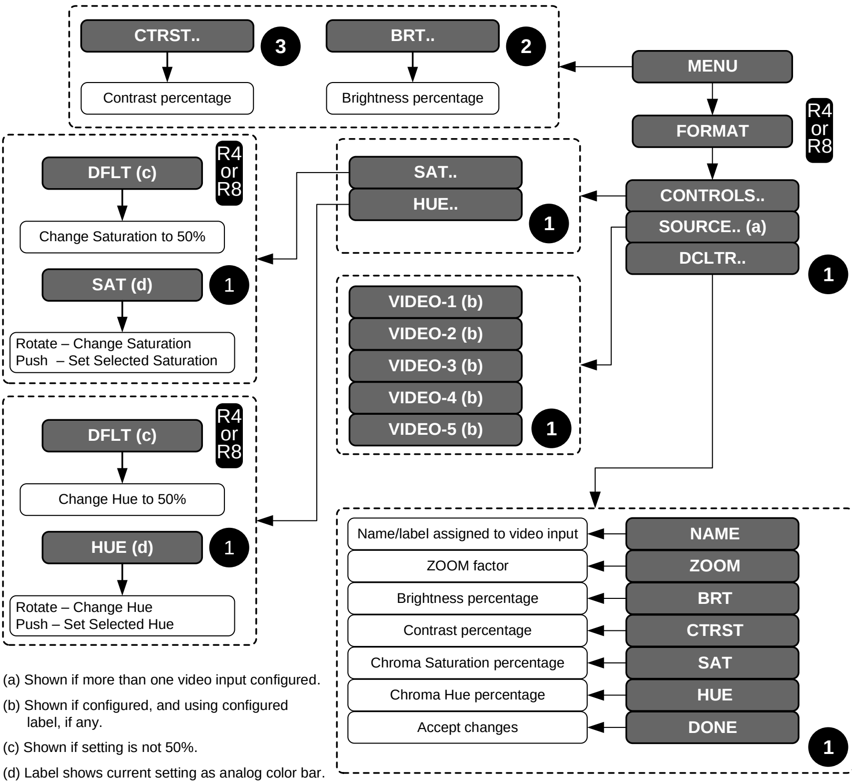


Figure V-2: MFD Page Format Menu

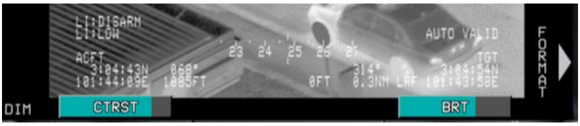
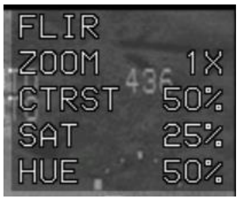


Figure V-3: Video Page Contrast and Brightness Setting

Figure V-4: Video Page Saturation and Hue Setting

Figure V-5: Video Page Sources

Source: Mission



Source: FLIR

Figure V-6: Video Status

V 1.4. Pan Mode

Figure V-7: 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.

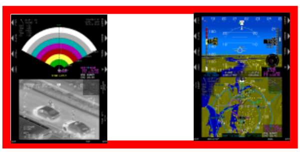
Exiting pan mode removes pan mode controls and mini map, if any.

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

Table V-2: Menu Synchronization

<table>
<tr><th>Menu Parameter</th><th>Notes</th></tr>
<tr><td colspan="2">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.
 </td></tr>
<tr><td>MFD Video Page Settings</td><td>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</td></tr>
</table>

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 possible views are represented. See Section 3 Display Symbology for further information on the following display symbology.

RD 1.1. Pitch Scale

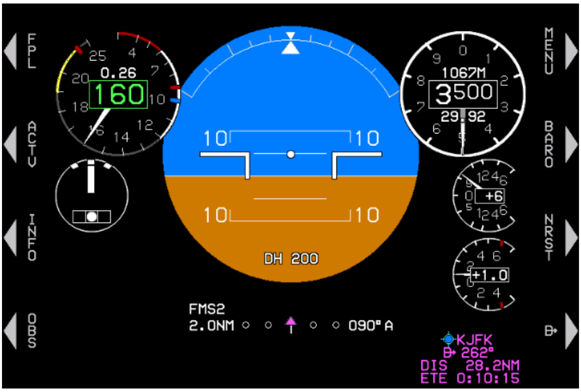
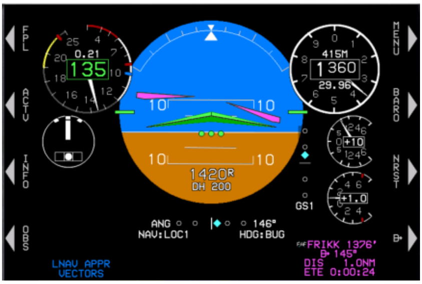


Figure RD-1: Pitch Scale

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

A pilot-selectable flight director is available through the menu system or integrated autopilot/flight director avionics. When selected, one of the symbology examples appear when valid steering commands are received.



FD-1 Single Cue

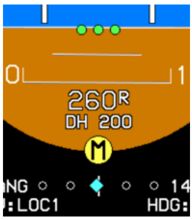
FD-2 Dual Cue

Figure RD-2: Flight Director

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.

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.

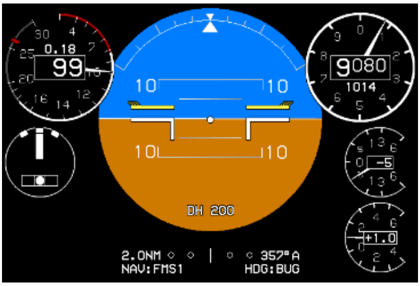
Roll Pointer

Sky Pointer

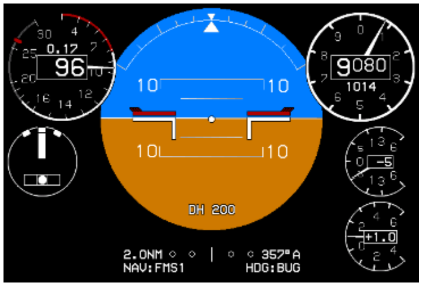
Figure RD-5: Bank Angle Scale Type

RD 1.6. 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.



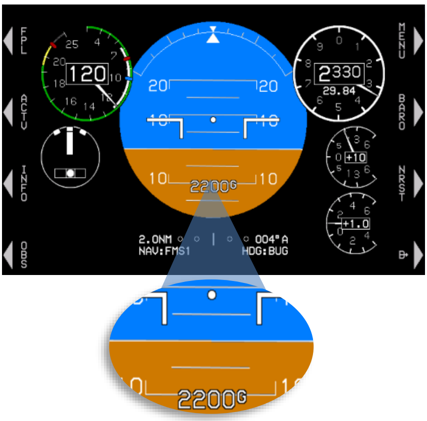
20 Knots above Stall



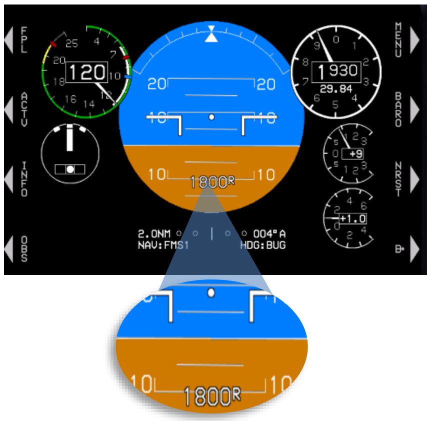
Stall Speed

Figure RD-6: Pitch Limit Indicator

RD 1.7. AGL Indication



GPS/SBAS



Radar Altitude

Figure RD-7: AGL Indicator

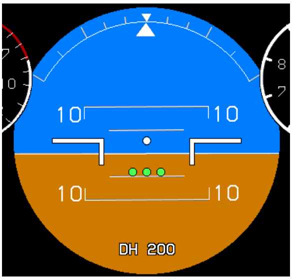
AGL altitude is displayed as shown in Figure RD-7 at the bottom of the display or above the CDI. The source for AGL indication is the source used for the TAWS, which is designated as follows:

R = Radar Altitude

G = GPS/SBAS geodetic height less database found elevation.

B = Barometric altitude less database ground elevation.

RD 1.8. Landing Gear Indication



If configured, PFD displays landing gear position as small green "tires" below FPM or large aircraft symbol reference marks.

Figure RD-8: Landing Gear Indication

RD 1.9. 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-16.

Knots per hour

Kilometers per hour

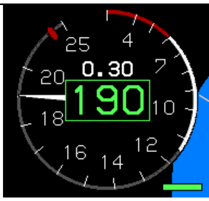
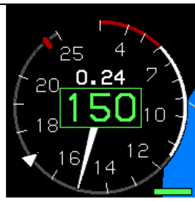
Figure RD-9: Airspeed Display

> **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
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 1.9.1 Airspeed Readout

When enabled the Mach indicator is displayed above the airspeed readout with a resolution of .01 Mach.

Figure RD-10: Airspeed Readout with Mach Number

RD 1.9.2 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.

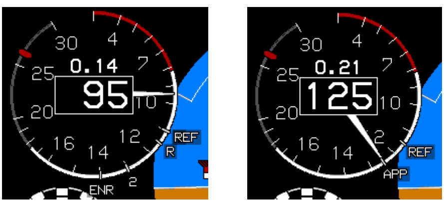


Figure RD-11: Takeoff and Landing Speed Bugs

RD 1.10. Altimeter

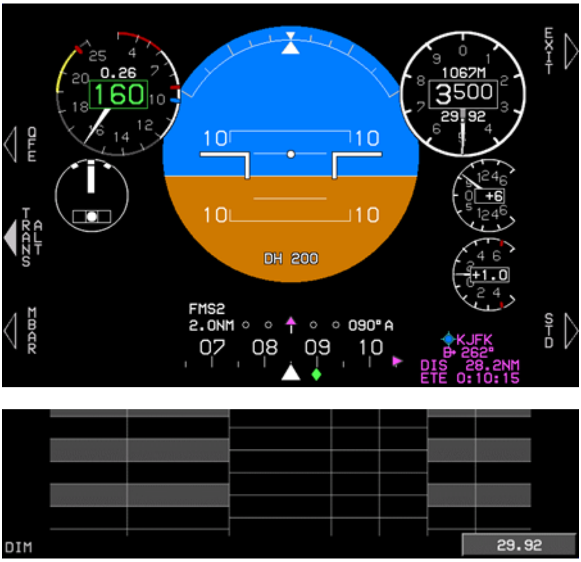


Figure RD-12: Altimeter Setting

The altimeter setting digitally displays the altimeter setting in either inches of mercury (inHg) or millibars/Hectopascal (mbar/hPa) according to the user-selected units. The mode is annunciated as QFE operations; otherwise, no mode is annunciated.

QNH

QFE

Figure RD-13: Altimeter

RD 1.11. Altitude Display

The altitude readout digitally displays barometric altitude to the nearest ten measurement units as adjusted by an altimeter setting and shows a 1000 measurement units range with labels and graduations every 100 measurement units. 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-16.

Altitude in feet

Altitude in meters

Figure RD-14: Altitude Display

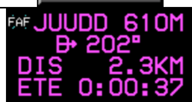
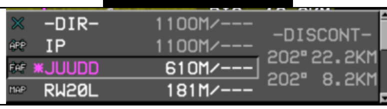
Altitude Display in Feet:
-30 meters or 100 feet below sea level

Altitude Display in Meters:
-40 meters or -128 imperial feet below sea level

Figure RD-15: Altitude Display (When Below Sea Level)

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-3: PFD Declutter Options	
	
Altitude in feet 2250	Altitude in meters 0660
Altitude in Meters 686M	Altitude in Imperial feet 2178FT
METERS ✓ DONE	FEET ✓ DONE
	
	

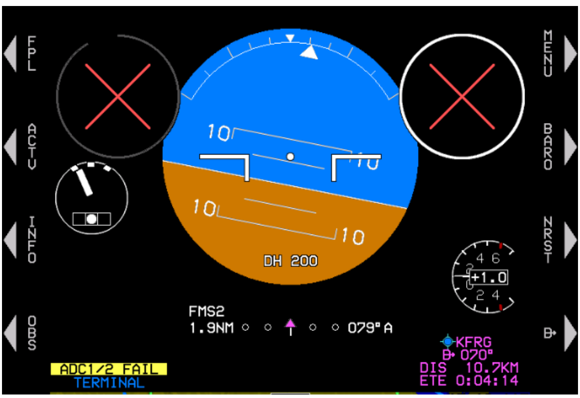


Figure RD-16: Airspeed and Altitude with Loss of ADC

RD 1.11.1 Altitude Sub-Mode

Altitude sub-mode user-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

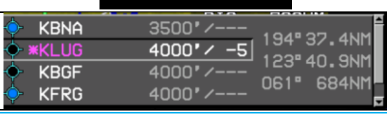
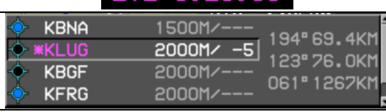
Figure RD-17: Target Altitude Bug

When using meters for altitude display, the target altitude bug setting is limited to the corresponding values in meters (shown in Figure RD-17 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-4: VNAV Sub-Mode

Altitude in Feet	Altitude in Meters
Arrive at 4,000' 5 NM before crossing KLUG	Arrive at 2,000M 5 KM before crossing KLUG
	
	
	

NOTE:

For VNAV bug use with integrated autopilot, see applicable autopilot pilot guide.

RD 1.12. Vertical Speed Indicator

Altitude in Feet for 2100 fpm Descent

Altitude in Meters 7 m/s Descent

Figure RD-18: VSI Bug

A vertical speed indicator is located below the altitude display with a readout, dial and pointer. The readout is displayed in feet per minute or meters per second 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.

RD 1.13. Vertical Speed Indicator Bug

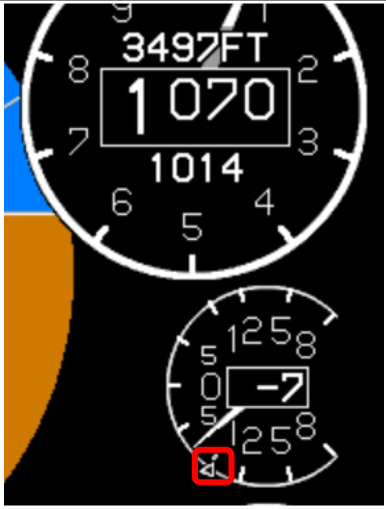
The VSI includes a user-settable triangular vertical speed bug. The VSI bug is mutually exclusive with the airspeed bug.

When using feet per minute for the VSI display, the vertical speed bug setting is limited to ±3,000 per minute.

When using meters per second for the VSI display, the vertical speed bug setting is limited corresponding values in meters per second.

NOTE:

For vertical speed bug use with integrated autopilot, see applicable autopilot pilot guide.

Table RD-5: 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

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-19: Vertical Speed Indicator RA Display

RD 1.14. 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 shown in the bottom area.

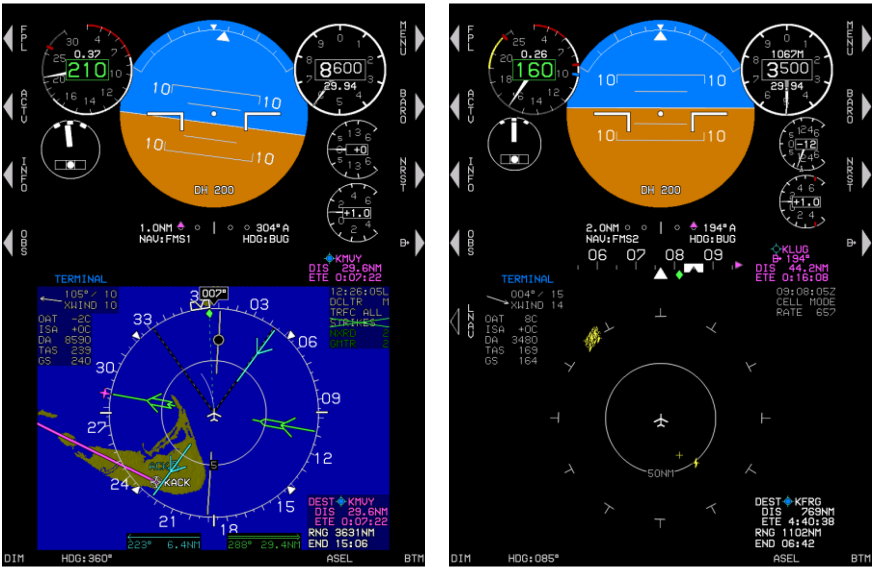


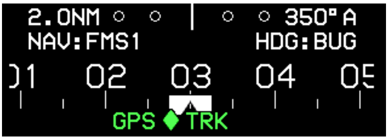
Figure RD-20: Heading Display

Table RD-6: 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.
	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.
	User-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.

Table RD-6: Heading Indicator and Heading Bug	
	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 1.14.1 Heading Failure Mode

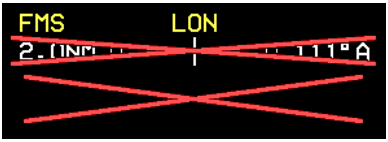
In addition, the equipment has a heading failure mode. With heading failed, the PFI heading scale and MFD compass rose align with track (if available) or are removed and replaced with a red-X.



In this failure mode, the PFI heading scale includes "GPS TRK" around the track marker to clearly delineate the failure mode.

Figure RD-21: GPS TRK

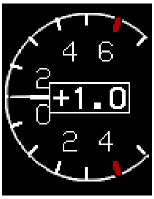
Good GPS



GPS Failure

Figure RD-22: Heading Indicator Heading Failure

RD 1.15. 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-23: G-Force Indicator

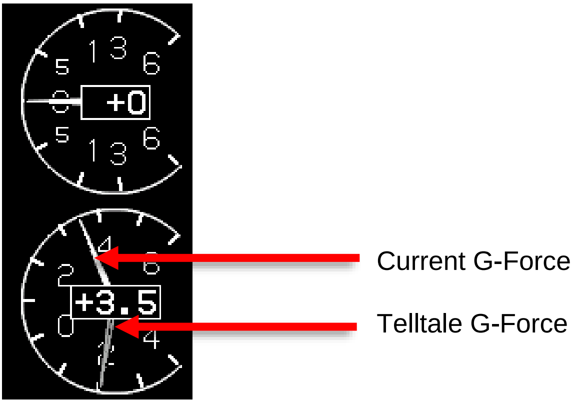
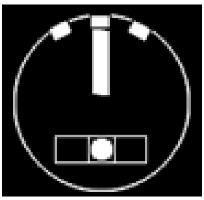


Figure RD-24: G-Force Telltale Indication

RD 1.16. 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-25: Turn Rate Indicator

RD 1.17. Timer Indication

A countdown or count-up timer can be displayed above the large aircraft reference marks when selected through the Time menu.

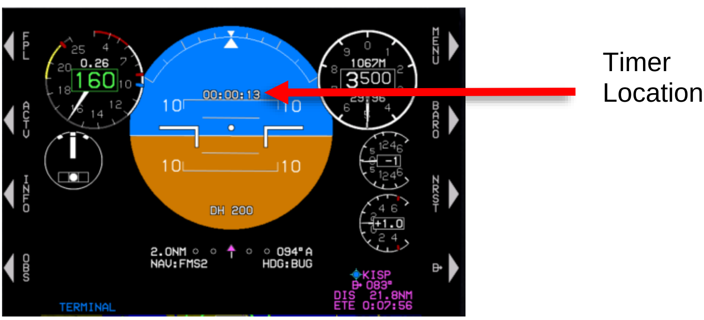


Figure RD-26: Timer Indication

RD 1.18. Vertical Deviation Indicator

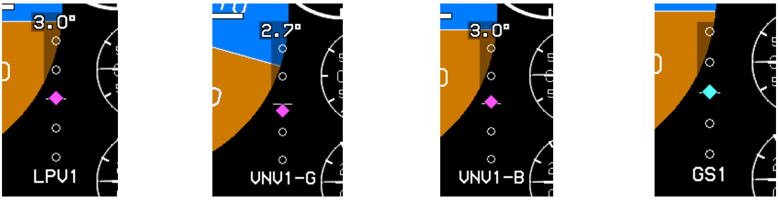


Figure RD-27: VDI

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.

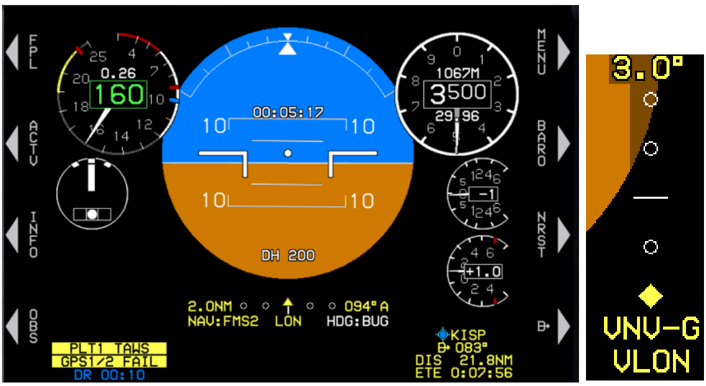
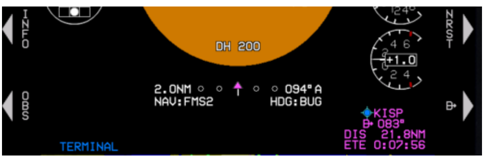


Figure RD-28: VDI Color during GPS/SBAS LON or VLON

RD 1.19. Course Deviation Indicator



Display NAV Source FMS2

(Normal GPS/SBAS)

NAV Source FMS2

(GPS/SBAS failed LON condition)

Figure RD-29: Course Deviation Indicator

Table RD-7 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-7: 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.

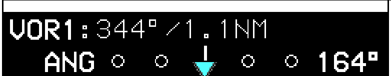
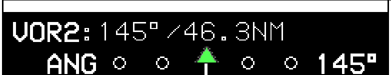
Table RD-7: CDI Behavior and Color	
CDI Pointer and Condition	**Color or Behavior**
	Nav source FMS1 GPS/SBAS (with GPS LON) amber (yellow) OBS automatic mode with a "TO" indication.
Normal conditions	Magenta
In FMS LP/LPV mode or VOR/VLOC approach mode	Angular scale annunciation
	Nav source is localizer (course error exceeds 105°). Reverse sensing with distance to approach threshold.
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.

Table RD-8: CDI Lateral Mode Indication	
CDI Pointer and Condition*	**Color or Behavior**
	Heading bug sub-mode guidance
	LNAV sub-mode guidance
	Failure Sub-Mode
* Installations with an analog autopilot enabled.	

RD 1.20. Active Waypoint and Waypoint Identifier

Figure RD-30: Active Waypoint

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 that desired path for lateral deviation for display on the GPS/SBAS CDI. In most cases, the EFIS 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)

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/SBS 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 rotate ❶ to desired eligible waypoint to begin SAR pattern creation process and push to enter.

2) Rotate ❶ to **SAR PTRN..** and push to enter.

3) Rotate ❶ to one of the five SAR pattern options and push to enter. *Pattern includes the option to select individual legs within the SAR pattern for navigation guidance.

    a) **EXP SQUARE..***

    b) **LADDER..***

    c) **ORBIT..**

    d) **RACE TRACK..**

    e) **SECTOR..***

4) Rotate ❶ through each step, create the desired parameters (e.g., direction, track, leg length, leg spacing, and number of legs), and 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, rotate ❶ to SAR pattern exit waypoint as it appears in white and push to enter, to make this the active waypoint.

7) Push ❶ to accept **WAYPOINT** as the active waypoint without any changes. Press **ACTV (L2)** to view active flight plan. Now the SAR pattern is the active waypoint. Push ❶ to enter.

8) Rotate ❶ to **SAR SGMNT..** and push to enter.

9) Rotate ❶ CW or CCW to advance forward or backwards through all legs to begin leg selection process. When desired leg is magenta, then push ❶ to select and exit menu.

10) Control the aircraft to new magenta line for maneuvering to begin following navigation guidance. See following sub-sections for examples of selected segments.

11) To delete existing SAR pattern, Press **ACTV (L2)**. Rotate ❶ to SAR pattern and press **DELETE (R3)**.

12) 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

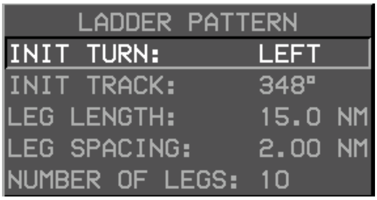
Parameters	Increments (Range)/Direction	Notes
Initial Turn	Left or Right	
Initial Track	Outbound from previous waypoint in 1° increments	Magnetic or True
Leg Spacing	NM or KM 0.25 unit increments between 0.25 unit and 10 units	
Number of Legs	1 to 50	

Figure SAR-3: Expanding Square Pattern-Turn and Leg

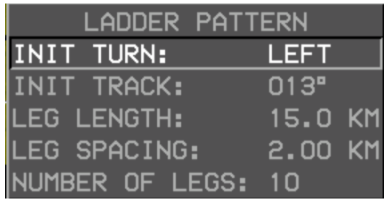
Figure SAR-4: Expanding Square Pattern-Individual Leg Selected

SAR 3. Rising Ladder Pattern

Figure SAR-5: Rising Ladder Pattern



Distance in NM



Distance in KM

Figure SAR-6: 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	

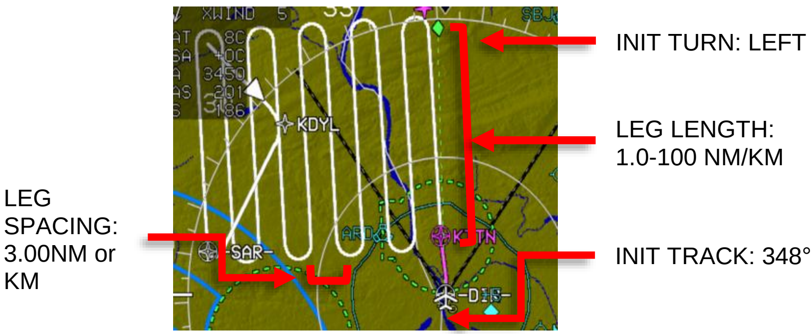
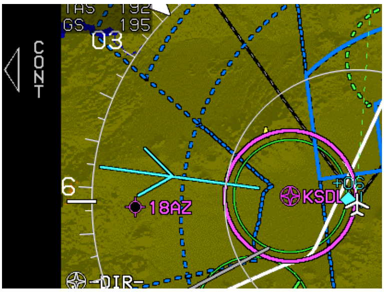


Figure SAR-7: Rising Ladder Pattern-Turn, Leg, and Track

Figure SAR-8: 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, **CONT (L6)** appears to allow for continuing out of the orbit and normal sequencing in the active flight plan.

Figure SAR-9: Orbit Pattern

Distance in NM

Distance in KM

Figure SAR-10: 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

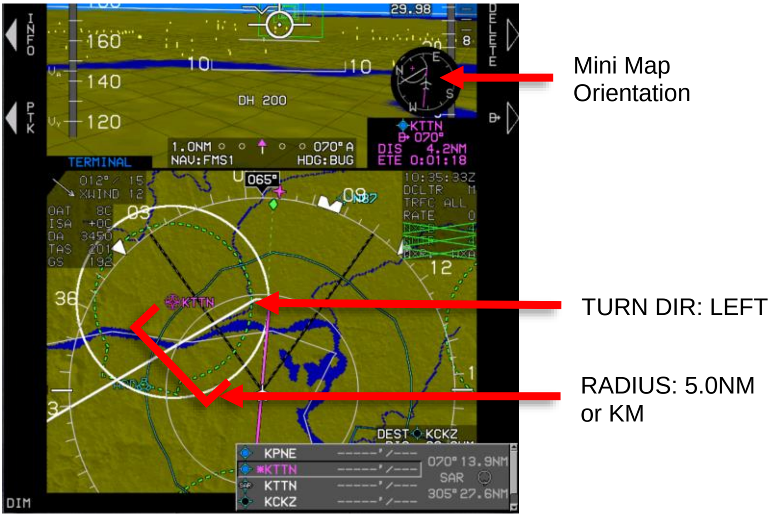
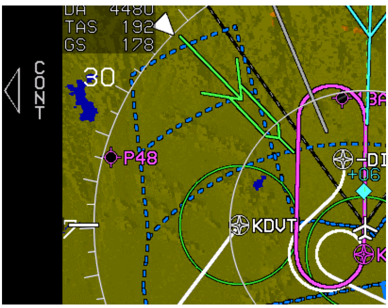


Figure SAR-11: Orbit Pattern-Turn and Radius

SAR 5. Race Track Pattern



With no other menus displayed, **CONT (L6)** appears for continuing out of the racetrack and normal sequencing in the active flight plan.

Figure SAR-12: Race Track Pattern

Distance in NM

Distance in KM

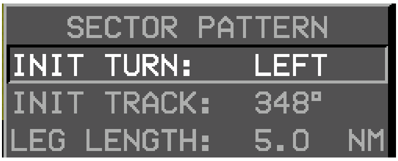
Figure SAR-13: Race Track Pattern Parameters

Table SAR-4: Race Tack 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	
The SAR exit waypoint is a duplicate of the previous waypoint.		

Figure SAR-14: Race Track Pattern-Turn, Leg, and Track

SAR 6. Sector Search Pattern

Figure SAR-15: Sector Search Pattern



Distance in NM

Distance in KM

Figure SAR-16: Sector Search Pattern Parameters

Table SAR-5: Sector Search 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 in 0.5 unit increments between 1 unit and 100 units	
Exit waypoint is a duplicate of the previous waypoint.		

Figure SAR-17: Sector Pattern-Turn and Track

Figure SAR-18: Sector Search Pattern-Individual Leg Selected

Electronic Circuit Breaker Unit (ECBU)

ECBU 1. Electronic Circuit Breaker

The EFIS supports interface to an electronic circuit breaker unit (ECBU). The ECBU replaces conventional thermal mechanical circuit breakers and functions as both a breaker and a switch for controlling loads. Each ECBU comprises of multiple solid-state electronic circuit breaker (ECB) devices that actually control the loads. The ECB page acts as the user interface for controlling individual ECB state and to display tripped, pulled or collared circuit breaker lists.

NOTE:

ECBU functionality is only available as a prototype version in EFIS software. The functionality is not TSO'd. GMF option is available to either upload or delete the ECBU configuration file.

ECBU 2. Top-Level Menu PFD or MFD (Essential Mode or Normal Mode)

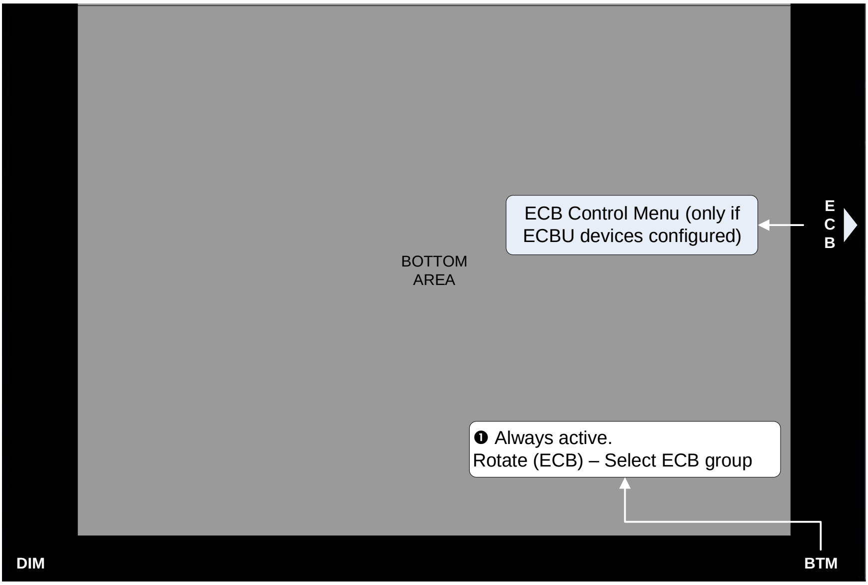


Figure ECB-1: Top-Level Menu PFD or MFD (Essential Mode or Normal Mode)

ECBU 3. PFD Page First Level

ECB (R6): Activates the ECB control menu option.

ECBU 4. MFD Page First Level

ECB (R6): Same function as PFD Page First Level. **SET FUEL (R6)** has precedence over **ECB**.

ECBU 5. ECB Control Menu

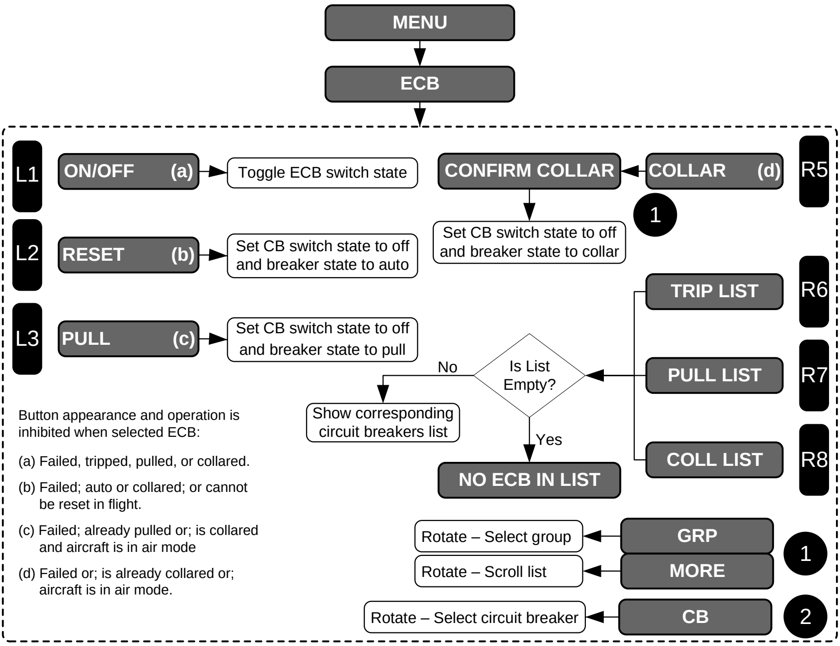


Figure ECB-2: ECB Control Menu

ECBU 6. Warning/Caution/Advisory Alerts

Warning, caution, and advisory alerts are only active when ECBU is configured. See Section 2 System Overview for more information.

Table ECB-1: Warning/Caution/Advisory Alerts

Visual Alert		Voice/Audible Alert	Condition
Warning	CHECK BREAKER	"Check Electric, Check Electric"	Alert condition exists for more than 1 second.
Caution	CHECK BREAKER	Alert Tone	
Advisory	CHECK BREAKER	Chime	

ECBU 7. Breakers Page

BREAKERS ❶: Shows the Electronic Circuit Breakers page.

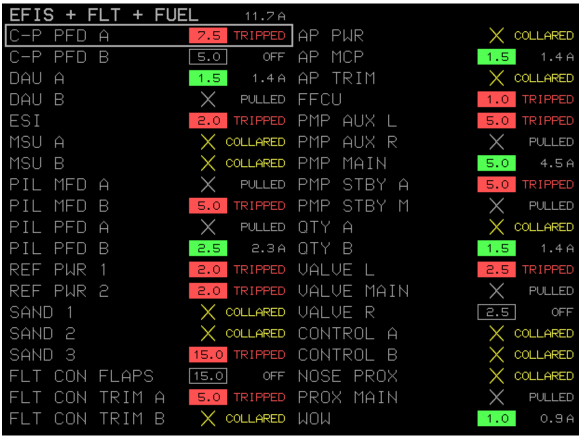


Figure ECB-3: ECB Page

The Electronic Circuit Breaker screen includes the following elements.

ECBU 7.1. Single ECB Element

Figure ECB-4: Single ECB Element

The following data items are displayed for each ECB in the circuit breaker screen:

Name: Configured ECB name is displayed in light gray color.

Trip Current: When the ECB breaker state is auto or tripped, the configured trip current readout is displayed with a resolution of 0.1A. Otherwise, “X” is displayed. The resolution of readout changes to 1A when needed to accommodate all digits of trip current. A rectangular box is drawn around the readout. The coloring scheme for the trip current is defined in Table ECB-2.

Table ECB-2: Scale Graduations and Display

ECB State	Box Color	Readout/Text Color
Auto (switch state – off)	Hollow Light Gray	Light Gray
Auto (switch state – on)	Filled Light Green	Black
Tripped (breaker state)	Filled Light Red	Black

Table ECB-2: Scale Graduations and Display		
ECB State	**Box Color**	**Readout/Text Color**
Pulled (breaker state)	None	Light Gray
Collared (breaker state)	None	Yellow

When responses from the corresponding ECBU have ceased for more than 2 seconds, the trip current readout area displays a red-X as shown in Figure ECB-5.

Figure ECB-5: Trip Current Readout

Current Flow/ECB State: When the ECB breaker state is auto and switch state is on, displays the current flow readout with a resolution of 0.1A. Otherwise displays the ECB state in text format. The readout includes the unit of measure. The coloring scheme for the current flow/ECB state is defined in Table ECB-3.

Table ECB-3: Current Flow ECB State Coloring Scheme		
ECB State	**Text**	**Color**
Auto (switch state – off)	OFF	Light Gray
Auto (switch state – on)	Readout in amps (See above)	Light Gray – Normal Brown – Stale*
Tripped (breaker state)	TRIPPED	Light Red
Pulled (breaker state)	PULLED	Light Gray
Collared (breaker state)	COLLARED	Yellow
Failed	NO DATA	Light Gray
* Current flow of the ECB is declared as stale when timeout occurs.		

ECBU 7.2. ECB Group Display

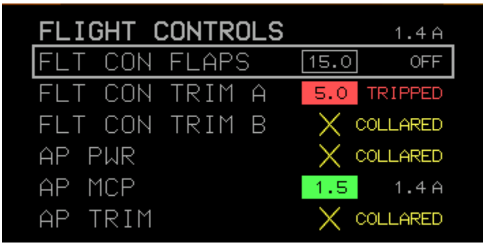


Figure ECB-6: ECB Group Display

ECB page can be configured to display a group of ECB elements based on its functionality. Grouping of the ECB elements are achieved through the ECBU configuration file. ECB group is displayed by default when the breaker page is selected to be displayed on the display.

ECB page displays only one group at a time. When showing a group display, the configured group name is displayed in light gray color at the top of the ECB page. The group current readout is displayed right side of the group name. The readout is displayed with a resolution of 0.1A and includes the unit of measure. The readout is displayed in brown color if any of the ECB current in the group is stale. Otherwise, the readout is displayed in light gray color. Note that, the group current is calculated by adding all of the ECB currents in that group.

Each ECB in a group is pilot-selectable. The selected ECB is indicated by a light gray rectangle drawn around the ECB. If more than 19 ECBs are configured in a group, the ECBs are displayed in two columns.

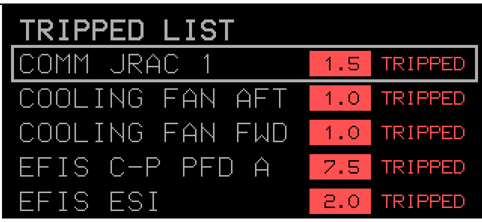
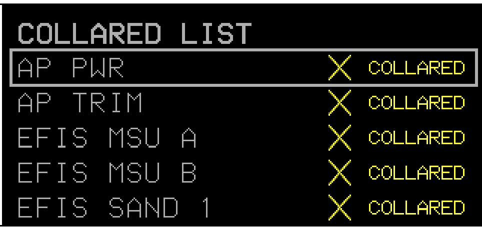
ECBU 7.3. ECB Fixed List Display

ECB page can show a fixed list based on its current breaker state using menu options. At least one ECB element is needed in the corresponding list for showing it on the screen.

ECB page display a pulled list, tripped list or collared list. When showing a fixed list display, the list name is displayed in light gray color at the top of the ECB page as shown in Table ECB-4.

Each ECB in a fixed list is pilot-settable. The selected ECB is indicated by a light gray rectangle drawn around the ECB. If more than 19 ECBs are present in a list, then the ECBs are displayed in two columns. If the total number of ECBs in a list exceeds 38, then a scroll bar is displayed on the right side of the breaker page.

Table ECB-4: ECB Fixed List Display	
	Pulled List

Table ECB-4: ECB Fixed List Display	
	Tripped List
	Collared List

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. The bank angle scale may be set to auto-declutter by the pilot when the bank angle is less than 2.8°. The pitch ladder is limited to ±10° from the flight path marker or aircraft waterline, whichever is greater. The unusual attitude display appears when the aircraft pitch exceeds ± 30° or bank angle exceeds 65°.

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.

Conformally – Angle-preserving. 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 dual 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.

Display of ADF – Display of single and or dual ADF bearing information in the form of an RMI pointer (when enabled in EFIS limits).

Display of 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.

Display of 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.

Display of Localizer – Display of VLOC1 or VLOC2 in the form of horizontal deviation dots and deviation.

Display of Marker Beacon – Display of outer, middle, and inner marker beacons in the form of a color-coded circle with the corresponding letter 

.

Display of Traffic Information – When integrated with an appropriate traffic system, the PFD and MFD display traffic information in two formats. One format is via traffic symbols as shown on the PFI area, MFD Map page, and Traffic page. The second format is with the traffic pop-up thumbnail display showing traffic position in a full 360° format on the PFD. Distance displayed in NM or KM as configured in EFIS limits.

Display of VOR RMI – Display of VOR1 and VOR2 bearing in the form of RMI pointers.

Dot – (CDI scale referenced) represents an additional 2° for VOR and 1.25° for Localizer.

EFIS-Coupled – The 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.

Geodetic – Set of reference points used to locate places on the earth.

Geodesic – A generalization of the notion of a straight line to curved spaces. The shortest route between two points on the Earth's surface.

Geoid – Global mean sea level.

G-Force – Indications to show the G-force and tell-tales on the aircraft.

Glide Slope Sidelobes – False glide slope signals.

GPS SBAS/WAAS 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 bearing to follow the magenta line.

GPS SBAS/WAAS 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 3 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.

HOTAS – Hands-On Throttle And Stick

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. Examples are:

XFILL INHBT, TAWS INHBT, FPM INHBT, FLTA INHBT, and TAS INHBT.

Integrated Peripherals – Internal devices of the essential unit.

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.

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.)

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 approach minimum is approved, e.g. LP APPR, LPV APPR, RNP: 0.10A RNP: 15.0A.

Lubber Line – Green-dashed line marked on the compass showing the direction straight ahead.

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 IDU configuration (limits) file.

Magnetic Declination (MAGVAR) – Sometimes called magnetic variation; the angle between magnetic north and true north.

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.

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. Examples are:

ALT MISCOMP, GS MISCOMP, LOC MISCOMP, ATT MISCOMP, HDG MISCOMP, PLT MISCOMP, CPLT MISCOMP, GPS MISCOMP, IAS MISCOMP, RALT MISCOMP, and BARO MISCOMP.

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.

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.

Obstructions Display – Display of obstructions identified in the embedded obstruction database which are within 8.5 NM (Map), 12 NM (PFI wide FOV), and 17NM (PFI narrow FOV) of the aircraft present position. Non-threatening obstructions are displayed by color to identify altitude relative to the aircraft's current altitude (amber [yellow] < 2000' below, light red < 500' below, bright red = at or above aircraft). Threatening obstructions, defined as those that pierce the TAWS envelope, are identified by highlight when producing a caution and identified by flashing highlight when producing a warning. Distance is always referencing NM and altitude always in feet.

Omnibearing – Magnetic bearing of an omni-range station.

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.

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.

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 enroute 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.

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.

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 Dual-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 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.

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 enroute 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.)

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.

Terrain Display and TAWS – Display of terrain, including identification and annunciation of threatening terrain in accordance with Terrain Awareness Warning System (TAWS) requirements. (All altitude references are in Feet) Coloring scheme for SVS-TAWS PFD and MAP has been simplified as follows:

Terrain at or below 100 feet less than aircraft altitude – Olive shades

Terrain above 100 feet less than aircraft altitude – Brown shades

TAWS FLTA Caution Terrain – Amber (Yellow)

FLTA alerts – Amber and Red

Obstacles Below aircraft – Amber (Yellow)

Obstacles at and above aircraft – Red

When over water – Deep Blue

Threatening terrain is determined by the requirements of TAWS TSO-C151b. Threatening terrain is shaded amber (yellow) for caution situations or shaded red for warning situations per TSO-C151b. TAWS cautions and warnings are accompanied by an amber (yellow) or red flag and an aural annunciation. TAWS Class A, TAWS Class B, and TAWS Class C.

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 Display – When integrated with an appropriate traffic system, traffic is shown using standard TCAS symbology showing relative position, altitude, climb/decent, and color. The pilot may also show traffic information by selecting the dedicated traffic display page.

Transmit-Enabled – IDU providing data to external sensors and generating aural alerts. IDUs depend upon intra-system communications to determine which IDU on a side takes over transmit-enabled responsibilities. Only one transmit-enabled per side, two talkers in a dual-side system, 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.

Vertical Speed Display – Display of altitude rate of change (vertical speed or climb rate). (FPM or m/s as configured in EFIS limits.)

V_{HOLD} (Holding Speed) – The aircraft's normal speed (in airspeed units and configured in EFIS limits) for flying holding patterns. This value is used for calculating the turn radius of holding patterns.

V_{PROC} (Procedure Speed) – The aircraft's normal speed (in airspeed units and configured in EFIS limits) for flying instrument approaches (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).

IDU-680 EFIS Software Version 9.0B (Fixed Wing)

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