

3D SYNTHETIC
VISION EFIS

HIGHWAY-
IN-THE-SKY
NAVIGATION

GRAPHICAL
FLIGHT
MANAGEMENT
SYSTEM

INTEGRATED
AUDIO/RADIO
MANAGEMENT



IDU-680 Version 8.0F Pilot Guide (Rotorcraft)

Pilot Operating Guide and Reference

(Rotorcraft)

EFIS Software Version 8.0F

Document 64-000098-080F

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 Rotorcraft Flight Manual (RFM). Refer to the applicable RFM for aircraft specific information, such as unique ground tests, limitations, and emergency procedures.

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Revision Record

Rev	Notes/Pages changed, added, or deleted by current revision	Date	Author
1 st Ed	--	Jan 2018	G. Schmidt
A	<p>Added audio/video icons with links to YouTube throughout the document, predominantly Sections 2, 3, 5, and 7.</p> <p>Removal of Audio/Radio Management Appendix.</p> <p>Pages with changes to images: 1-4; 2-19; 3-2 to 3; 3-5 to 7; 3-21; 3-47; 3-49; 3-64; 3-66 to 67; 3-78; 4-12; 5-7 to 9; 5-23 to 24; 5-43; 5-49; 5-51; 5-53 to 54; 5-60 to 61; 5-64 to 65; 5-68; 5-74; 5-78; 6-1; 7-49 to 50; 8-22 to 23; 8-28; T-6; T-9; S-5; D-4; D-9; WX-10; RD-4; V-5; RD-7 to 8</p> <p>Pages with edits to text (corrections, clarifications, deletions, and/or additions): i; 1-4; 2-1; 2-4, 2-14 to 16; 2-18 to 21; 2-23 to 25; 2-32; 2-34 to 35; 2-37 to 39; 2-41; 2-50; 2-64; 3-8; 3-10; 3-13; 3-20; 3-23; 3-25 to 28; 3-33 to 35; 3-40 to 41; 3-46; 3-49; 3-57 to 58; 3-62; 3-65 to 66; 3-72 to 73; 4-1; 4-6; 4-8 to 9; 4-12; 4-14; 5-4 to 6; 5-10 to 14; 5-19; 5-21; 5-24 to 26; 5-28; 5-32; 5-44 to 45; 5-47; 5-58; 5-63 to 65; 5-69 to 71; 5-75; 5-77; 6-2 to 3; 6-5 to 6; 7-3; 7-5; 7-11; 7-27; 7-31; 7-51; 7-55; 7-61; 8-1; 8-9; 8-11; 8-15 to 19; 8-26 to 27; 9-2; 9-4 to 6; 9-10; 9-12; ; T-3; T-8 D-2; D-5; D-13 to 14; WX-1 to 12; RD-1 to 4; RD-7 to 8; G-2; G-5</p> <p>Changes to subheading and/or caption numbering: 2-23 to 25; 3-8 to 66; 4-5 to 31; 5-25 to 34; 5-51 to 69; 7-22; 7-24 to 25; 9-9; T-3 to 10; V-3 to 4; V-6; RD-7 to 8</p>	Apr 2018	G. Schmidt
Retain this record in front of manual. Upon receipt of a revision, insert changes and complete table below.			
Revision Number	Revision Date	Insertion Date/Initials	

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Section 1 Introduction

1.1. Introduction

Aviation has become more complex with sophisticated “automation centered” systems, which minimize pilot involvement and automate control of the aircraft and its systems, thereby relegating the pilot to the role of manager and emergency backup.

The Genesys Aerosystems Electronic Flight Instrument System (EFIS) is designed as 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.

The Genesys Aerosystems EFIS goal is IFR-VFR equivalence with HUD symbology overlaying real-time 3-D virtual view of the outside world. This “synthetic vision” provides the pilot in IMC with simple visual clues for navigation and aircraft control as those used in VFR conditions. The “virtual VFR” eliminates the need to scan multiple instruments for aircraft control or interpret complicated enroute and approach procedures. As experience is gained with this integrated system, the pilot will fly with more precision, awareness, and confidence.

1.2. EFIS/FMS Description

The integrated display unit (IDU) has 16 pushbuttons 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.

The four encoders from left to right are designated ④, ③, ②, and ①. With ④ only controlling the backlighting intensity. References throughout this guide refer to which encoder to push and/or scroll for desired outcomes.

On the bezel between the two center encoders, a slip indicator or blank housing acts as the USB memory door. When lifted prior to power-up, the ground maintenance mode is initiated after power-up. If a limits change, software, or database update is planned, the USB drive must be inserted prior to power-up.



Figure 1-1: IDU-680 Input Identification

A sensor on the face of the IDU bezel measures ambient light levels. Use 4 to control the brightness of the panel lighting or display lighting. Panel lighting refers to the illumination of legends, encoders, and buttons (push and scroll clockwise to increase or counter clockwise to decrease). Display lighting refers to the illumination of the LCD display (without pushing, scroll 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 bright light shining or reflecting directly into the display, shield the light sensor to avoid the IDU from going directly into the flight mode.

1.3. About This Guide

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 PFI/ND and PFD/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 operation of each task. Basic description of all encoder and button functions with menu tile 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 with views of referenced published procedures. Includes descriptions of selection

of departure, published instrument approach, standard terminal arrival procedures, as well as, how the active flight plan quickly reflects changes to ATC clearances.

TERRAIN AWARENESS WARNING SYSTEM (Section 8): Description of Enhanced HTAWS and HTAWS functionality for this aircraft with all configurations. Defines the various parameters, which automatically apply to each mode of flight.

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

APPENDICES: Audio Radio Management, Traffic, Remote Bugs Panel, WX-500 Lightning Strikes, Datalink, Weather Radar, and Video. Sections on equipment and features not installed in every aircraft and 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.

1.3.1. Audio and Video Interactive Capabilities

Throughout this guide, references to audio annunciations and video demonstrations are indicated with the following icons. When viewing this guide on a computer or mobile device, click on the icons to hear the respective audio clip or watch a demonstration video via Genesys Aerosystems' YouTube™ channel. Check the YouTube channel for additional videos as they become available.



Audio



Video

Figure 1-2: Audio and Video Icons

Section 2 System Overview

2.1. Abbreviations and Acronyms

µm Hg	Micrometer of Mercury
OR	No Radius
3-D	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
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
AP	Autopilot
APP	Waypoint is part of an Instrument Approach Procedure
APPR	Approach
APT	Airport
APV	Approach with Vertical Guidance
AOA	Angle of Attack
ARINC	Aeronautical Radio, Inc.
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
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
dBZ	Decibel 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
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
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
FPL	Flight Plan
fpm	Feet per minute
FPM	Flight Path Marker
FPNM	Feet Per Nautical Mile
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
GMETAR	Graphical METAR (also GMTR)
GMF	Ground Maintenance Function
GN	Gain
GND	Ground
GNSS	Global Navigation Satellite System
GPI	Glidepath Intercept

GPIP	Glide Path Intercept Point
GPS	Global Positioning System
GPSV	Global Positioning System Vertical Navigation
GPWS	Ground Proximity Warning System
GRD	Grid; Ground
GS	Glideslope
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
HRZ SYNC	Horizon Synchronization
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
IDENT	Identification (Transponder Ident)
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
KT	Knot - Nautical Mile per Hour
KTAS	Knots True Airspeed
LAT	Latitude
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)
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
MOA	Military Operations Area
MOT	Mark On Target
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)
NTSC	National Television System Committee standard analog video system (30 frames per second) used in North America and most of South America
NWS	National Weather Service
OASIS	Open Architecture Systems Integration Symbology
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)
PAL	Predominant analog video system (25 frames per second) used outside North America and South America.
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
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
RDR	Radar
REC	ADF receiver in BFO or test mode
RF	Precision Arc to Fix (ARINC-424 Leg)
RFP	Radio Frequency Panel
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
RTC	Real Time Computing
RTCA	Radio Technical Commission for Aeronautics
RTD	Resistive Thermal Detector
RW	Runway
Rx	Receive
SAE	Society of Automotive Engineers
SAT	Saturation
SATLT	Satellite
SBAS	Satellite-Based Augmentation System
SCC	System Configuration Card (personality module)
SECAM	Analog color television system used in France
SIC	Side-in-Command
SID	Standard Instrument Departure

SIGMET	Significant Meteorological Advisory
SLCT	Select
SSM	Sign Status Matrix
STAB	Stability
STAR	Standard Terminal Arrival Routes
STBY	Stand-by
STD	Standard
STRKS	Strikes (Lightning detection)
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
THLD	Threshold
TIS	Traffic Information Service
TIS-B	Traffic information Service-Broadcast
TLT	Tilt
TRANS	Transition
TRK	Track

TRNDO	Tornadic
TSO	Technical Standard Order
TTA	Time to Alert
TURB	Turbulence
Tx	Transmit
USB	Universal Serial Bus, data storage device
USR	User Waypoint
UTC	Universal Time Coordinated
VA	Heading to Altitude (ARINC-424 Leg)
V _A	Speed above which it is unwise to make full application of any single flight control
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
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
VOX	Voice
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 _{TOS}	Minimum speed for a positive rate of climb with one engine inoperative
WAAS	Wide Area Augmentation System
WGS84	World Geodetic System 1984
WPT	Waypoint
WX	Weather
XFILL	Crossfill

2.2. System Overview



Figure 2-1: IDU-680 Primary Flight Display (PFD) and Navigation Display (ND)

The IDU-680 EFIS is a complete flight and navigation instrumentation system intuitively providing information via computer-generated displays. The displays include 3-D, enhanced situational awareness primary flight display (PFD) and multi-function display (MFD), which may be configured to show a moving map, HSI, terrain, traffic, Datalink, weather radar, video, audio/radio management or EICAS (engine indicating and crew alerting system) pages.

At any given time, each system 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.

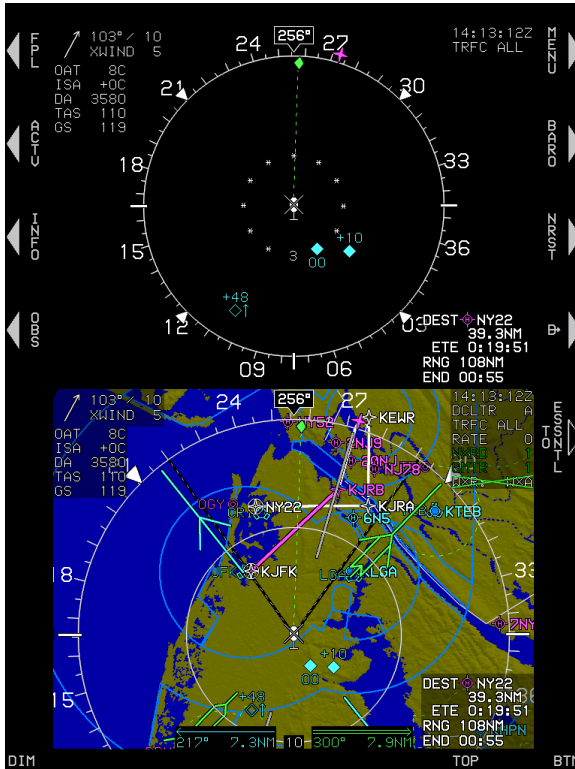


Figure 2-2: IDU-680 Multifunction Display (MFD)

2.2.1. Functional Integration and Display Redundancy

IDUs incorporate a high-brightness AMLCD screen; bezel pushbuttons; encoders and enter switches; 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, EICAS, ADS-B In, weather, traffic, audio/radio control, or OASIS etc.).

The IDUs depend upon intra-system (between IDUs on a side – depicted as “Sync” in Figure 2-3) and inter-system (between IDUs on opposite sides – depicted as “Crosslink” in Figure 2-3) to achieve synchronization of the integrated functions. The IDUs also depend

upon intra-system communications to determine which IDU on a side takes over “talker” responsibilities. The “talker” IDU is the IDU providing data to external sensors and generating visual and aural alerts.

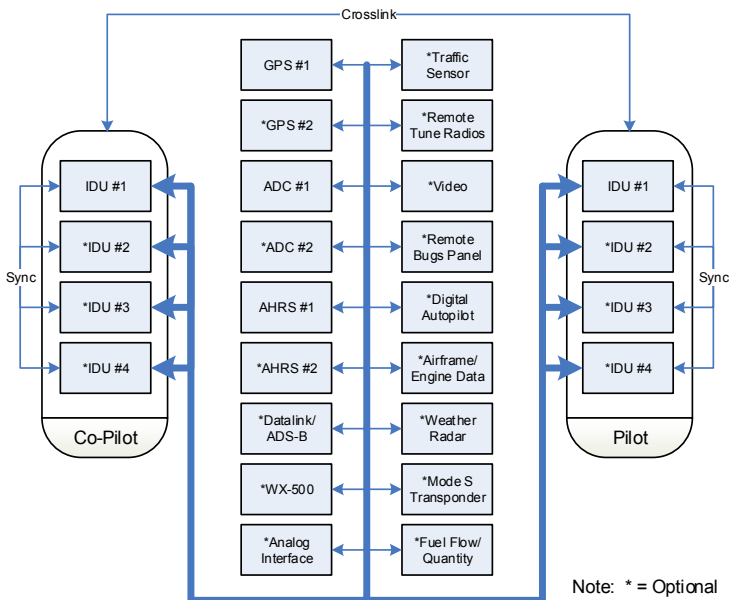


Figure 2-3: System Diagram

2.2.2. IDU Initialization

The hardware, including file system, IO, and graphics, is initialized. Immediately after graphics initialization, a logo screen with “INITIALIZING” is displayed with the Genesys Aerosystems logo, software version number, and part number. The software version number delineates: (1) major revision number (i.e., “8.0”), and (2) minor revision letter (i.e., “F”).

Table 2-1: IDU Software Version and Part Number

Version Number	Part Number
Rev 8.0F	25-EFIS80F-SW-0003

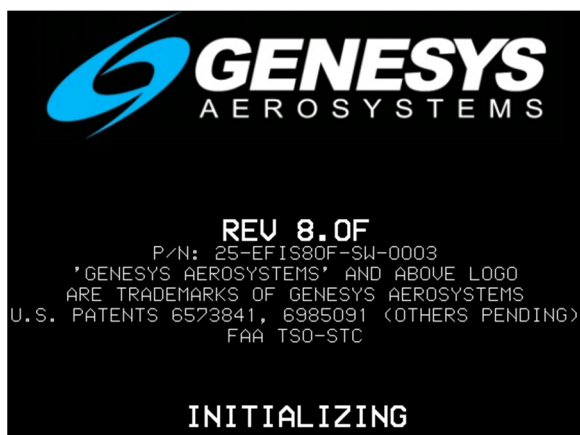


Figure 2-4: IDU-680 Initialization Screen

Aircraft configurations 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 number (Table 2-2) and system designation (pilot or co-pilot). The CPU number is identified below the part number on the initialization screen (Figure 2-4).

Table 2-2: CPU Number Designation

CPU Number/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 #0 or 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 8.0F to 8.0X), 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 are set to slaved mode and the 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 HeliSAS enabled) or turned off.
- 8) Heading mode is turned off.
- 9) HSI navigation source is set to FMS.
- 10) Horizon synchronization status is set to disabled.
- 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.
- 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) Vertical speed bug is turned off.

- 24) Crosslink is initialized to on.
- 25) If Genesys/S-TEC HeliSAS is enabled, flight directors are initialized to single-cue.
- 26) Map modes are set to allowed values.
- 27) On IDU-680 with DVI option, DVI is set to off.
- 28) On IDU-680, essential mode is set to off.
- 29) RDR-2000/2100 mode is set to off, vertical profile is set to off and scale is initialized to 80NM.

The following, if configured, are read from the flash drive storage and CRC-32 checked:

- 1) OASIS configuration
- 2) Radios
- 3) Magnetic variation coefficients database

Based upon the air/ground mode parameter value from the last system shutdown, the IDU decides whether it is booting on the ground or in flight.

If booting on the ground, the following actions happen:

- 1) A logo screen with “**TESTING**” is displayed for a number of seconds while the various hardware subsystems are initialized.

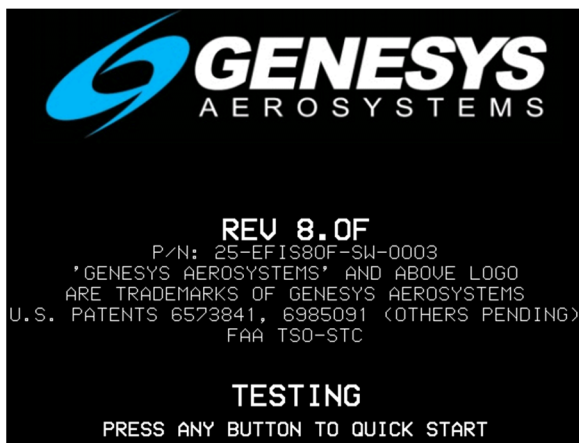


Figure 2-5: Logo Screen with “TESTING”

- 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 Flag” is enabled in EFIS limits, the application auto-sets the altimeter based upon the terrain elevation at the startup point (only applicable at surveyed airports.)
- 6) A logo screen displaying:
 - a) Software CRC-32;
 - b) Aircraft type;
 - c) OASIS configuration name and CRC-32;
 - d) Audio/Radio configuration name and CRC-32;
 - e) Sounds database name and CRC-32;
 - f) Magnetic variation coefficients version and CRC-32; and
 - g) Database versions and validity dates are displayed along with **“PRESS ANY BUTTON TO CONTINUE.”**

```

REV 8.0F
P/N: 25-EFIS80F-SW-0003
SOFTWARE OK (PILOT CPU #1)
SOFTWARE CRC = 2B81CAA1
AIRCRAFT TYPE GENERIC

SOUND CONFIG: STANDARD EFIS SOUND (0CAC54E8)
OASIS CONFIG: OASIS DEMO V1.00 (8FF8EFB9)
MAG VAR DATA: WMM-2015 (5ACF8586)
NAVIGATION DATA: COVERAGE = WORLD (CYCLE 1804)
VALID DATE 03-29-2018
EXPIRE DATE 04-26-2018
OBSTRUCTION DATA: DATE 04-26-2018
TERRAIN DATA: COVERAGE = S75W180 - N75E181
VALID DATE 05-26-2007

PRESS ANY BUTTON TO CONTINUE
  
```

Figure 2-6: CRC Screen

- 7) After a button is pressed, if all critical sensors (GPS, ADC, and AHRS) are in normal condition, the display screens are shown immediately. IDU #1 initializes to the PFD screen.
- 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 2-7: Two-Minute Countdown Screen

The display screens initialize at the earliest of:

- a) when 2 minutes have elapsed;
 - b) when the pilot presses any button to escape the startup countdown; or
 - c) when all critical sensors are in normal condition.
- 9) The display screen is shown at the earliest of:
- a) IDU #1: PFD Normal mode (PFD on top, an MFD page (last selected MFD page on this IDU) on bottom).
 - b) IDU #2 initializes to the ENGINE page on top an MFD page (last selected MFD page on this IDU) on bottom. All other IDUs initialize to MFD on top and MFD on bottom.
- 10) On IDU #1 or #2, #3, or #4 the fuel set menu is activated to remind the pilot to set the fuel totalizer quantity.

- a) IDU #1: PFD Normal Mode (PFD on top, ND on bottom).
 - b) IDU #2 or other CPUs: If OASIS is configured, CPU #2 initializes to the OASIS EICAS function. If OASIS is not configured, CPU #2 initializes to the MFD screen. All other CPUs initialize to the MFD screen.
- 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.

If booting in the air, the following actions happen:

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

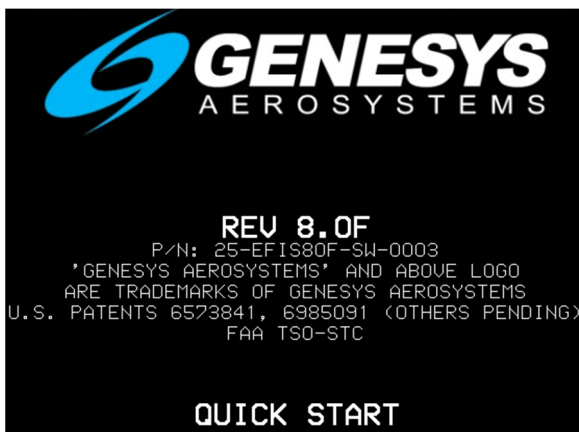


Figure 2-8: QUICK START Screen

- 2) BIT result file created during the last ground boot is checked.
 - a) **Failure** = indicates a failure, the program exits with an error message.
 - b) **Passage** = program continues.
- 3) The display screens initialize immediately.
 - a) Display screens initialize as follows:
 - i) IDU #1: PFD Normal mode (PFD on top, MFD on bottom).

- ii) Other IDUs: If OASIS is configured, IDU #2 initializes to primary EICAS on top and MFD on bottom. If OASIS is not configured, IDU #2 initializes to MFD on top and MFD on bottom. All other IDUs initialize to MFD on top and MFD on bottom.

NOTE:

After IDU initialization, if any menu is active, 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.

2.3. General Arrangement



Figure 2-9: Primary IDU-680 PFI on Top Half, ND on Bottom Half

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. 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) in bottom area are displayed (Figure 2-9).

2.3.1. 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 groundspeed
- 6) Heading
- 7) Localizer and glideslope deviations
- 8) Radar altitude

2.3.2. IDU Intra-System Communications

Communication between IDUs installed on the same system is referred to as intra-system communications. In a dual system (pilot and co-pilot) configuration, the crosslink system to system communications is referred to as inter-system communications. IDUs on a system 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 | 6) Barometric setting agreement |
| 2) Screen counter incrementing (i.e., screen not frozen) | 7) GPS position, track, and groundspeed agreement |
| 3) Airspeed agreement | 8) Heading agreement |
| 4) Altitude agreement | 9) Localizer and glideslope deviation agreement |
| 5) Attitude agreement | 10) Radar altitude agreement |

2.3.3. GPS Aiding Limitation

To prevent gyro drift in the roll attitude solution, continuous corrections to roll attitude are made based upon speed, accelerations, and rates. The preferred correction speed source is airspeed from the air data computer (ADC). However, airspeed data becomes noisy and inaccurate as the aircraft slows, and the system automatically transitions to GPS groundspeed (at approximately 55 KIAS) under these conditions.

When flying in a GPS-denied environment, be aware that flight below 55 KIAS could result in a degraded roll attitude solution. Therefore, avoid IMC conditions and crosscheck other attitude instruments when flying below 55 KIAS and transition to flight above 55 KIAS as soon as practicable.

NOTE:

Not applicable for rotorcraft with other AHRS than Genesys ADAHRS installed.

2.3.4. Normal and Essential Modes



Figure 2-10: Normal Mode

The EFIS has Normal mode and Essential mode. Normal mode for IDUs configured as #1 is a PFI page in the top area and a pilot-selectable multi-function page in the bottom area.

Normal mode for IDUs configured as #2 is a pilot-selectable EICAS page in the top area and, if the top area EICAS page is half-screen, a pilot-selectable multi-function page in the bottom area. If IDUs configured as #3 or #4 are installed, their Normal mode is pilot-selectable multi-function pages in both areas.

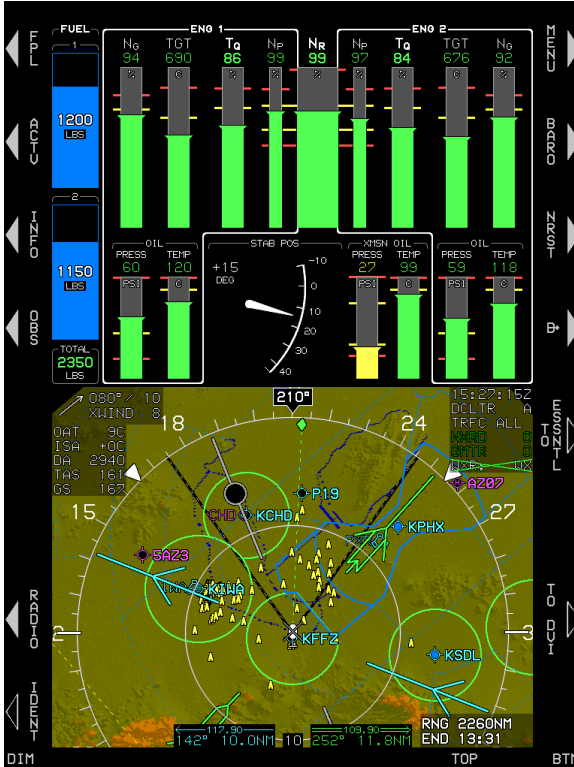


Figure 2-11: MFD with EICAS Normal Mode

Essential mode presents a PFI page in the top area and EICAS in the bottom area and is designed to provide the pilot with everything needed for continued safe operation on a single screen. Press **(R5)** to switch any screen between Normal and Essential modes; the legend changes between **TO ESSNTL** and **TO MFD** to indicate the button action. Mode change is instantaneous.

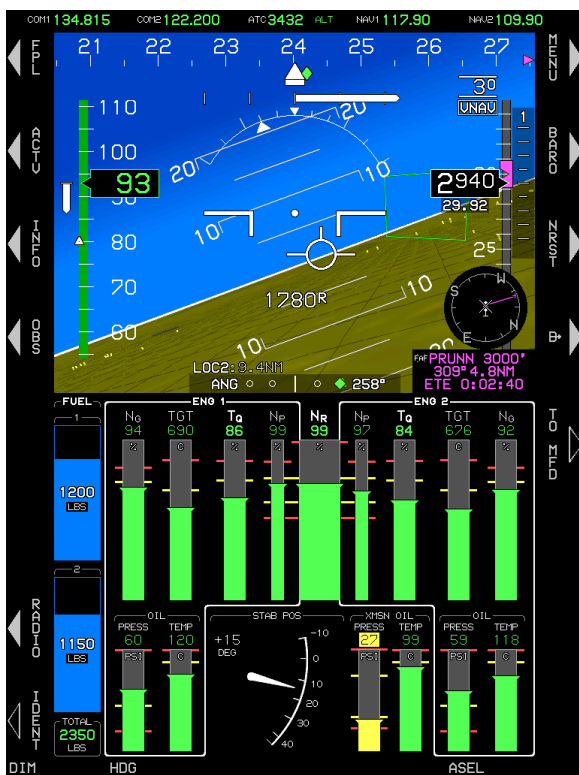


Figure 2-12: MFD with EICAS Essential Mode

2.4. EICAS Display

The software is configured on all other IDU-680s so any screen display may be shown at any time. The only limitation to this rule is since these IDU-680s are configured as a primary display of engine information; at least one of the Multi-Function display areas must show the engine display. Figure 2-13 is an IDU-680 MFD with the top display area showing the EICAS and bottom area configured to the MAP page.

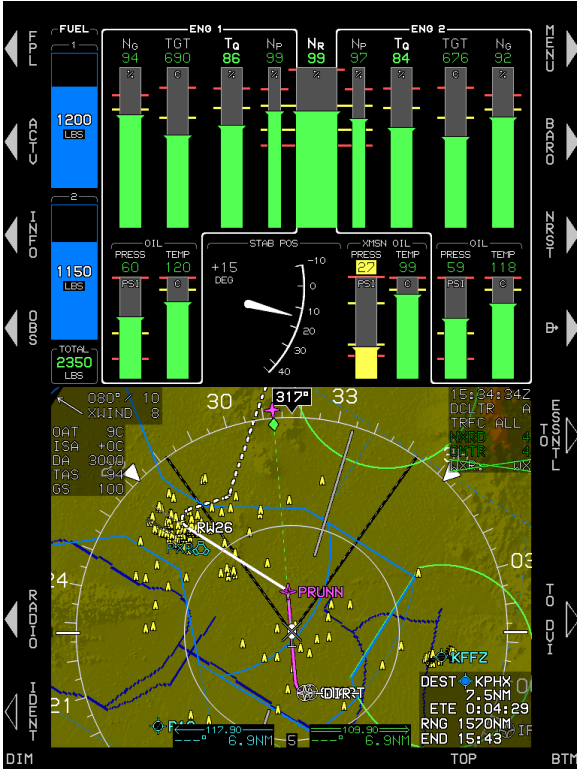


Figure 2-13: MFD Normal Mode EICAS

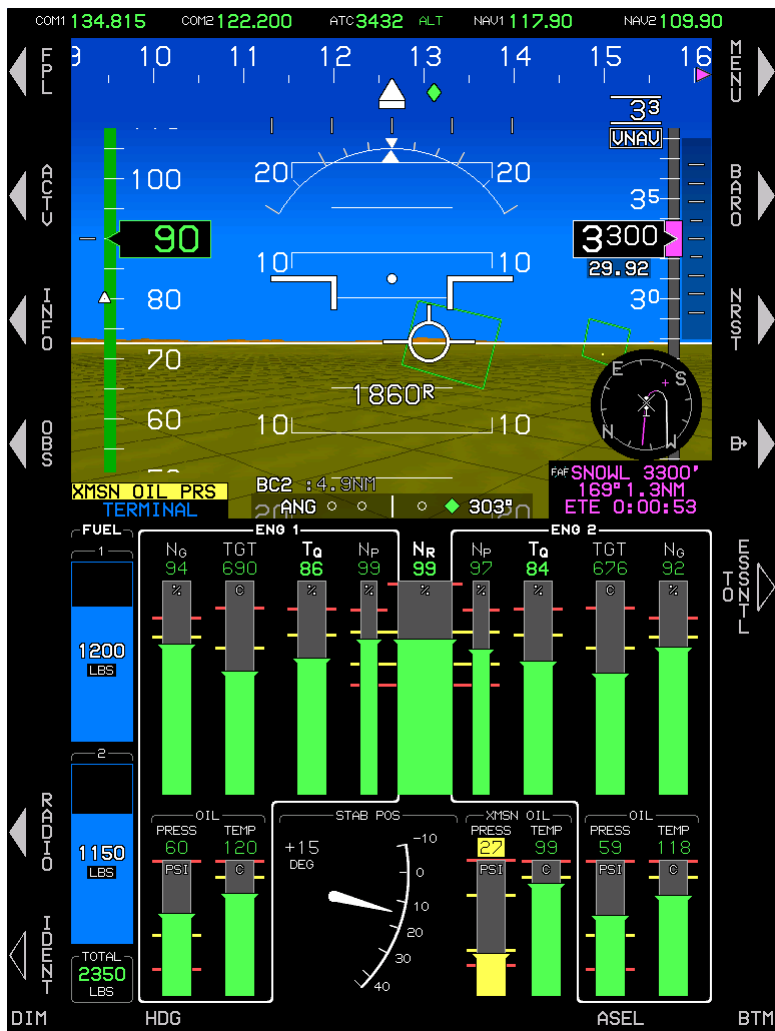


Figure 2-14: PFD with EICAS

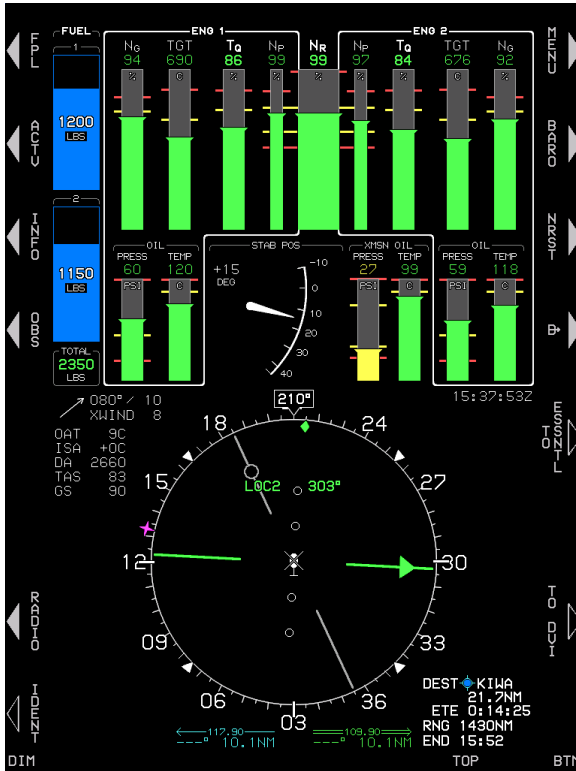


Figure 2-15: MFD with HSI and EICAS

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.

WHITE for 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. Examples:

- Scales markings (airspeed, altitude, heading, VSI, pitch, map ranges, etc.)
- Pilot-selected values (airspeed, heading, altitude)
- Secondary flight data (TAS, wind, OAT, timers, etc.)

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.



CYAN for IFR navigation dataset items (airports with instrument approach procedures, VORs, and intersections) and VOR #1.



MAGENTA (light magenta for visibility) indicates calculated or derived data and certain navigation database items. Examples:

- Active waypoint related symbols
- Course data (desired track, CDI)
- VFR airports, NDBs
- VNAV altitudes



GRAY as 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 (light green for visibility) for VOR #2 and to indicate normal or valid operation (airspeed, altitude tape coloring, status indication, etc.). Examples:

- Aircraft ground track
- Skyway symbology
- Airspeeds in green arc



DARK GREEN for terrain indication on moving map. The slope between adjacent terrain determines the shade used.



AMBER (YELLOW) identifies conditions requiring immediate pilot awareness and possible subsequent action.



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, and advisory text on black background.



RED indicates aircraft limitations or conditions, which require immediate pilot action, or a device failure (red "X").



BLACK for 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. 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) Master Visual and Aural Alerts
- 4) Caution Alerts
- 5) Advisory Alerts

All warnings, including time-critical warnings, also activate the warning (red) light and master caution light discrete outputs. Once acknowledged, the flashing behavior stops, the repeating audio alert is interrupted, and the discrete outputs are deactivated.

All cautions, including time-critical cautions, also activate the caution (yellow) light and master caution light discrete outputs. Once acknowledged, the flashing behavior stops, the audio alert is interrupted, and the discrete outputs are deactivated.

2.6.1. Time-Critical Warning and Caution Alerts

Time-critical warning and caution alerts trigger the following elements (Table 2-3) and display in the pilot's primary field of view with a shaded background (Figure 2-16 and Figure 2-17). EFIS limits have enabled the option for time-critical alerts by pressing the Master Warning or the Master Caution lights.



Figure 2-16: Time-Critical Warning Alert



Figure 2-17: Time-Critical Caution Alert

NOTE:

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

Table 2-3: Time-Critical Warning and Caution Alerts in Primary Field of View





Alert Type	Text Color	Flash Rate	Audio Alert at Full Volume
 	Red	2 Hz	Repeated until acknowledged by pressing warning/caution acknowledge switch.
 	Amber (Yellow)	1 Hz	Plays only once

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

















Visual Alert	Voice Alert “--” No Voice Alert	Condition ** No time delay
 	 “Warning Obstruction, Warning Obstruction”	Obstruction within TAWS FLTA warning envelope. Half-second time delay.
 	 “Warning, Terrain, Warning Terrain”	Terrain cell within HTAWS FLTA warning envelope. Half-second time delay.
 	 “Terrain, Terrain, Pull Up, Pull Up”	Terrain cell within TAWS FLTA warning envelope. Half-second time delay.
	 “Pull Up, Pull Up”	Within GPWS Mode 1 warning envelope. Half-second time delay.
 	 “Glideslope, Glideslope”	Within GPWS Mode 5 warning envelope. Half-second time delay.
 	 “Traffic, Traffic”	Resolution advisory. Not given if own aircraft at or below 400’ AGL. Not given if target is at or below 200’ AGL (ground target). Audio not generated with TCAS-II system. **

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










Visual Alert	Voice Alert "--" No Voice Alert	Condition ** No time delay
CHECK GEAR CHECK GEAR	 "Check Gear, Check Gear"	Activates if aircraft is below 150' AGL, is descending, and any landing gear is not down. 2-second time delay.
TERRAIN TERRAIN	 "Caution Terrain, Caution Terrain"	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.
	 "Too Low Gear, Too Low Gear"	Within GPWS Mode 4-2 "Too Low Gear" envelope. Half-second time delay.
GLIDESLOPE GLIDESLOPE	 "Glideslope, Glideslope"	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). **

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

Visual Alert	Voice Alert "--" No Voice Alert	Condition ** No time delay
	--	Annunciates the horizon synchronization function is engaged. This annunciation does not flash nor illuminate a master visual alert because it is not really a caution but instead is a pilot selection annunciation.

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

Table 2-5: Time-Critical Warning and Caution Alerts Priority

1) GPWS Mode 1 Warning
2) GPWS Mode 2 Warning
3) TAWS FLTA Warning
4) Obstruction Warning
5) TAWS FLTA Caution
6) Obstruction Caution
7) GPWS Mode 4-1
8) GPWS Mode 4-2
9) GPWS Mode 4-3
10) GPWS Mode 1 Caution
11) GPWS Mode 2 Caution
12) GPWS Mode 3
13) GPWS Mode 5 Warning
14) GPWS Mode 5 Caution
15) Check Gear
16) Traffic Warning (Resolution Advisory)
17) Traffic Caution (Traffic Advisory)
18) Horizon Synchronization Caution

2.6.2. Warning Alerts

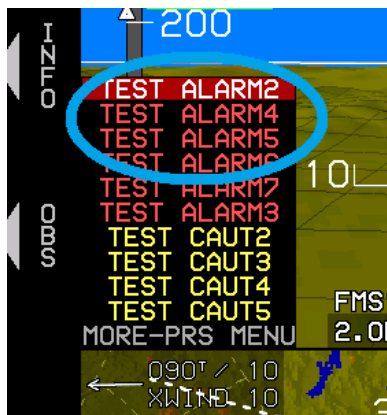


Figure 2-18: Warning Alerts

NOTE:

If an OASIS Engine page is configured, it is possible for the ENGINE page to generate these warning alerts.

Table 2-6: Warning Alert Elements



Type Alert	Location	Flash Rate	Audio Alert at Full Volume
 	PFID lower left corner of transmit enabled IDU	2 Hz	Repeated until acknowledged by pressing warning/caution acknowledge switch.

Table 2-7: Warning Alerts








Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<div style="background-color: red; color: white; padding: 2px; text-align: center; font-weight: bold;">LOW FUEL</div>	 "Fuel Low, Fuel Low"	One of the following conditions is true: <ol style="list-style-type: none"> 1) A low fuel warning discrete input is active 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.
<div style="background-color: red; color: white; padding: 2px; text-align: center; font-weight: bold;">OBSTRUCTION</div>	 "Warning Obstruction, Warning Obstruction"	Obstruction within TAWS FLTA warning envelope. (Used on CPU #0 only.) Half-second time delay.
<div style="background-color: red; color: white; padding: 2px; text-align: center; font-weight: bold;">TERRAIN</div>	 "Warning, Terrain, Warning Terrain"	Terrain cell within HTAWS FLTA warning envelope. (Used on CPU #0 only.) Half-second time delay.
<div style="background-color: red; color: white; padding: 2px; text-align: center; font-weight: bold;">PULL UP</div>	 "Pull Up, Pull Up"	Within GPWS Mode 1 warning envelope. (Used on CPU #0 only.) Half-second time delay.
<div style="background-color: red; color: white; padding: 2px; text-align: center; font-weight: bold;">PULL UP</div>	 "Terrain, Terrain, Pull Up, Pull Up"	Within GPWS Mode 2 warning envelope. (Used on CPU #0 only.) Half-second time delay.
<div style="background-color: red; color: white; padding: 2px; text-align: center; font-weight: bold;">GLIDESLOPE</div>	 "Glideslope, Glideslope"	Within GPWS Mode 5 warning envelope. (Used on CPU #0 only.) Half-second time delay.

Table 2-7: Warning Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition ** No 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. (Used on CPU #0 only)**

2.6.3. Caution Alerts

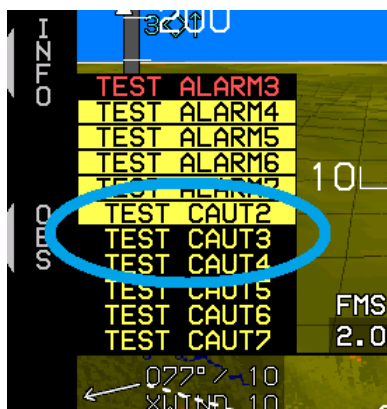


Figure 2-19: Caution Alerts

NOTE:

If an OASIS Engine page is configured, it is possible for the ENGINE page to generate these caution alerts.

Table 2-8: Caution Alert Elements



Type Alert	Location	Flash Rate	Audio Alert at Full Volume
 	PFD lower left corner of transmit enabled IDU	1 Hz	Plays only once

Table 2-9: Caution Alerts




Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<div style="background-color: yellow; border: 1px solid black; padding: 2px; margin-bottom: 2px;">ADC1 FAIL</div> <div style="background-color: yellow; border: 1px solid black; padding: 2px; margin-bottom: 2px;">ADC2 FAIL</div> <div style="background-color: yellow; border: 1px solid black; padding: 2px;">ADC1/2 FAIL</div>	 Alert Tone	Indicates no valid IAS, pressure altitude, nor VSI received from numbered ADC(s) for more than 1 second. **
<div style="background-color: yellow; border: 1px solid black; padding: 2px;">ADS-B FAIL</div>	 Alert Tone	Enabled by ADS-B out fail warning limits setting. Mode-S transponder indicates bad ADS-B out status. Also, set by audio/radio interface with NGT-9000R transponder. 2-second time delay.
<div style="background-color: yellow; border: 1px solid black; padding: 2px; margin-bottom: 2px;">AHRS1 FAIL</div> <div style="background-color: yellow; border: 1px solid black; padding: 2px; margin-bottom: 2px;">AHRS2 FAIL</div> <div style="background-color: yellow; border: 1px solid black; padding: 2px;">AHRS1/2 FAIL</div>	 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. **

Table 2-9: Caution Alerts



Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<p>AUX SENSOR</p>	<p>  “Auxiliary Sensor Failure, Auxiliary Sensor Failure” </p>	<p>No valid message or bad status received from installed optional sensors. Sensor status displayed in faults menu.</p> <p>5-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. Applies to the following optional sensors:</p> <ol style="list-style-type: none"> 1) RS-232 TAS 2) ADS-B system 3) WX-500 Lightning system 4) Analog interface system 5) Weather Radar 6) Weather Radar control panel
<p> PLT1 OVRTMP PLT2 OVRTMP PLT3 OVRTMP PLT4 OVRTMP CPLT1 OVRTMP CPLT2 OVRTMP CPLT3 OVRTMP CPLT4 OVRTMP </p>	<p>  Alert Tone </p>	<p>IDU core temperature greater than 95°C. 2-second time delay.</p>

Table 2-9: Caution Alerts


Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<p>PLT MISCOMP CPLT MISCOMP</p>	<p> Alert Tone</p>	<p>Only when fresh intra-system monitor messages are received. Indicates critical parameters used by displays on the indicated side exceed miscompare thresholds. Compares the following critical parameters:</p> <ol style="list-style-type: none"> 1) Attitude (pitch and roll) 2) Heading 3) Pressure altitude 4) Indicated airspeed 5) Localizer (both inputs) 6) Glideslope (both inputs) 7) Radar altitude 8) Latitude 9) Longitude 10) Track 11) Groundspeed <p>1-second time delay. Inhibited during and for 10 seconds after unusual attitude mode.</p>

Table 2-9: Caution Alerts




Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<p>ALT MISCOMP</p>	<p> Alert Tone</p>	<p>With neither ADC failed, indicates pressure altitude difference between ADCs is beyond limits. 10-second time delay. Inhibit for 5 minutes after startup.</p>
<p>ATT MISCOMP</p>	<p> Alert Tone</p>	<p>With neither AHRS failed, indicates pitch or roll difference between AHRS is beyond limits (6°). 10-second time delay. Inhibit for 5 minutes after startup.</p>
<p>PLT RANGE CPLT RANGE</p>	<p> "Check Range, Check Range"</p>	<p>Based upon flight plan in use on the indicated side, less than 30 minutes buffer (at current groundspeed) between calculated range and distance to:</p> <ol style="list-style-type: none"> 1) last waypoint if it is active; or 2) airport if on a missed approach; or 3) along-route distance to destination. <p>Not activated in climbing flight nor if below 60 kts groundspeed. 5-minute time delay.</p>

Table 2-9: Caution Alerts




Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<ul style="list-style-type: none"> 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 CPU #) could not be read upon power-up. Internal limits are in use by the system. Only active on the ground.
<ul style="list-style-type: none"> 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 CPU #), 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.
<ul style="list-style-type: none"> COOLING FAN 	 Alert Tone	Triggered when external cooling fan is commanded on by discrete output, but the cooling fan status discrete input indicates the cooling fan is not rotating. 1-minute time delay.

Table 2-9: Caution Alerts



Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<p>FUEL SPLIT</p>	<p> Alert Tone</p>	<p>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. Issues a caution if the difference exceeds the fuel split caution threshold. Only performed if the fuel split caution threshold is non-zero and both left and right wing tank fuel is monitored and valid. 1-minute time delay.</p>
<p>LOW FUEL</p>	<p> "Fuel Low, Fuel Low"</p>	<p>A low fuel warning is not active and one of the following conditions is true:</p> <ol style="list-style-type: none"> 1) One of the low fuel caution discrete inputs is active 2) One of the sensed fuel tank quantities is below its low fuel caution threshold 3) Total aircraft fuel is below the pilot-set minimum fuel threshold. <p>1-minute time delay.</p>

Table 2-9: Caution Alerts



Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<p>GPS MISCOMP</p>	<p> Alert Tone</p>	<p>Neither GPS/SBAS failed. Indicates position, track, or groundspeed difference between GPS/SBAS units is beyond the following limits:</p> <p>Position: Enroute Mode 4NM Terminal Mode 2NM Departure Mode .6NM IFR Approach Mode .6NM VFR Approach Mode .6NM</p> <p>Track: If groundspeed is greater than 30 kts, miscompare if difference is more than 4°.</p> <p>Groundspeed: If difference between GPS#1 and GPS#2 miscompare is more than 10 kts.</p> <p>10-second time delay. Inhibited during and for 10 seconds after unusual attitude mode.</p>
<p>GS MISCOMP</p>	<p> Alert Tone</p>	<p>Indicates at least one glideslope is receiving a signal within 1 dot of center and difference between glideslope signals is beyond limits (0.25 dots).</p> <p>10-second time delay.</p>

Table 2-9: Caution Alerts




Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
HDG MISCOMP	 Alert Tone	With neither AHRS failed nor in DG mode. Indicates heading difference between AHRS is beyond the heading miscompare threshold limit. 10-second delay. Inhibited during and for 10 seconds after unusual attitude mode. Inhibit for 5 minutes after startup.
IAS MISCOMP	 Alert Tone	Neither ADC failed. Indicates IAS difference between ADCs is beyond limits. 10-second time delay. Inhibit for 5 minutes after startup.
LOC MISCOMP	 Alert Tone	Only active when two valid localizers are received. 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.

Table 2-9: Caution Alerts





Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<p>RALT MISCOMP</p>	<p> Alert Tone</p>	<p>With neither radar altimeter in failure condition. Indicates that radar altitude difference between radar altimeters is beyond limits. 10 second time delay. Limits are as follows:</p> <p>>= 500'AGL Δ14% 100 – 500'AGL Δ10% < 100'AGL Δ10'</p>
<p>OAT FAIL OAT1 FAIL OAT2 FAIL OAT1/2 FAIL</p>	<p> Alert Tone</p>	<p>Applicable to dual ADC installation. Indicates OAT indication is invalid but other air data parameters are normal (i.e., air data not red-X'd). Half-second time delay.</p>
<p>RALT FAIL 1 RALT FAIL 2 RALT FAIL 1-2 RALT FAIL</p>	<p> Alert Tone</p>	<p>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.</p>
<p>SAME ADC</p>	<p> Alert Tone</p>	<p>With good inter-system communications, and neither ADC failed, indicates both sides are operating from same ADC source. **</p>

Table 2-9: Caution Alerts












Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
SAME AHRS	 Alert Tone	With good inter-system communications, and neither AHRS failed, indicates both sides are operating from same AHRS source. **
SAME EICAS	 Alert Tone	If EICAS configured, with good inter-system communications. Indicates both sides are operating from the same data source. **
SAME GPS	 Alert Tone	With good inter-system communications, and neither GPS/SBAS failed, indicates both sides are operating from same GPS/SBAS source. **
SAME NAV	 Alert Tone	With good inter-system communications, indicates both sides are operating from same navigation source. **
SAME RADALT	 Alert Tone	With good inter-system communications and neither radar altimeter in failure condition, indicates both sides are operating from same radar altimeter source. **
TAWS AUTOROT	 Alert Tone	TAWS autorotation mode activated through use of discrete input. **

Table 2-9: Caution Alerts

Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
<div style="background-color: yellow; padding: 2px; display: inline-block;">TCAS FAIL</div>	 Alert Tone	TAS indicates lack of communications with system or failure indication from system. **
<div style="background-color: yellow; padding: 2px; display: inline-block;">TOTALZR QTY</div>	 Alert Tone	Compares the volume of sensed fuel to the fuel totalizer calculation. Issues a caution if the difference exceeds the totalizer mismatch caution threshold. Only performed if: <ol style="list-style-type: none"> 1) Totalizer mismatch caution threshold is non-zero; 2) Fuel totalizer is enabled; 3) Unmonitored fuel flag is false; 4) Fuel totalizer has a valid value; and 5) Fuel levels are valid. 1-minute time delay.
<div style="background-color: yellow; padding: 2px; display: inline-block;">XFILL FAIL</div>	 Alert Tone	Indicates lack of inter-system communications. 2-second time delay. Inhibit for 30 seconds after startup.
<div style="background-color: yellow; padding: 2px; display: inline-block;">GPS1 FAIL</div> <div style="background-color: yellow; padding: 2px; display: inline-block;">GPS2 FAIL</div> <div style="background-color: yellow; padding: 2px; display: inline-block;">GPS1/2 FAIL</div>	 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.

2.6.4. Side-Specific Caution Alerts

Side-specific caution alerts are displayed on all IDUs on a side that detect a failure on an IDU on that side.

Visual Alert	Voice Alert/ Alert Tone	Condition ** No time delay
CHECK IDU 1 CHECK IDU 2 CHECK IDU 3 CHECK IDU 4	 Alert Tone	IDU status has not been received from another same-side IDU in the last second ± 0.1 seconds. # indicates which IDU is failing the check. **

2.6.5. Advisory Alerts



Figure 2-20: Advisory Alerts


Type Alert	Location	Appearance	Audio Alert
	PFD lower left corner*	While condition persists	A single advisory chime is played at 80% volume
* In the lower-left corner of transmit enabled IDU (PFI showing) or left corner of transmit enabled IDU bottom area (PFI not showing).			

Table 2-12: Advisory Alerts
















Visual Alert	Alert Tone	Condition ** No time delay
ADC1 INIT ADC2 INIT ADC1/2 INIT	 Chime	Indicates ADC# not at full accuracy during warm-up. **
AHRS1 DG AHRS2 DG AHRS1/2 DG	 Chime	Indicates numbered AHRS in DG mode. **
CREW CALL	 Chime	Only active with EFIS control of an audio controller and Call notice is received from the controller.
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 CPU #) is not functioning correctly. Only active on the ground. 1-minute time delay.
FPM INHBT	 Chime	Flight path marker inhibit function activated through use of momentary discrete input. **
BARO MISCOMP	 Chime	Indicates mismatch of altimeter settings or altimeter modes between systems. 10-second time delay.
TAS INHBT	 Chime	TAS aural inhibited through activation of TCAS/TAS audio inhibit input. **
TAWS GS CNX	 Chime	TAWS glideslope cancel (GPWS Mode 5) activated through use of discrete input. Enhanced HTAWS only. **
TAWS INHBT	 Chime	TAWS inhibited through discrete input. **
TAWS LOW ALT	 Chime	TAWS low altitude mode activated through use of discrete input. **
TCAS STBY	 Chime	Indicates system is either: (1) in standby; or (2) executing functional test in flight. **

Table 2-12: Advisory Alerts

Visual Alert	Alert Tone	Condition ** No time delay
TA ONLY	 Chime	Indicates TCAS-II system is unable to display resolution advisories. **
TCAS TEST	 Chime	Indicates system is in functional test on ground. **
XFILL ARM	 Chime	Only active with good inter-system communications and crossfill not inhibited. Indicates systems are not synchronized and synchronized function is available. **
XFILL INHBT	 Chime	Only with good inter-system communications, indicates crossfill is inhibited through discrete input. **

2.6.6. 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 bottom area (PFI 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 copilot systems can generate different alerts, such as when the pilot and co-pilot systems are not crossfilled and are operating on different FMS flight plans.

Table 2-13: 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 0.01 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. Valid range is from 00:00 to 59:59. Inhibited during and for 10 seconds after unusual attitude mode. **
LNAV APPR	 Chime	GPS/SBAS in LNAV approach mode. **

Table 2-13: Side-Specific Advisory Alerts












Visual Alert	Alert Tone	Condition ** No time delay
LNU/UNU APPR	 Chime	GPS/SBAS in LNAV/VNAV approach mode. **
LP APPR	 Chime	GPS/SBAS in LP approach mode. **
LPU APPR	 Chime	GPS/SBAS in LPV approach mode. **
MANUAL LEG	 Chime	Advises GPS/SBAS is in a condition where a manual termination leg is active.
SUSPEND	 Chime	Automatic waypoint sequencing is suspended under any of the following conditions: <ol style="list-style-type: none"> 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. **
TERMINAL	 Chime	GPS/SBAS in terminal mode. **
VFR APPR	 Chime	GPS/SBAS in VFR approach mode. **

Table 2-13: Side-Specific Advisory Alerts

Visual Alert	Alert Tone	Condition ** No time delay
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 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 advisory, PLT PFD and CPLT PFD TAWS caution, and FLTA INHBT advisory have priority. **
TRUE NORTH	 Chime	System operating in true north mode. **

2.6.7. Audio-Only Caution and Advisory Alerts

Table 2-14: 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.

Table 2-14: Audio-Only Caution and Advisory Alerts












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

Table 2-14: Audio-Only Caution and Advisory Alerts

Caution or Advisory Alert	Voice Alert/ Alert Tone	Condition ** No time delay
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. ** 
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. **

2.6.8. Voice Alerts and Muting

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

2.6.9. 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 aural annunciation is played at a time. In addition, to further minimize cockpit confusion, annunciations are grouped and prioritized so only one annunciation is active. Annunciations prioritized in this manner are as follows (higher in list = higher priority).

Table 2-15: Annunciations Priority	
1)	GPWS Mode 1 Warning
2)	GPWS Mode 2 Warning
3)	TAWS FLTA Warning
4)	Obstruction Warning
5)	TAWS FLTA Caution
6)	Obstruction Caution
7)	GPWS Mode 4-1
8)	GPWS Mode 4-2
9)	GPWS Mode 4-3
10)	GPWS Mode 1 Caution
11)	GPWS Mode 2 Caution
12)	GPWS Mode 3
13)	GPWS Mode 5 Warning
14)	GPWS Mode 5 Caution
15)	Check Gear
16)	Traffic Warning (Resolution Advisory)
17)	Traffic Caution (Traffic Advisory)
18)	Low Fuel Warning
19)	Low Fuel Caution
20)	Fuel Split Caution
21)	Fuel Totalizer Mismatch Caution
22)	Check Range

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

2.7. Database and Software Updates

2.7.1. Navigation and Obstruction Databases

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.

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 shown on enroute and terminal area charts.

- 4) All airways shown on enroute 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 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). Waypoints utilized as a final approach waypoint (FAWP) or missed approach waypoint (MAWP) in an LNAV approach procedure are uniquely identified as such (when appropriate) to provide proper approach mode operation.

- 7) LNAV/VNAV procedures in the area(s) where IFR operation is intended. LPV, LP, and/or LNAV/VNAV published procedures are available. Select a procedure by name to load the appropriate waypoints and legs into the active flight plan. Waypoints used as a final approach waypoint (FAWP) and LTP/FTP/MAWP in an LNAV/VNAV procedure are uniquely identified as such to provide proper approach mode operation.

The obstruction database is distributed by a government agency in each country. Not all countries have obstruction databases available.

2.7.2. Update Requirements

Scheduled updates for databases are as follows:

- 1) Navigation Database - Every 28 days
- 2) Obstruction Database - Every 28 days
- 3) MAGVAR Database - Every 5 years (updated as described in a Genesys Aerosystems Service Bulletin)

CAUTION:

Failure to update the EFIS with the correct navigation database applicable to the IDU software version causes the IDU to remain in continual reboot mode and does not allow any display page to appear.

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.

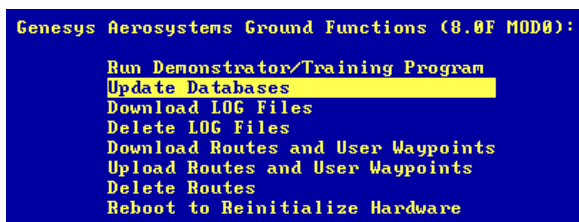


Figure 2-21: Ground Maintenance Page

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) Insert the USB flash drive into USB port with the power off.

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) Scroll **1** to **Update Databases** and push to enter.
- 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 2-4). 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 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.

2.7.3. Software and Terrain Database Update

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

2.8. Demonstrator

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 navigation database. Use this feature on the ground in ground mode as follows:

- 1) With power off, lift the USB flash drive door and insert a USB flash drive.

- 2) Power on the system. Scroll **1** to **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.

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 time-critical warning, caution, and advisory aural and flag annunciations are presented as appropriate during simulated flights.

NOTE:

When operating in Demonstrator mode, the IDU is isolated from all sensors and other IDUs. Flight plans created on an IDU are stored on that IDU alone. To make the flight plan available on all other displays, the following action must be taken.

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

2.9. 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 multi-purpose tool for training pilots and provides features to record and capture images. See installation and user guide distributed with the ETT installer for further details.

2.10. 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). Mode is determined separately from the system initialization modes. This parameter is continuously calculated as follows:

- 1) With a weight on wheels/weight on ground discrete input configured, air or ground mode is determined solely from the discrete input position.
- 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 30 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.

Section 3 Display Symbolology

3.1. Introduction

This section details the symbology used on the PFD and MFD IDU-680 in normal and essential modes. Not all combinations of possible views are represented.



Figure 3-1: PFD in Normal Mode



Figure 3-2: PFD in Essential Mode with EICAS Configured

3.1.1. IDU-680 PFD Display Basic Mode

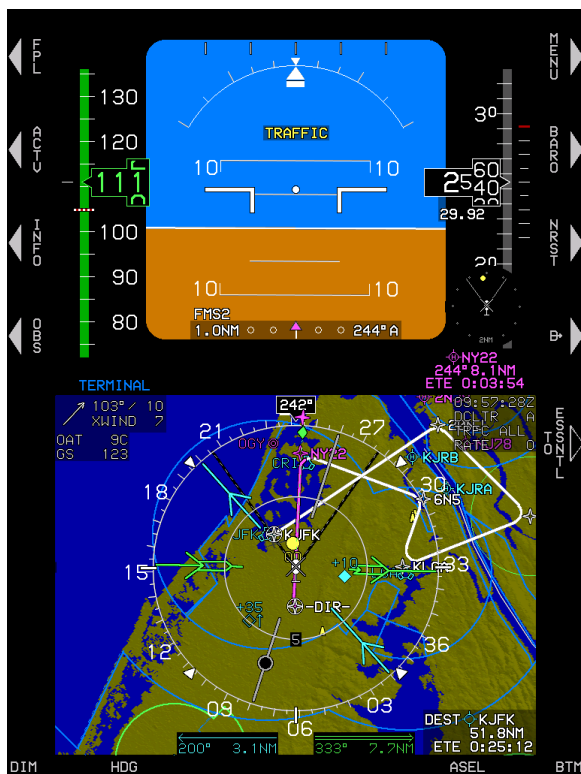


Figure 3-3: PFD in Basic Mode (with Compass Rose Detected on Bottom Area)

When selected, 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 basic mode:

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

3.1.2. IDU-680 MFD Display

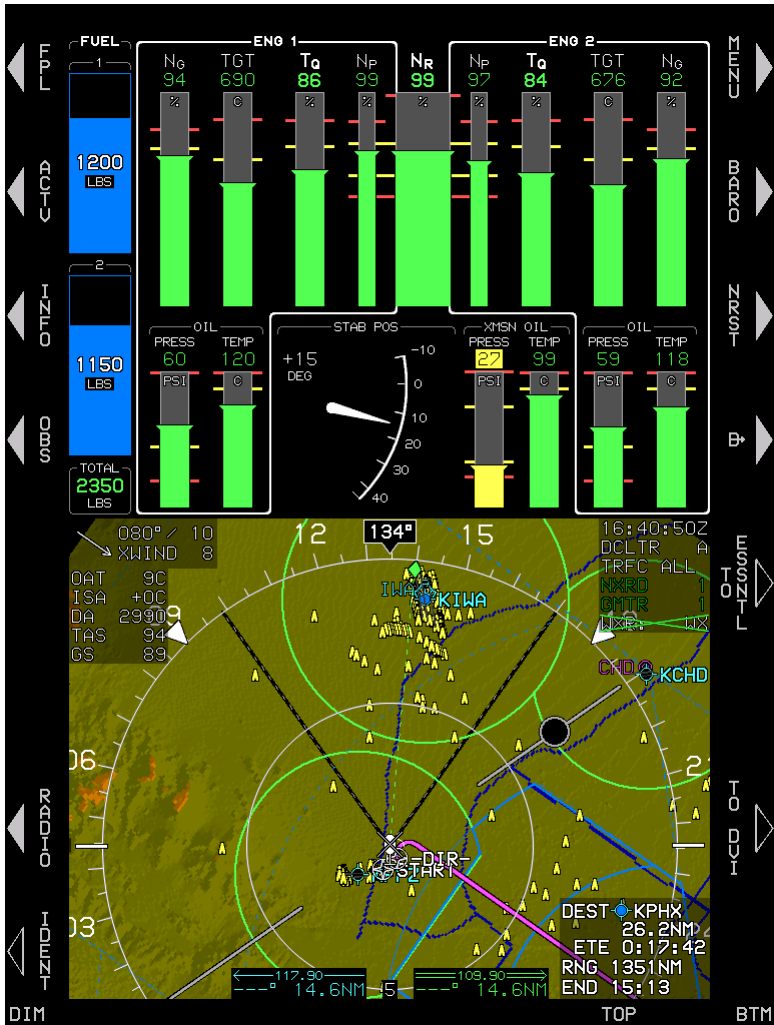


Figure 3-4: MFD in Normal Mode with EICAS Page on Top and MAP on Bottom



Figure 3-5: MFD in Essential Mode with EICAS Configured



Figure 3-6: MFD in Normal Mode

3.2. Menu Functions



Further menu levels

Without further menu levels

Soft menu function tiles appear in the margins next to IDU buttons and indicate further menu levels with a filled triangle or no further menu levels with a hollow triangle. The triangles point to the associated button.

Figure 3-7: Menu Functions

Menu messages are displayed adjacent to the encoders when appropriate for five seconds. Menu messages are cleared if any IDU button is pressed or encoders ①, ②, or ③ are pushed or scrolled.



Figure 3-8: Encoder Functions

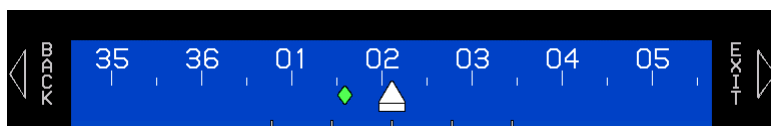


Figure 3-9: Menu Management

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.

3.2.1. Altitude Display and Altimeter Setting



Press **BARO (R2)** to enter the altimeter setting mode and view the altimeter setting in inches of mercury (inHg) or millibars (mbar) value in the lower right corner. Scroll **1** CW to increase or CCW to decrease QNH. Push **1** to enter the new value.



Synthetic Vision - QNH



Basic Mode - QNH



Synthetic Vision - QFE



Basic Mode - QFE

Figure 3-10: Altimeter Setting

Push **1** to enter the new value or press. Digital display of altitude is either purely digital (nearest 10 ft.) or incorporates rolling digits (nearest 20 ft.) as determined by EFIS limits.

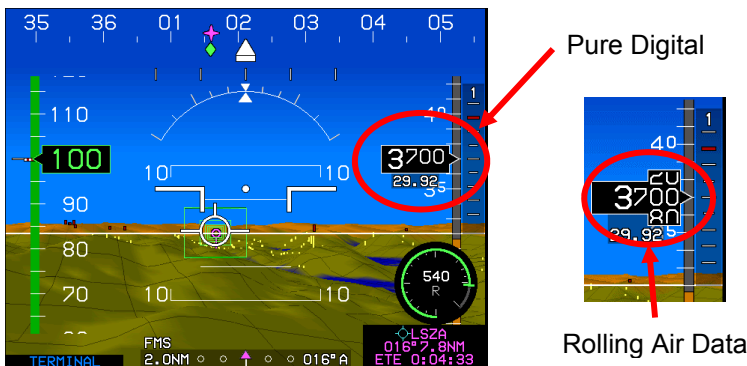


Figure 3-11: Selecting Altimeter Setting

QFE: Barometric setting resulting 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 altitude for flight above the transition altitude.

QNH: Barometric setting resulting in the altimeter displaying altitude above mean sea level at the reporting station.

3.2.2. Selected Altitude Sub-Mode (Target Altitude)

When in selected altitude sub-mode, the altitude scale has a pilot-settable target altitude bug geometrically interacting with the altitude box pointer. The target altitude bug value has a resolution of 100 ft., and a range from -1000 ft. to 20,000 ft.

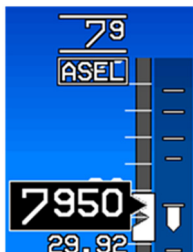


When in altitude hold mode, the target altitude bug value is green, while the target altitude bug is filled-white.

When in a climb or descent mode, the target altitude bug value is white, and the target altitude bug is hollow-white.

During altitude hold capture, the target altitude bug setting annunciation is green and flashes, while the target altitude bug is filled-white.

Figure 3-12: Target Altitude Bug (Vertically Integrated)

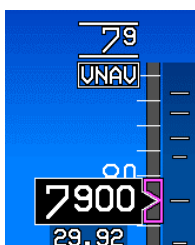


When not vertically integrated with an autopilot, the target altitude bug setting is white, and the target altitude bug is filled-white at all times.

Figure 3-13: Target Altitude Bug (Not Vertically Integrated)

3.2.3. VNAV Sub-Mode

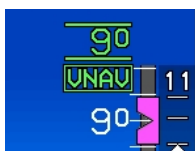
When in VNAV sub-mode, the altitude scale shows the active waypoint VNAV altitude (if it exists) with a bug symbol geometrically interacting with the altitude box pointer. The VNAV altitude bug setting is annunciated above the altitude scale with a resolution of 100 feet.



When not vertically integrated with a fully integrated digital autopilot, the VNAV altitude bug-setting includes “VNAV” indicating VNAV altitude sub-mode. When vertically integrated with a fully integrated digital autopilot, it is not needed, because an indication also appears in the autopilot mode annunciation area.

Figure 3-14: VNAV Sub-Mode (Not Vertically Integrated)

The VNAV altitude bug is a visual reference or, when vertically integrated with an autopilot either fully or partially integrated through the vertical mode discrete input, as a control parameter for climbs or descents.



When vertically integrated with an autopilot:

When in altitude hold mode, the VNAV altitude bug-setting is green, and the VNAV altitude bug is a filled-magenta. During altitude hold capture, the VNAV altitude bug-setting flashes.



When in climb or descent mode, the VNAV altitude bug value is white, and the VNAV altitude bug is hollow-magenta.

Figure 3-15: VNAV Sub-Mode (Vertically Integrated)

When the VNAV altitude or target altitude differs from aircraft altitude to the extent the associated bug is off-scale, the associated bug appears to be “parked” in the direction of the difference with half of the associated bug visible as seen in Figure 3-15.

3.2.4. Altitude Display (VNAV Tile)

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



Figure 3-16: Altitude Display (VNAV Tile)

3.2.5. Altitude Display (Metric Units)



Pilot-selectable altitude values may be presented in metric units with a resolution of ten meters.

Figure 3-17: Altitude Display (Metric Units)


3.3. PFD Symbology

The PFD combines pitot-static information, heading, attitude, 3-D 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.



Figure 3-18: PFD Symbology

3.3.1. 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 ft. The minimum altitude bug can be used in conjunction with a selected altitude or VNAV bug. When a minimum altitude is set, descending from above to below causes an audible alert of “Minimums, Minimums” and the minimum altitude to turn amber (yellow) and flash. 

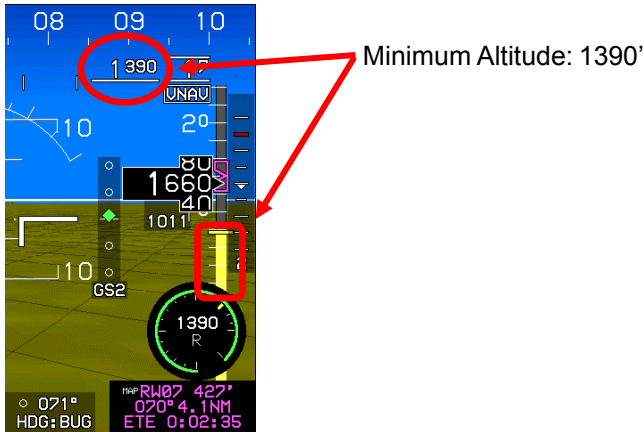


Figure 3-19: Minimum Altitude

3.3.2. Vertical Speed Indicator



The vertical speed indicator (VSI) is located to the right of the altitude box, depicted as a "worm" format, and provides an analog and digital representation of VSI in feet per minute (fpm).

Figure 3-20: VSI



The pilot-selectable VSI bug setting (100 fpm resolution) in this example is set to 1000 fpm. The vertical speed bug is used as a visual reference or, when vertically integrated with an autopilot (either fully integrated or partially integrated through use of the vertical mode discrete input), as a control parameter for climbs or descents. It is mutually exclusive with the airspeed bug.

Figure 3-21: VSI Bug

Table 3-1: Scale Graduations and Display

Traffic Installed	Scale Limit	Scale Graduations and Display
With TCAS-II	±2,000 fpm	±500, ±1,000, ±2,000 Background of the VSI functions as an RA display with green and red regions to provide RA maneuver guidance.
Without TCAS-II	±2,000 fpm	±500, ±1,000, ±2,000 fpm

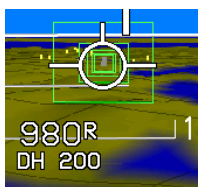


When vertically integrated with an autopilot, the VSI bug-setting is green with the speed bug filled-white when in VSI climb or descent mode. Otherwise, the VSI bug setting is white, and VSI bug is hollow-white. When not vertically integrated with an autopilot, the vertical speed bug setting is white, and the vertical speed bug is filled-white at all times.

Figure 3-22: VSI Bug (Vertically Integrated)

3.3.3. Normal AGL Indication

AGL altitude is displayed in two formats, above the course deviation indicator (normal) and as the (analog) AGL indicator. These are mutually exclusive of each other and driven by the AGL altitude source used for TAWS but not displayed when source is invalid. Source indication designates the source for either format as follows:



R = Radar altitude

G = GPS/SBAS geodetic height less database ground elevation

B = Barometric altitude less database ground elevation

Figure 3-23: Normal AGL Indication

AGL altitude is not displayed in either format when it is greater than the radar altimeter maximum valid altitude nor when it is invalid. Additionally, AGL indication includes set decision height (see § 3.3.5)

Table 3-2: AGL Indication to Avoid Jumpiness

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

3.3.4. Analog AGL Indication



Pilot-selected analog AGL indication is displayed in the lower right corner of the PFD above the active waypoint identifier with a green circular tape and digital readout in the center. The circular tape has a green radial line at its end and disappears above 1000' AGL.

Figure 3-24: Analog AGL Indication
Table 3-3: Analog AGL Indicator

Markings 0-1000 Feet		AGL	Scaling (clock position)
0-100 Feet	100 Feet-1000 Feet	0' AGL	6:00
Linear	Logarithmic	50' AGL	9:00
		100' AGL	12:00
		200' AGL	1:30
		500' AGL	3:00

Table 3-4: Analog AGL Indicator Markings

	Major Tick Marks	Minor Tick Marks
0'	✓	
10'		✓
20'		✓
30'		✓
40'		✓
50'	✓	
60'		✓
70'		✓
80'		✓
90'		✓
100'	✓	

	Major Tick Marks	Minor Tick Marks
200'		✓
300'		✓
400'		✓
500'	✓	
1000'	✓	

The analog AGL indicator disappears in unusual attitude mode and is mutually exclusive with the mini-map and traffic thumbnail. When the Analog AGL altitude display is shown, the normal AGL display is removed. Analog AGL altitude is not displayed when it is greater than the radar altitude maximum valid value (2,500 ft.), when it is invalid, nor when analog AGL is deselected by the pilot.

3.3.5. Decision Height

Pilot-settable decision height is displayed above the CDI with the abbreviation DH and by a yellow radial on the analog indicator.


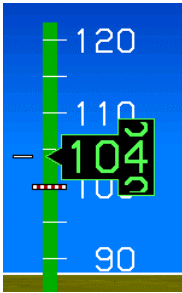
When the aircraft descends below decision height, **DH ###** turns amber (yellow) and flashes and the circular tape turns amber (yellow). This is accompanied by “Decision Height” audible alert. 



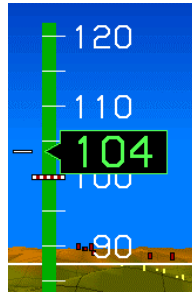
Figure 3-25: Decision Height

3.3.6. Airspeed Display

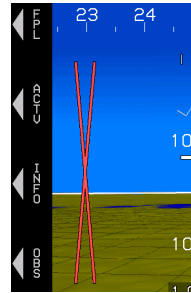
Airspeed is digitally displayed in same color as airspeed scale in knots, miles, or kilometers per hour with interactive pointer. The airspeed scale is commensurate with the certification category of the aircraft.



Rolling Digits



Pure Digital

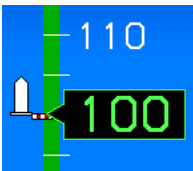


ADC Failure

Figure 3-26: Airspeed Display

The airspeed box pointer interacts with the airspeed scale and has graduations every five measurement units with labels every ten measurement units with high numbers at the top. The airspeed scale range has at least 40-75 measurement units.

The airspeed trend vector calculated along the rotorcraft longitudinal axis is in a “worm” format to provide analog representation of IAS achieved in five seconds assuming the instantaneous longitudinal acceleration is maintained.



Airspeed trend noodle indicating speed of 105 KIAS within 5 seconds.

Figure 3-27: Airspeed Trend



With Analog Autopilot



Without Autopilot

Figure 3-28: Airspeed Bug

The pilot-settable airspeed bug geometrically interacts with the airspeed box pointer and is colored as per Table 3-5. When the bug setting differs from aircraft speed to the extent the bug is off scale, the bug appears to be “parked”.

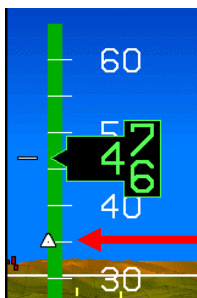
Table 3-5: Airspeed Bug Setting Annunciation and Bug Colors		
	Vertically Integrated Autopilot	
	Without	With
Airspeed Bug Setting	White at all times	Green when in airspeed climb or descent mode otherwise white.
Airspeed Bug	Filled-white at all times	Filled-white when in airspeed climb or descent mode otherwise hollow-white.

Table 3-6: Airspeed Bug Limits	
Low end	High end
V _{MIN}	Red-line (V _{NE})



The airspeed scale for Part 27 and Part 29 rotorcraft has additional specific airspeed markings as follows:

A red cross-hatched line at V_{NE} (power-off).



If enabled, a “white triangle” translational lift reference speed marker.

Figure 3-29: Airspeed Scale FAR Part 27/29

3.3.7. Airspeed Display (with EFIS-Coupled)



Airspeed descent to 4,000' with green color and filled airspeed

Figure 3-30: Airspeed Display (with EFIS-Coupled)

3.3.8. Heading Display

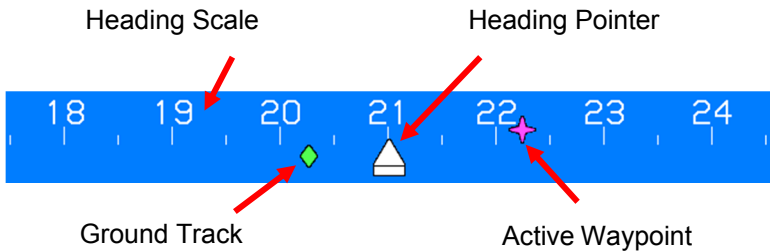


Figure 3-31: Heading Display

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

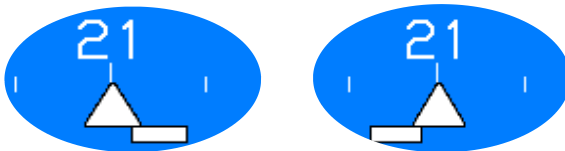


Figure 3-32: Dampened Integral Slip Indicator

NOTE:

The track pointer is not displayed whenever groundspeed is less than 30 knots.

Table 3-7: Heading Display	
	Track pointer off scale when aircraft track is displaced from boundaries.
	When changed, Heading bug value displayed for 5 seconds
	When heading bug is displaced beyond the boundaries of the heading scale,
<p>Partial heading bug is shown at the limit of the heading scale with the heading bug value above.</p>	



When AHRS is in DG mode, DG appears as shown.

Figure 3-33: DG Indicated when AHRS in DG Mode

The waypoint pointer and shortest direction of turn indications turn amber (yellow) in the event of GPS loss of navigation (LON).

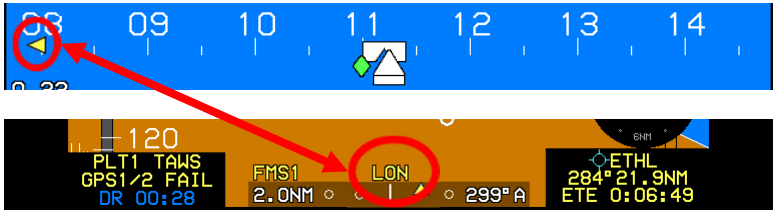


Figure 3-34: GPS Loss of Navigation

3.3.9. Pitch Scale

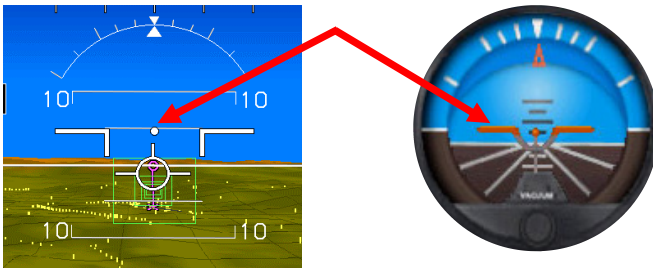


Figure 3-35: Pitch Scale

The PFD 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 waterline symbol or large aircraft symbol reference marks.

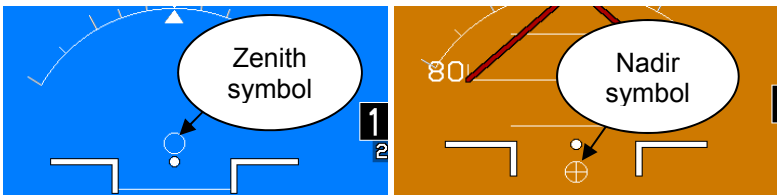


Figure 3-36: Pitch Scale Zenith and Nadir Symbol

Pitch scale has increments every 5° with major increments and pitch scale labels every 10°. Increments are equally spaced to approximately conform to the 3-D PFD background. Pointer bars at the ends of each major increment indicate direction to the horizon and automatically declutter to present the fewest possible increments needed to unambiguously 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°.

3.3.10. Turn Rate Indicator

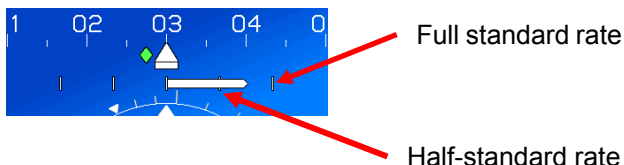


Figure 3-37: Turn Indicator (Selected from Declutter Menu)

3.3.11. Landing Gear Indication

If configured, PFD displays landing gear position as small “tires” below flight path marker (FPM) or large aircraft symbol reference marks.

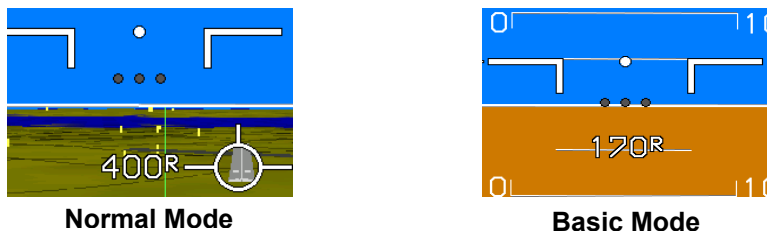
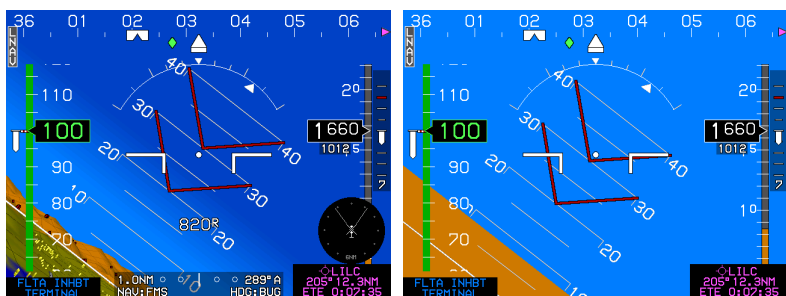


Figure 3-38: Landing Gear Indication

3.3.12. Unusual Attitude Mode



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

More than 30° pitch up and in Unusual Attitude Mode

Figure 3-39: Unusual Attitude Mode

Unusual attitude mode is enabled when pitch attitude exceeds +30° or -30° or bank angle exceeds 50° and remains engaged until pitch attitude returns to within 5° of the horizon and bank attitude returns to within 10° of the horizon. Recovery chevrons tied to the 30° and higher pitch scale indications (both positive and negative) aid in unusual attitude recovery and are a normal part of the pitch scale and are not necessarily tied to unusual attitude mode.

The following features are disabled in the unusual attitude mode:

- 1) Terrain and obstruction rendering
- 2) CDI
- 3) VDI
- 4) FPM
- 5) Highway in the Sky boxes
- 6) Atmospheric perspective
- 7) Analog and Digital AGL indication
- 8) Active waypoint symbology
- 9) Mini Map
- 10) Traffic thumbnail
- 11) If in basic mode, PFD reverts to normal mode
- 12) If in zoom mode FOV, PFD reverts to normal FOV
- 13) Runways

3.3.13. PFD Background

The PFD has a 3-D background generated from terrain elevation and obstruction elevation data stored in electronic memory. The “actual horizon” displayed on the PFD is based upon the higher of terrain within 90NM or a horizon calculated using a visible horizon equation. Thus, the relative elevation of terrain and obstructions with respect to aircraft altitude and performance is observed by reference to the primary flight information pitch ladder and FPM.

The background has two pilot-selectable field-of-view (FOV) modes, wide FOV mode (approximately 70°) and narrow FOV mode (approximately 35°). In unusual attitude mode, wide FOV mode is automatically selected.

A blended-tone sky is displayed in conjunction with terrain. The sky fades from light blue at the horizon to dark blue at the top of the display to simulate atmospheric perspective and enhance the 3-D presentation. Additionally, the blended sky increases contrast of the directional scale, emphasizes the horizon, and provides a compelling visual cue to a nose-high attitude.

Terrain and obstruction rendering uses hidden-surface-removal techniques while terrain/sky rendering uses atmospheric-perspective techniques. Terrain with obstruction rendering is collectively pilot-selectable to declutter the display (***independent declutter of obstructions is not possible***). 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 to give guidance to the horizon.



Figure 3-40: PFD Terrain and Obstructions

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 shown with a resolution as in Table 3-8. 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 it does when flying toward the Poles.

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

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°

Table 3-9: Terrain and Obstruction Rendering Levels

Feature	Coloring	Notes
SVS BASIC	Shades of brown for non-water terrain.	Amber and red not used for normal display of terrain. Deep blue denotes areas of water and takes precedence over shades of brown.
SVS TAWS	Shades of olive when at or below 100 ft. less than aircraft altitude. Shades of brown when above 100 ft. less than AIRCRAFT altitude. TAWS coloring of FLTA alert or warning cells.	Amber and red are used for normal display of terrain and to show terrain areas causing FLTA alerts. Deep blue denotes areas of water and takes precedence over other colors.
None	No terrain or Obstructions are shown. Neither, SVS BASIC or SVS TAWS are selected.	

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

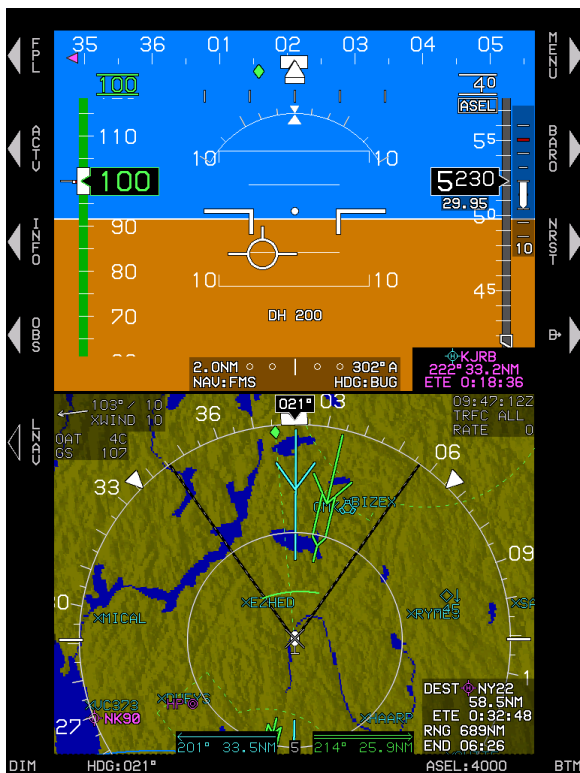


Figure 3-41: PFD with Terrain Deselected on PFD and Retained on the ND MAP

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 PFD display as vertical amber (yellow) lines. Obstructions are conformal in both location and size and are only shown in conjunction with terrain regardless of altitude. Obstructions representing a collision hazard are annunciated audibly and visually with a time-critical warning or caution alert. All vertical amber (yellow) lines in Figure 3-42 are

obstructions near the airport. See Section 2 System Overview for description of alerts when obstructions represent a collision hazard.

NOTE:

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

Towers, antennas, and obstructions representing a collision hazard cause an obstruction annunciation and audible “Caution, Obstruction” alert.

WARNING:

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

Obstructions within the following ranges are depicted on the PFD in SVS Basic or SVS TAWS modes:

- 1) Narrow FOV: 17NM
- 2) Wide FOV: 12NM



Obstructions without hazardous condition



Obstructions creating an OBSTRUCTION caution

Figure 3-42: PFD with Obstructions

NOTE:

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

3.3.14. Flight Path Marker (Velocity Vector)

The FPM appears on 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 with respect to the center of the display to account for the difference between aircraft track and heading, and is vertically displaced perpendicular to the horizon to account for aircraft climb or descent angle.

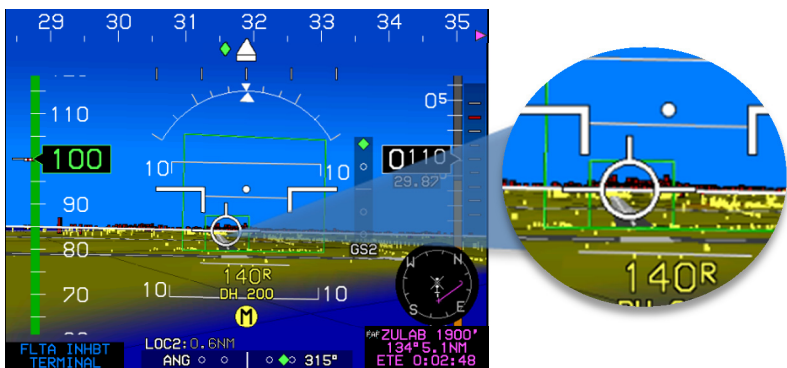
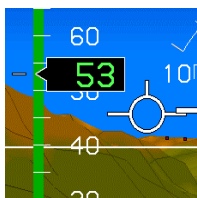
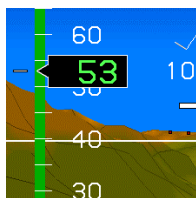


Figure 3-43: Flight Path Marker

Because the FPM is used in conjunction with a 3-D background, the FPM utility normally associated with a HUD is achieved. When the FPM is displaced to the extent it interferes with heading, altitude, or airspeed indications, it is removed from the display as in Figure 3-44.



FPM nearing airspeed tape due to strong crosswind.



FPM removed due to excessive crosswinds from the right.

Figure 3-44: Flight Path Marker Views

FPM movement is dampened by reference to aircraft pitch and heading so not to deviate from pitch or heading at a rate greater than $1^{\circ}/\text{sec}$.



Figure 3-45: Flight Path Marker Grayed to Indicate Degraded Condition with GPS Failure

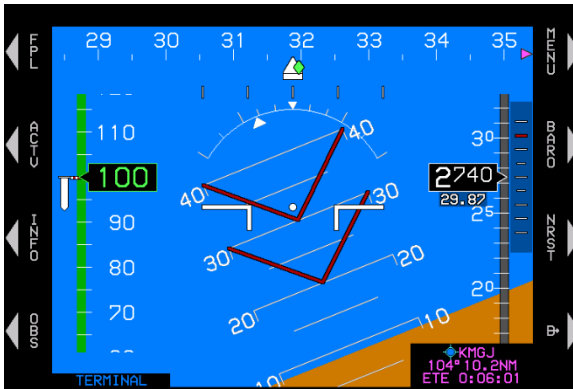


Figure 3-46: Flight Path Marker absent (Unusual Attitude Mode)

The FPM is not shown in basic mode. In unusual attitude mode, it disappears to allow the pilot to concentrate on the large aircraft symbol reference marks for unusual attitude recovery. When the location of the FPM is displaced to the extent that it would interfere with heading, altitude or airspeed indications, it is removed from the display. FPM at low speed (airspeed < 45 KIAS) and <30 knots groundspeed the Hover vector symbology appears. Behavior further depends upon whether the aircraft is in flight or on the ground.



Figure 3-47: PFD with Flight Path Marker Removed

3.3.15. Hover Vector



AGL Indicator (Normal)



AGL Indicator (Analog)

Figure 3-48: PFD Hover Vector Symbology

The hover vector indicates direction and groundspeed of drift at low groundspeeds (when lower than 30 knots) consisting of large aircraft symbol reference marks, an inner concentric ring indicating 10 knots groundspeed, an outer concentric ring indicating 20 knots groundspeed, and vertical and horizontal dashed lines passing through the center extending to the outer ring. The white dot of the large aircraft symbol reference marks indicates 0 knots groundspeed and is the center for the concentric rings. A gray dot, equal in size to the white dot and connected to the white dot by a white line, floats over the concentric ring area to indicate direction

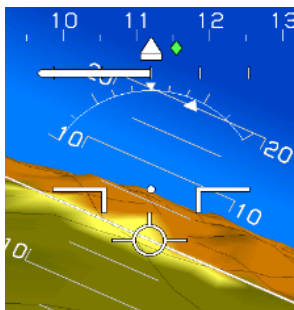
and magnitude of drift in a gods-eye view. A diamond-shaped acceleration cue is centered on the gray dot to indicate direction and magnitude of horizontal acceleration. Deviation of the dot in a straight up direction (12 o'clock position) indicates forward flight, while straight down (6 o'clock position) indicates rearward flight. Deviation of the dot laterally indicates lateral drift in that direction. The movement of the dot is constrained to less than five knots per second to prevent jumpiness. See § 3.7 for full hover vector symbology with Hover page on MFD.

NOTE:

In the event the bank scale was decluttered, it becomes uncluttered while at low speed < 30 knots groundspeed.

3.3.16. Bank Angle Scale

The bank scale and roll pointer are centered upon the large aircraft symbol reference marks in basic or unusual attitude mode. When bank angle scale decluttering is selected (not in basic mode), the bank angle scale and sky pointer are displayed when the magnitude of bank angle exceeds 2.8° . With decluttering selected, appearance of the bank angle scale and roll pointer is dampened based upon magnitude and time to prevent nuisance appearances.



When decluttering is not selected, the bank angle scale and sky pointer appear full time with level, 10° , 20° , 30° , 45° , and 60° marks on left and right sides. The bank angle scale and roll pointer are centered upon the large aircraft symbol reference marks (basic or unusual attitude mode).

Figure 3-49: PFD Bank Scale

3.3.17. Timer Indication



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

Figure 3-50: Timer

3.3.18. Marker Beacon Symbolology

Marker beacons data acquired from the navigation receiver are displayed on the PFD and disabled when the selected NAV source is FMS. Valid marker beacon signals cause circular indicators with appropriate coloring and markings to display in the lower central portion of the PFD.

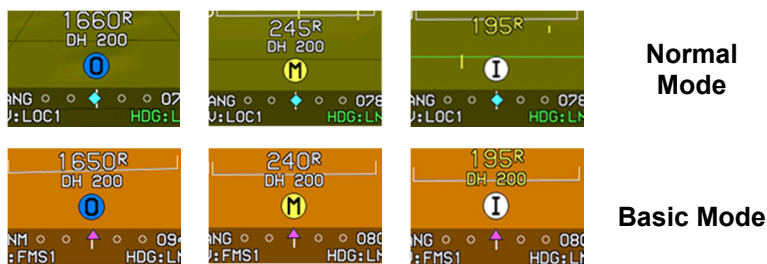


Figure 3-51: Marker Beacons

3.3.19. Flight Director Symbolology

Flight director (FD) symbolology is controlled on the IDU or integrated autopilot/flight director. When selected, FD symbolology and valid steering commands are received from the FD with one of the following symbols shown in Normal mode. The PFD has a waterline symbol 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 symbol reference marks.



Figure 3-52: Flight Director FD1 Single Cue

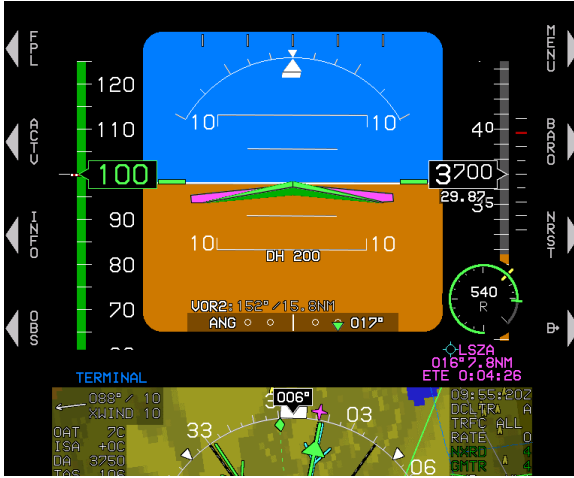


Figure 3-53: Flight Director FD1 (Basic Mode with Compass Rose Detected on ND)



Figure 3-54: Flight Director FD2 (Normal Mode)



Figure 3-55: Flight Director FD2 (Basic Mode without Compass Rose Detected on ND)

3.3.20. Course Deviation Indicator

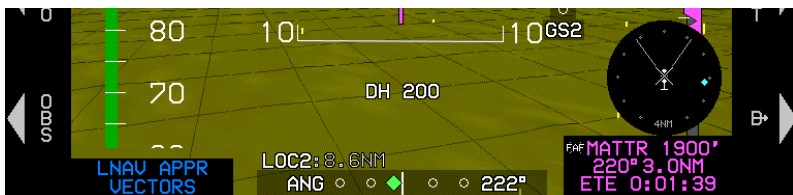


Figure 3-56: Course Deviation Indicator

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

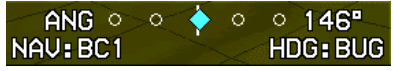









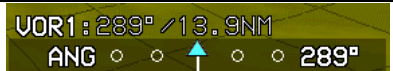

- 1) Manual RNP: The pilot may override the automatic accuracy types by setting a manual RNP value.
- 2) Automatic RNP: These are based upon RNP values, which are coded in the navigation database. The EFIS looks at the leg coding on all legs other than those on the final approach segment. On the final 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 3-10 for enroute, terminal, and various approach modes according to the “Level of Service” record.

Table 3-10: 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: Enroute: ± 2 NM From Enroute 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 Enroute: Change from ± 1 NM FSD to ± 2 NM FSD over distance of 1 NM; start transition when entering enroute 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.
Slaved to GPS/SBAS (with GPS LON)	Amber (Yellow)
Normal conditions	Magenta

Table 3-10: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
In sources other than FMS	Angular scale annunciation
With Analog Autopilot Configured	
	Reverse sensing (Course error exceeds 105°)
	Red "X" displayed over CDI
	Selected nav source FMS1
	Selected nav source VLOC1
	Selected nav source VOR1 with "TO" indication.
	Selected nav source VOR2 With "FROM" indication.
With HeliSAS-E Configured or Without Autopilot Configured	
	Reverse sensing (Course error exceeds 105°)
	Red "X" displayed over CDI
	Selected nav source FMS1
	Selected nav source VLOC1
	Selected nav source VOR1 with "TO" indication.
	Selected nav source VOR2 With "FROM" indication.

3.3.21. 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**

3.3.22. 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)

3.3.23. No Autopilot or Fully-Integrated Autopilot Course Deviation Indicator

In an installation without an autopilot or an installation with a fully integrated autopilot (i.e., HeliSAS-E), review the RFMS for operational characteristics and interface with EFIS pitch and roll steering modes, control parameters and annunciations.



Without Autopilot



With Autopilot

Figure 3-57: CDI No Autopilot or Fully-Integrated Autopilot

3.3.24. Vertical Deviation Indicator (VDI)

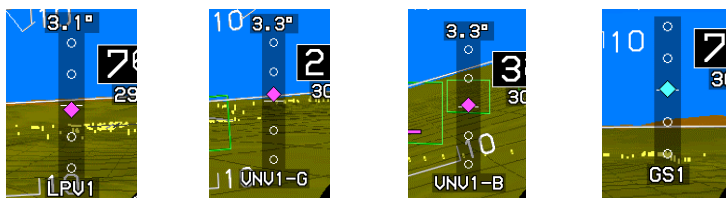


Figure 3-58: Vertical Deviation Indicator

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.

- 1) **LPV Mode and LPV1 or LPV2:** When descending on the final approach segment in LPV mode. GPS Altitude utilized to generate VDI; pilot may follow guidance to LPV minima regardless of temperature.
- 2) **LNAV Mode and VNAV1-G or VNAV2-G:** When descending on the final approach segment in LP, LNAV/VNAV, and LNAV or RNP modes when using GPS VNAV. GPS Altitude utilized to generate VDI; pilot may follow guidance to LNAV minima regardless of temperature.
- 3) **LNAV Mode and VNV1-B or VNV2-B:** Default FMS barometric VNAV mode. Using barometric altitude to generate the VDI, pilot may follow guidance to LNAV minima as long as the specified temperature is within limits.
- 4) **GS1 or GS2:** Glideslope receiver #1 or #2 as indicated. Pilot follows guidance to published barometric DH.



Figure 3-59: Vertical Deviation Indicator Color during GPS/SBAS LON or VLON

Table 3-11: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
FMS	Conforms to the VDI display	Magenta
Glideslope	Source must be valid when a valid glideslope is received.	Cyan

Table 3-11: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
LPV or VNAV mode	Source is valid if: On VNAV descent segments when approaching Top of Descent point to provide descent anticipation as long as the following are true: <ol style="list-style-type: none"> 1) On VNAV descent segments; or 2) If the vertical deviations on VNAV level segments option is enabled, on VNAV level segments; or 3) If the vertical deviations on VNAV level segments option is disabled, when approaching the Top of Descent point to provide descent anticipation; Providing: <ol style="list-style-type: none"> 1) Aircraft is within 2NM or twice the full scale deflection for the mode of flight (whichever is greater) of the lateral navigation route; and 2) Aircraft is in TO operation relative to the active VNAV waypoint (i.e., taking into account VNAV offsets); and 3) If on the final approach segment, aircraft is within a 35° lateral wedge of the azimuth reference point (either GARP or MAWPT + 10,000 ft.). 	Magenta
LPV,VNV-G	During GPS LON or GPS VLON	Pointer and Text Color Amber (Yellow)

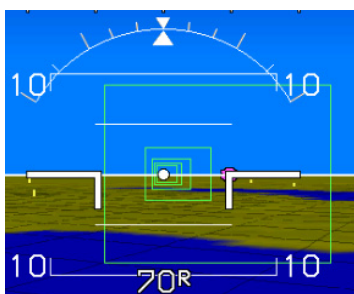
3.3.25. Vertical Deviation Indicator (EFIS Coupled)



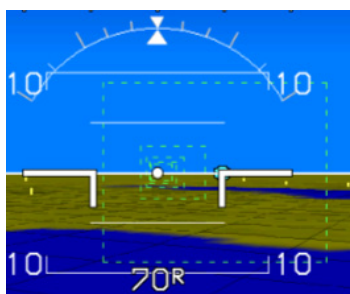
Figure 3-60: EFIS Coupled Vertically with Glideslope Mode

When vertically integrated with an autopilot (either fully integrated or partially integrated) through glideslope mode discrete input with the glideslope mode engaged, the selected vertical navigation source is green to indicate the autopilot is vertically coupled to the selected vertical navigation source. Otherwise, the selected vertical navigation source is white.

3.3.26. Highway in the Sky/Skyway



Coupled to Skyway



Uncoupled to Skyway

Figure 3-61: Highway in the Sky

When not decluttered, the PFD displays the active navigation route or manual OBS course in 3-D with a series of skyway boxes, which overly the flight plan route at a desired altitude and provide lateral and vertical guidance. See Section 7 IFR Procedures for details.

3.3.27. Active Waypoint and Waypoint Identifier



Figure 3-62: Active Waypoint

The PFD 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 at 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 enroute fixes). The active waypoint symbol is drawn using hidden-surface removal techniques of the 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 identifier of the waypoint along with the bearing and distance to the waypoint is displayed in the lower right corner of the PFD in magenta. If a target altitude is not set and the active waypoint has a VNAV altitude associated as in Figure 3-62, the identifier includes a display of the VNAV altitude.

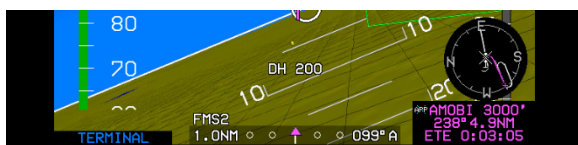
NOTE:

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

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

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

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

3.3.28. Mini Map**Figure 3-63: Mini Map****Table 3-12: Mini-Map Behavior (When Not Decluttered)**

VOR Pointer, Active Leg, Ownship Symbol	Color	Condition
VOR 1	Cyan	When valid
VOR 2	Green	When valid
Active Leg	Magenta	GPS/SBAS normal
Active Leg	Amber (Yellow)	GPS/SBAS LON condition
Ownship Symbol (Figure 3-67)	White	Always
Mutually exclusive with the Analog AGL Indicator		
Mini-Map disappears in Unusual Attitude Mode		
Mutually exclusive with Traffic Thumbnail		

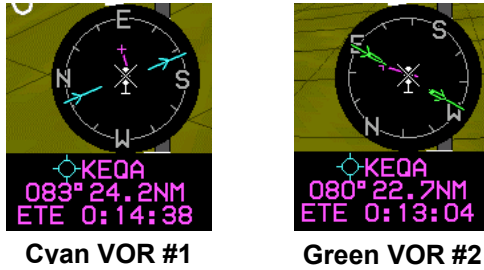


Figure 3-64: Mini Map VOR Symbology




3.3.29. Runways

The PFD displays airport runways in a 3-D manner. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, runways for the airport associated with the procedure, as well as, runways associated with the three nearest airports (computed by TAWS algorithms) are displayed. Runways are displayed with hidden-surface removal techniques of the terrain and obstruction rendering, 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 displayed as defined in Table 3-13.



Figure 3-65: Runways

Table 3-13: Runway Drawing Criteria

Feature	Color	Notes
Runway markings, aiming point markings, centerline, designation, and displaced threshold arrows	Dark gray 	According to characteristics from navigation database, e.g., including position, orientation, length, and width.
Runway markings	Medium gray 	
Landing portion of the selected runway.	Light gray 	Taking into account displaced threshold data.
Runway markings for the selected runway	Lighter gray than light gray.	

3.3.30. Heliports

Heliports appear as distinguishable 150' x 150' helipads with applicable markings.



Figure 3-66: Heliports

3.4. MFD Symbology

The navigation display is presented in a variety of formats:

- 1) Moving Map
- 2) Conventional HSI
- 3) Navigation Log
- 4) EICAS
- 5) Video (see Video Appendix)
- 6) Traffic (see Traffic Appendix)
- 7) Strikes (see WX-500 Lightning Strikes Appendix)
- 8) Datalink (see Datalink Appendix)
- 9) WX RDR (see Weather Radar Appendix)

3.4.1. Ownship Symbology

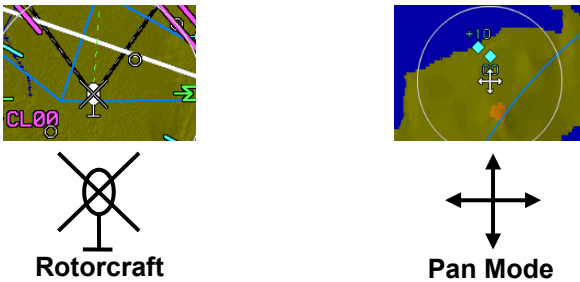


Figure 3-67: Ownship Symbology

3.4.2. Moving Map



Figure 3-68: Basic Moving Map



Figure 3-69: Moving Map with Instrument Approach

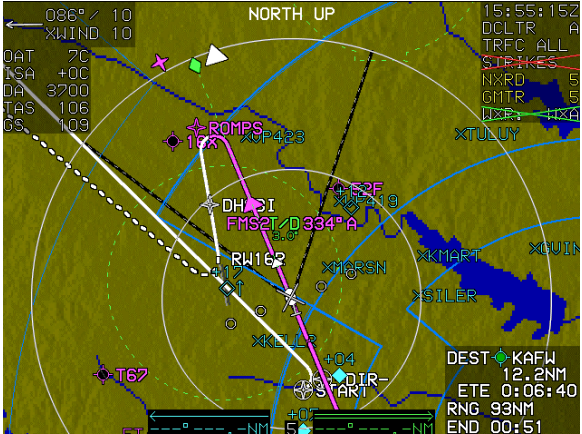


Figure 3-70: North-Up Arc Mode



Figure 3-71: North-Up Centered Mode



Figure 3-72: Heading-Up Centered Mode

3.4.3. Compass Rose/ND Boundary Circle Symbol



Figure 3-73: Compass Rose/ND Boundary Circle Symbol

In heading up mode, the magnetic digital heading readout and pointer are aligned with the longitudinal axis of the ownship symbol.

3.4.4. Clock Options

The following are displayed in the upper right corner of the ND.



Zulu Time



Local Offset Time

Figure 3-74: Clock Options

Feature	Options	Notes
Zulu Time or Local Offset	hh:mm:ssZ hh:mm:ssL	Synchronized with the GPS/SBAS constellation.
Declutter Mode	DCLTR A DCLTR M	= Automatic declutter mode = Manual declutter mode
Terrain Status	Enabled or Disabled	Terrain status is indicated by the absence or presence of terrain.

3.4.5. Air Data and Groundspeed



Figure 3-75: Air Data and Groundspeed

The following are displayed in the upper left corner of the ND:

- 1) **Wind:** Information consists of the following readouts:
 - a) Direction in degrees;
 - b) Speed in knots;
 - c) Crosswind component in knots; and
 - d) Graphical wind vector arrow oriented to correspond to the ND orientation.

NOTE:

Wind information is not shown when indicated airspeed is in the noise range of less than 20 knots, when the EFIS is in ground mode or the AHRS is in DG mode.

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

- 2) **Outside Air Temperature:** Digitally in degrees C or F (as configured).
- 3) **International Standard Atmosphere (ISA):** Difference between ISA temperature and current outside air temperature is displayed digitally in degrees C or F (negative values = less than standard OAT). Decluttered if the “Show ISA Temperature Flag” is disabled in EFIS limits.
- 4) **Density Altitude:** Digitally in feet. Decluttered if the “Show Density altitude Flag” is disabled in EFIS limits.
- 5) **True Airspeed:** Digitally in knots. Decluttered if the “True Airspeed Flag” is disabled in EFIS limits.
- 6) **Groundspeed:** Digitally in knots.



ISA Temperature disabled
Density altitude disabled
True airspeed disabled

Figure 3-76: Air Data and Groundspeed (Decluttered)

3.4.6. Fuel Totalizer/Waypoint Bearing and Distance Functions



GPS in normal state and current active waypoint



GPS in LON condition



GPS in normal state and not the current active waypoint

Figure 3-77: Fuel Totalizer/Waypoint Bearing and Distance Functions

Table 3-15: Fuel Totalizer/Waypoint Bearing and Distance Functions

Function	Conditions	Type Symbols Options
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, range and time to destination waypoint are based on the flight plan route. Otherwise, range and time are based on a direct geodetic path. Waypoint information is white but turns amber (yellow) with GPS LON caution.	ETA or ETE Degree (°) or True North (T) symbol
Range	Based on instantaneous fuel flow, fuel remaining and groundspeed are shown immediately below “DEST” waypoint information for easy comparison.	
Endurance	Based on instantaneous fuel flow and fuel remaining is shown.	

3.4.7. Navigation Data

The ND displays navigation data in correct relationship to the ownship symbol with navigation data symbols including airport symbols, NDBs, and user waypoints. High altitude and low altitude airways may be shown.



Figure 3-78: Navigation Data and Airspace Depiction

Table 3-16: Navigation Symbolology

	IFR Airport		NDB
	VFR Airport		FIX
	VORTAC		High Altitude Airway
	DME only or TACAN		Low Altitude Airway
	VOR		User Waypoint
	User Waypoint in Pan Mode		HSI CDI scale

The ND has manual and automatic decluttering of navigation data. There are six levels of automatic declutter based upon the number of navigation data symbols drawn in the current ND format and range. Decluttering is 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 enroute and terminal NDBs are shown.
- 4) **Fixes** (including User Waypoints): Manually or automatically decluttered. In automatic declutter mode, enroute fixes are shown in level 1. Terminal fixes are manually selected and not shown in automatic declutter mode. Enroute 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.

Table 3-17: Airspace Depiction

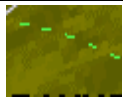
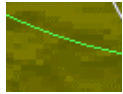
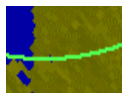

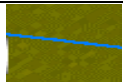
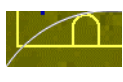

Table 3-17: Airspace Depiction		
Type of ARINC 424 Airspace		Vertical Limits
 Single pixel, dashed lines		More than $\pm 500'$
 Single pixel solid lines		Within $\pm 500'$
 Double pixel solid lines		Within airspace vertical limits
		Color of Airspace
 Class C, Control Area, TRSAs, Class D		Green

Table 3-17: Airspace Depiction

Type of ARINC 424 Airspace	Vertical Limits
 Class B, TCAs (where applicable)	Blue
 Caution Areas, Danger Areas, MOAs, Training Areas, Warning Areas, Unknown Areas	Amber (Yellow)
 Prohibited Areas, Restricted Areas, Temporary Flight Restricted Areas (when equipped with Datalink)	Red

3.4.8. Analog Navigation Symbology

When selected, the ND displays analog (VOR1 and VOR2) navigation symbology when valid. When the VOR1 and/or VOR2 pointers are selected for display, bearing and distance for the selected VOR pointers appear at the bottom of the ND view (cyan for VOR1, green for VOR2). Both VOR 1 and 2 distance readouts match the color for the respective pointer. If the DME channel is in hold mode, “H” is shown in the yellow distance readout. If a bearing or distance are not valid, the respective field is filled with dashes.



Figure 3-79: HSI Bearing Distance Readout with DME in HOLD



Figure 3-80: Analog Navigation Symbology, HSI in ARC Mode

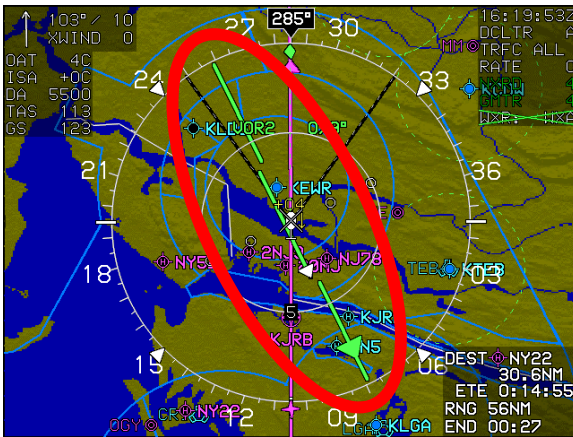
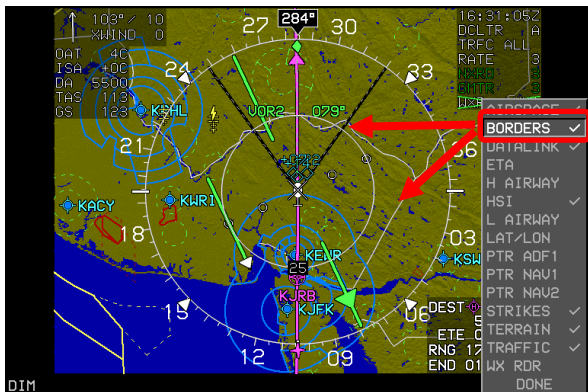


Figure 3-81: Analog Navigation Symbology, HSI in Centered Mode

3.4.9. Borders

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



State Borders Drawn



Without State Borders Drawn

Figure 3-82: Borders

3.4.10. Terrain/Obstructions

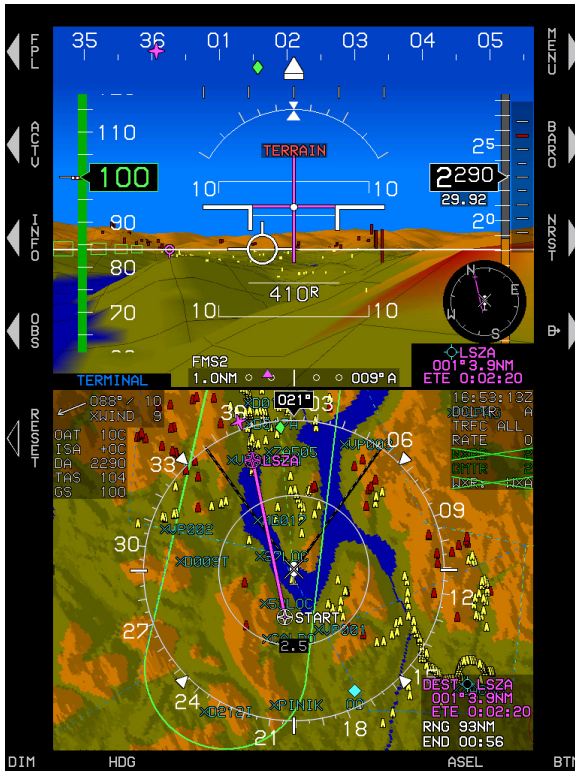


Figure 3-83: Terrain/Obstructions

Terrain is displayed on the ND in correct relationship to the ownship symbol using color to show relationship to aircraft altitude.

Table 3-18: Terrain Color

Based on Aircraft Altitude	Color	Notes
Terrain at or below 100 feet less than aircraft altitude	Olive shades	Terrain slope determines shade.
Terrain above 100 feet less than aircraft altitude	Brown shades	
FLTA alerts	Amber and Red	See Section 8 TAWS
Water at all altitudes	Deep Blue	Takes precedence over other colors.

Obstructions are displayed on the ND in correct relationship to the ownship symbol using color to show relationship to aircraft altitude.

Lateral Distance Away	21 NM or less	PFD in Narrow FOV
	15 NM or less	PFD in Wide FOV
	8.5 NM or greater	Not depicted on the ND
	8.5 NM or less	As described below
Vertical Criteria	More than 2000' below aircraft	Not depicted on the ND
	Within 2000' but more than 500' below aircraft	Depicted in amber
	Within 500' but below aircraft	Depicted in light red
	At or above aircraft altitude	Depicted in deep red



Figure 3-84: Obstructions

Terrain and obstruction rendering is pilot-selectable for the pilot to declutter the display by deselecting terrain (*independent declutter of obstructions is not possible*). Furthermore, terrain and obstruction rendering is disabled when:

- 1) The GPS/SBAS sensor is failed; OR
- 2) When the ADC is failed; OR

hiding waypoint information. When exiting the pan mode, all previous settings are restored as before pan mode was enabled.

3.4.12. Start Point

Activation of **NRST** or Direct-To functions creates and activates a flight plan from the present position to the selected waypoint. A waypoint named “START” is placed at the current aircraft location when the flight plan is created.



Figure 3-86: Start Point

3.4.13. Direct Point

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



- ALT- altitude terminations
- DIR- waypoints that begin a Direct-To leg
- DME- distance or DME terminations
- INT- intercept terminations
- RAD- radial terminations

Figure 3-87: Direct Point

3.4.14. Altitude Capture Predictor/Top of Descent

When a selected altitude or VNAV is specified on the PFD, T/D marks correct point on the flight plan path at which descent must be commenced and contains location on the flight plan path with indication of the glidepath angle used to calculate position. After passing top of descent along the lubber line, altitude is captured and

shown as a green arc located ahead of the aircraft. The arc marks the bottom-of-descent or top-of-climb point.

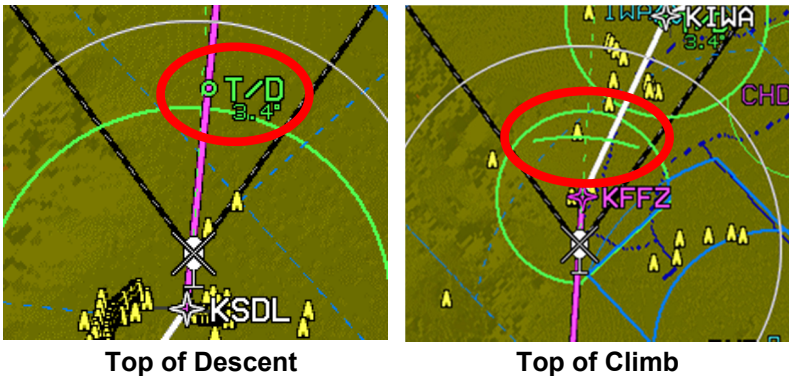


Figure 3-88: Top of Descent or Top of Climb

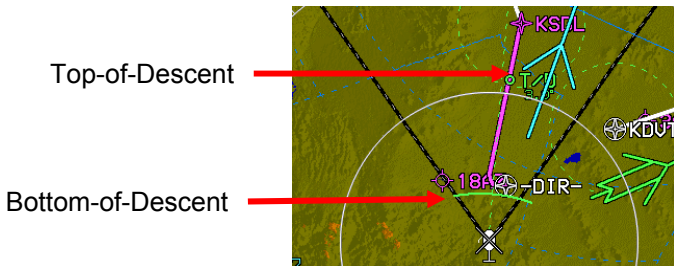


Figure 3-89: Top-of-Descent and Bottom-of-Descent

3.4.15. Projected Path

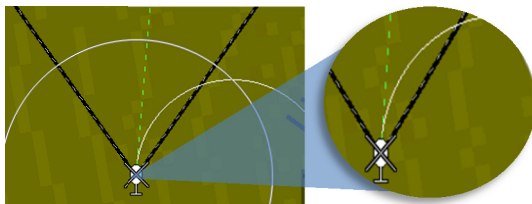


Figure 3-90: Projected Path

When the aircraft is in a bank angle, a projected path emanates from the ownship symbol. This curving path is based on aircraft bank angle and groundspeed as projected one minute into the future up

3.4.16.2. Active Flight Plan Path



Figure 3-92: Loss of Navigation

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.

3.4.16.3. Manual Course

Manual course through the waypoint shown centered on the waypoint, which matches lateral guidance on PFD (GPS/SBAS CDI) in manual mode, skyway boxes, and mini-map.

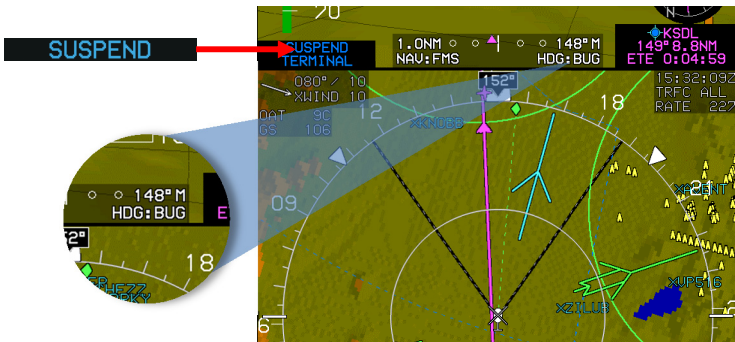


Figure 3-93: Manual Course

3.4.17. Field of View Indication



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

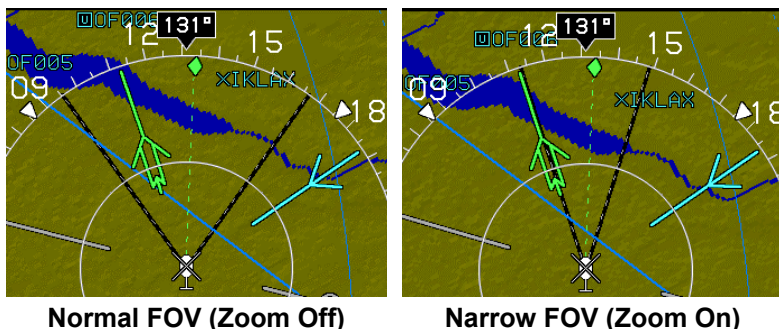


Figure 3-94: Field of View

3.4.18. Range



The white range ring is centered on the aircraft's position to quickly estimate distances. Distance (in NM) from the aircraft to the ring is a white number overlaying the 6 o'clock position of the ring. The range ring is half the distance to the directional scale. Consequently, when the range ring shows a distance of 5NM, the directional scale is 10NM. Scroll 1 or 2 to set the overall map scale ranges in NM to of the following values as appropriate:

0.5, **1**, **2.5**, **5**, **10**, **25**, **100**, and, **200**.



Figure 3-95: Range

3.5. HSI Screen

A vertical deviation indicator (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 PFD, with the exception of the VDI source displayed on the top of the VDI to avoid clutter with waypoint information below. For clarification the conformance to VDI display requirements are as specified in § 3.3.24.



Figure 3-96: HSI Screen

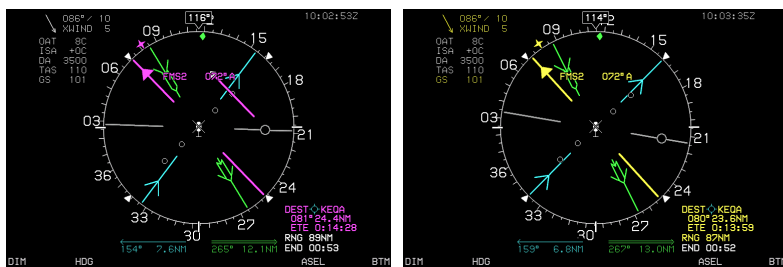
- 1) VNV1-B: Default FMS barometric VNAV mode.

- 2) VNV2-B: Default FMS barometric VNAV mode.
- 3) GS1: Glideslope #1
- 4) GS2: Glideslope #2

3.5.1. Conventional HSI/PTR Format

When selected, the ND displays conventional HSI symbology, including a selected course needle, a lateral deviation indicator, and a “TO-FROM” indicator. Navigation source indication and OBS setting are displayed in the top center of the HSI in the same color as the course needle. HSI pointer color is:

- 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) Yellow when HSI is slaved to GPS/SBAS and there is a GPS LON condition.



Normal Magenta Pointer

GPS Loss of Navigation Amber
(Yellow) Pointer

Figure 3-97: Conventional HSI/PTR Format

The ownship symbol (Figure 3-67) is centered and pointing straight up on the HSI. The HSI has a compass rose aligned with either magnetic north or true north depending upon the status of the true north discrete input. 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.

When selected, VOR1, VOR2, and ADF navigation are displayed as seen in Figure 3-97 with the magenta single line FMS2 showing a course of 072°, a cyan single line VOR1 needle showing 154° and 7.6 DME to the station, and a green double line VOR2 needle showing a bearing of 265° and 12.1 DME to the station. The ADF is tuned to an NDB with a bearing of 211° to the station. When the signal is invalid, the associated pointer is not shown. When an ADF2 is enabled, the ADF2 double needle is as shown in Figure 3-98.

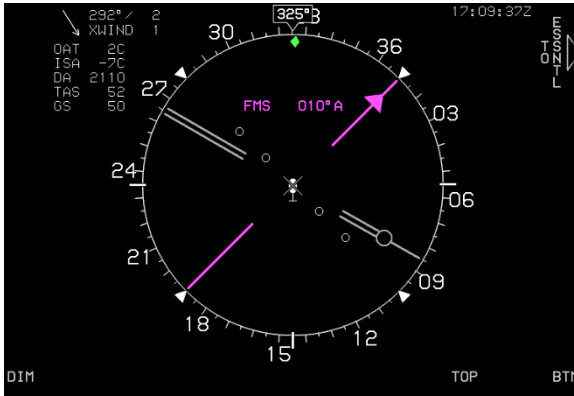


Figure 3-98: Conventional HSI with FMS and ADF2

3.5.2. HSI CDI and VDI Scale



Figure 3-99: HSI CDI and VDI Scale

3.5.3. Analog Navigation Symbolology



Figure 3-100: Analog Navigation Display VOR1 and VOR2

When selected, the HSI displays analog (VOR1 [cyan] and VOR2 [green]) navigation symbolology with an RMI pointer format overlaid upon 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 of the respective pointer.



Figure 3-101: HSI Bearing Distance Readout with DME in HOLD

If a DME channel is in hold mode, the associated distance readout is displayed in amber (yellow) rather than blue or green, and “H” is ahead of the distance readout.

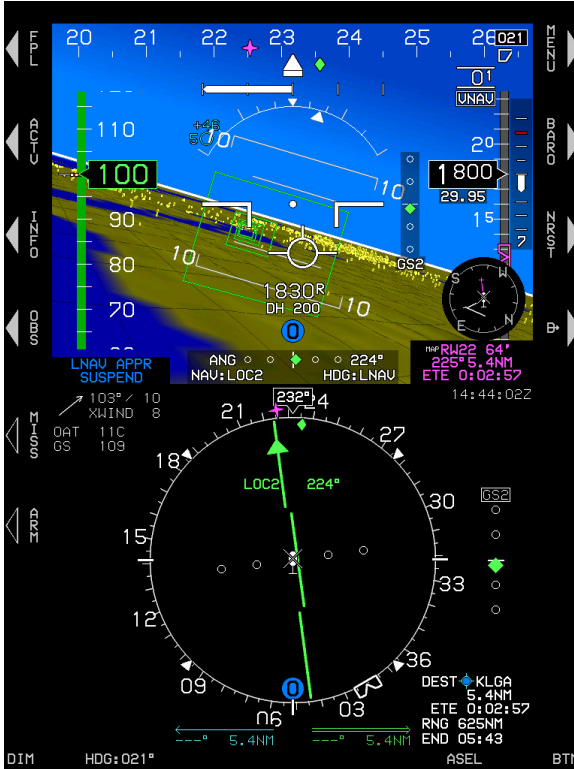


Figure 3-102: HSI with Marker Beacon Displayed

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

3.5.4. Compass Rose Symbols



Figure 3-103: 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.

If referenced to magnetic north, the heading readout uses the degree (°) symbol. Otherwise, a stylized true north (T) symbol is used. A green diamond-shaped track pointer aligned with the aircraft's track across the earth appears on the compass rose but is not displayed when groundspeed is less than 30 knots. The pilot-settable heading bug geometrically interacting with the heading pointer appears on the compass rose. A magenta, star-shaped waypoint pointer is displayed on the heading scale at a point corresponding with the active waypoint but turns amber (yellow) in the event of GPS LON caution.

NOTE:

See Section 7 IFR Procedures for description of the following heading modes with the AHRS and EFIS:

- 1) ADAHRS Slaved—EFIS Magnetic North
- 2) ADAHRS Slaved—EFIS True North
- 3) ADAHRS Free/"DG"—EFIS Magnetic North
- 4) ADAHRS Free/"DG"—EFIS True North

3.5.5. Air Data and Groundspeed



Air data and groundspeed are displayed as explained as specified in § 3.4.5.

Figure 3-104: HSI Display Air Data and Groundspeed

3.5.6. Clock/Options



A screenshot of an HSI clock display showing the time 12:50:22Z in white text on a black background.

Figure 3-105: HSI Clock

The following are displayed in the upper right corner of the HSI:

- 1) **Zulu Time or LCL Time:** As specified in § 3.4.4

- 2) **Traffic:** If configured as specified in Traffic Appendix.
- 3) **Datalink:** If configured as specified in Datalink Appendix.
- 4) **Weather Radar:** If configured Weather Radar Appendix.

3.5.7. Fuel Totalizer/Waypoint Bearing and Distance Functions



Fuel totalizer, waypoint bearing, and waypoint distance are displayed in lower right corner of the HSI as specified in § 3.4.6.

Figure 3-106: HSI Fuel Totalizer/Waypoint Bearing

3.6. Navigation Log

11:12:24Z GS 109		FUEL 110LBS FLOW 118PPH				
WAYPOINT	UNAU/OFFSET	PATH	DIST	ETE	ETA	FUEL
X	START 3700'	-DISCONT-	18.7m	0:10	11:04	125
IP	3700'	-DISCONT-	18.9m	0:10	11:04	125
-DIR-	3700'	-DISCONT-	18.9m	0:10	11:04	125
ZULAB	1900'	B- 178°	8.3m	0:04	11:09	115
WR431R	54'	B- 314°	5.4m	0:02	11:12	110
-ALT-	1000'	315° 1000'	2.3m	0:01	11:14	102
CRI	2661'	B- 235°	5.2m	0:02	11:16	101
COL	4000'	B- 225°	21.7m	0:11	11:28	78
COL	4000'	190°	6.1m	0:03	11:32	71
(KJFK)						

With Fuel Enabled

11:14:00Z GS 111		FLOW 137PPH				
WAYPOINT	UNAU/OFFSET	PATH	DIST	ETE	ETA	
X	START 3600'	-DISCONT-	18.9m	0:10	11:13	
IP	3600'	-DISCONT-	18.9m	0:10	11:13	
ZULAB	1900'	B- 314°	12.0m	0:06	11:09	
WR431R	54'	B- 314°	5.2m	0:03	11:12	
-ALT-	1000'	315° 1000'	0.0m	0:00	11:12	
CRI	3029'	B- 263°	6.4m	0:03	11:15	
COL	4000'	B- 225°	21.7m	0:11	11:27	
COL	4000'	190°	6.1m	0:03	11:30	
(KJFK)						

Without Fuel Enabled

Figure 3-107: Navigation Log

3.6.1. Clock and Groundspeed

The following are displayed in the upper left corner of the NAV Log:

- 1) **Zulu Time or LCL Time:** As specified in § 3.4.4.
- 2) **Groundspeed:** Displayed digitally in knots

3.6.2. Fuel Remaining and Fuel Flow Data

The following are displayed in the upper right corner of the NAV Log:

- 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, current total fuel flow is displayed digitally in fuel units.

3.6.3. Waypoint Identifier Column

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

When a waypoint is part of a procedure or parallel offset, the following legends are drawn on top of the navigation data symbol:

- 1) **FAF** = Waypoint is a final approach fix.
- 2) **MAP** = Waypoint is a missed approach point.
- 3) **MA** = Waypoint is part of the missed approach segment of an instrument approach procedure.
- 4) **APP** = Waypoint is part of an instrument approach procedure, but is not a final approach fix, missed approach point, nor part of the missed approach segment.
- 5) **VFR** = Waypoint is part of a VFR approach.
- 6) **STAR** = Waypoint is part of a standard terminal arrival procedure.
- 7) **DP** = Waypoint is part of a departure procedure.
- 8) **PTK** = Parallel offset. In the case of a STAR or DP waypoint subject to a parallel offset, both STAR/DP and PTK are shown.


3.6.4. VNAV and VNAV Offset Column

VNAV altitude and associated VNAV offset (in NM) are displayed immediately to the right of the Waypoint Identifier column. In the case of an approach with a final approach segment data block, VNAV offset readout associated with the missed approach point is "GPI" to designate distance to the glidepath intercept point. VNAV altitudes and offsets from the navigation database or manually entered are white; those computed automatically are gray. VNAV and VNAV offset column elements align with waypoint identifier

column elements to indicate the VNAV information applies to the associated waypoint.

3.6.5. Path Column

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

- 1) Geodetic path between waypoints is displayed with  (R4), followed by the initial geodetic course for the leg.
- 2) Discontinuities (i.e., a leg where FMS is unable to compute a valid path) are shown as **-DISCONT-**.
- 3) Procedure turns are shown with a pictorial representation of a procedure turn (either left or right turns) as well as the entry and exit course for the procedure turn.
- 4) Holding patterns are shown with a pictorial representation of a holding pattern (either left or right turns) as well as the inbound course for the holding pattern.
- 5) Arcs are shown with a pictorial representation of an arc (either left or right turns) as well as the entry and exit radials for the arc.
- 6) An altitude termination leg is shown by the initial geodetic course for the leg followed by the altitude at which the leg terminates.

Path column elements are offset from waypoint identifier column elements to indicate path information, which applies to the leg between waypoints.

3.6.6. Distance Column

Distance between waypoints is displayed immediately to the right of the path column and is calculated taking into account the associated path as well as parallel offsets. In the case of a discontinuity, distance between waypoints is the direct geodetic distance between the two waypoints. Distance column elements are offset from waypoint identifier column elements to indicate distance information applies to the leg between waypoints.

3.6.7. Estimated Time Enroute Column

ETE between waypoints is displayed immediately to the right of the distance column and is calculated taking into account the associated

distance between waypoints and current groundspeed. ETE column elements are offset from waypoint identifier column elements to indicate ETE information applies to the leg between waypoints.

3.6.8. Estimated Time of Arrival Column

ETA at the active waypoint and all subsequent waypoints are displayed immediately to the right of the ETE column. ETA at the active waypoint is calculated taking into account the associated time remaining on the active leg and current time. ETA at subsequent waypoints is calculated taking into account the cumulative ETEs and current time. ETA column elements align with waypoint identifier column elements to indicate the ETA information applies to the associated waypoint.

3.6.9. Fuel Remaining Column

Fuel remaining at the active waypoint and all subsequent waypoints is displayed immediately to the right of the ETA column. Fuel remaining at the active waypoint is calculated taking into account the associated time remaining on the active leg, current fuel flow, and current fuel quantity. Fuel remaining at subsequent waypoints is calculated taking into account the cumulative ETEs, current fuel flow, and current fuel quantity. Fuel remaining column elements are aligned with waypoint identifier column elements to indicate the fuel remaining 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 | 4) ETA data |
| 2) Distance data | 5) Fuel remaining data |
| 3) ETE data | |

3.7. Hover Screen



The hover screen has the following elements. Hover screen ownship symbology is as in Figure 3-67.

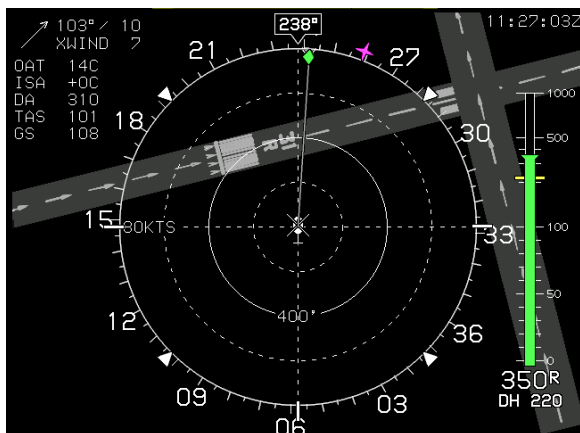


Figure 3-108: Hover Screen Orientation

3.7.1. Hover Screen Range

The following selectable hover screen ranges are available (all distances are from the ownship symbol to the compass rose): 400', 800', 1,600', 0.5NM, 1NM, 2NM, and 5NM. Two range rings (one at half the radius of the compass rose) centered upon the ownship symbol aid in judging range to displayed symbols. Range indication corresponding to the radius of the range ring is presented on the range ring (200', 400', 800', 0.25NM, 0.5NM, 1NM, and 2.5NM).

3.7.2. Hover Vector

The hover vector is used to indicate flight direction and groundspeed and re-uses the compass rose and range ring as speed scales. In addition, two intermediate speed scales (the first between the ownship symbol and the range ring, the second between the range ring and the compass rose) are drawn using dashed lines. The speed range for the hover vector indication changes based upon current groundspeed. Available speed ranges are (all speeds represent the speed indicated at the compass rose): 20 kts, 40 kts, and 80 kts with the currently selected speed range textually displayed adjacent to the compass rose. Changes in speed range employ a deadband to prevent flicker at speed range boundaries.

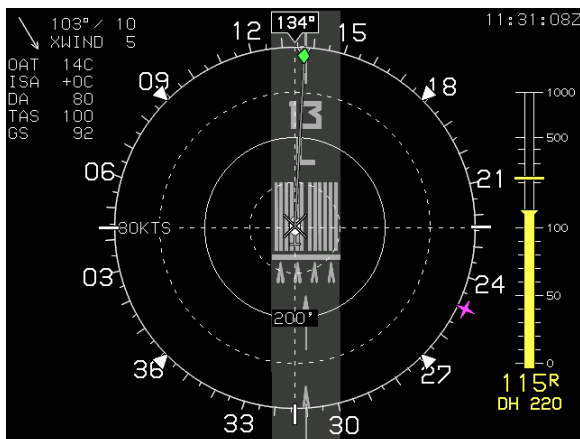


Figure 3-109: Hover Vector Symbolology

The ownship symbol indicates 0 knots groundspeed, and a dot connected to the ownship symbol by a gray line floating over the hover screen indicates flight direction and groundspeed. Deviation of the dot in a straight up direction (12 o'clock position) indicates forward flight while straight down (6 o'clock position) indicates rearward flight. Deviation of the dot laterally indicates lateral drift. Movement of the dot is constrained to less than five knots per second to prevent jumpiness. The hover vector line and dot are limited and cropped at the outer circle of the hover screen. When the AHRS is in DG mode, "DG" appears to the right of the ownship symbol.

3.7.3. Compass Rose Symbols



Figure 3-110: Hover Vector Compass Rose

A digital magnetic heading readout and pointer aligned with the longitudinal axis of the ownship symbol appear on the compass rose boundary circle. A green diamond-shaped track pointer aligned with the aircraft's track across the earth appears on the compass rose

when groundspeed is greater than or equal to 30 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the compass rose. A magenta, star-shaped waypoint pointer is displayed on the heading scale at a point corresponding with the active waypoint, which turns amber (yellow) in the event of GPS LON caution.

3.7.4. Active Flight Plan Path/Manual Course

When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path is shown on the hover screen in correct relationship to the ownship symbol. The active flight plan path meets all the requirements of GPS/SBAS path definition and matches the lateral navigation guidance given on the PFD (GPS/SBAS CDI in automatic OBS mode, skyway boxes, and mini-map). Active flight plan path waypoints are shown as fly-over or fly-by waypoints with the fly-over waypoint consisting of a waypoint symbol within a circle. The fly-by waypoint consists of a waypoint symbol without the circle.

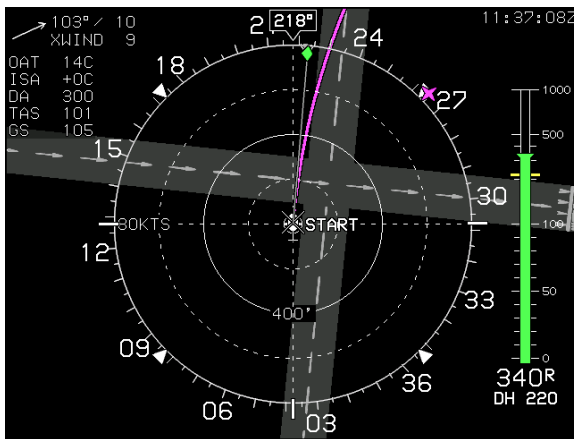


Figure 3-111: Hover Vector Active Flight Plan Path/Manual Course

When there is a parallel offset, the active flight plan path depicts the parallel offset path, and the original flight plan path is shown with haloed gray dashed lines (Figure 3-112).



Figure 3-112: Hover Vector Active Flight Plan Path/Parallel Course

When there is an active waypoint and the GPS/SBAS OBS setting is manual, 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 PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini-map).

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

3.7.5. Navigation Data

The hover screen displays navigation data symbols include (airports, VORs, NDBs, fixes, and user waypoints) in correct relationship to the ownship symbol. The user waypoint symbol includes an outlining box sized so it cannot be obscured by the ownship symbol to allow the pilot to hover by reference to a user waypoint. These symbols cannot be decluttered from the Hover Vector screen since there is no **FORMAT..** menu option.

The hover screen displays airport runways and some heliports in correct relationship and scale to the ownship symbol. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, the runways for the airport associated with the procedure are displayed, as well as runways associated with the three nearest airports. Runways are shown in dark gray according to characteristics contained in the navigation database, including position, orientation, length, and width. The landing portion of the

selected runway, taking into account displaced threshold data, is shown in light gray.

3.7.6. Projected Path

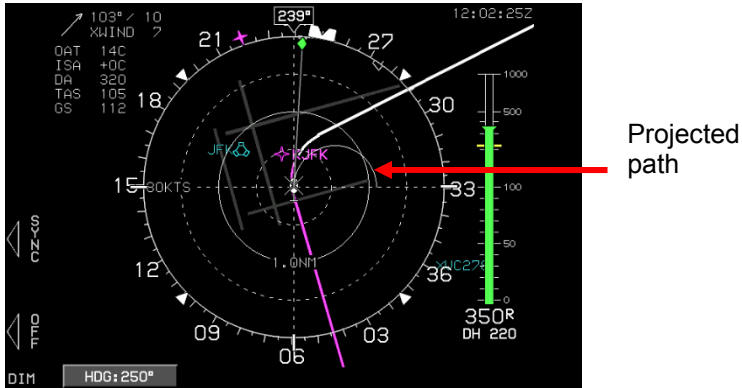


Figure 3-113: Hover Vector Projected Path

When the aircraft is in a bank angle, a projected path emanates from the ownship symbol. The projected path is based upon aircraft bank angle and groundspeed and projects one minute into the future up to a maximum of 180° of turn.

3.7.7. Air Data and Groundspeed

Displayed as specified in § 3.4.5.

3.7.8. Clock

As specified in § 3.4.4.

3.7.9. AGL Indication

AGL altitude is displayed as an analog indication and digital readout on the right side of the hover screen, which is driven by the AGL altitude source being used as follows:

R = Radar altitude

G = GPS/SBAS geodetic height less database ground elevation

B = Barometric altitude less database ground elevation

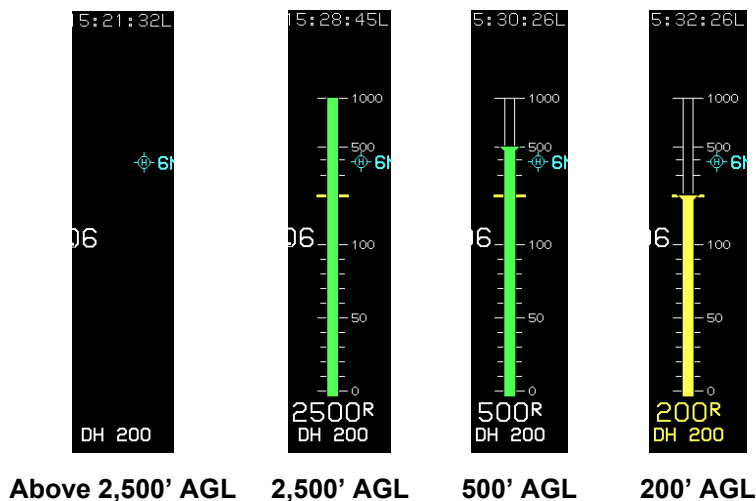


Figure 3-114: Hover Vector AGL Indication

Digital readout of AGL altitude is not displayed when it is greater than the radar altimeter maximum valid altitude nor when it is invalid. The digital readout of AGL altitude is not displayed when its source is barometric, and indicated airspeed is in the noise range (less than 20 KIAS) due to rotor wash effects. When AGL altitude source is radar altitude, the digital readout of AGL indication is smoothed to avoid jumpyiness (Table 3-2).

Table 3-20: Analog AGL Indication Designed Parameters		
Range of Altitude	Markings	Notes
0-1000'	Green-filled column	Thermometer fashioned style. The top of the column has a widened area for better registration against the scale accordingly so at AGL altitudes greater than 1,000 feet (i.e., maximum analog indication), the widened area disappears.
Scaling		
0 to 100'	Linear	0'AGL is at the bottom, 50'AGL is at 25% of height, 100'AGL is at 50% of height, 200'AGL is at 67% of height, 500'AGL is at 83% of height and 1,000'AGL is at full height
100'-1,000'	Logarithmic	

Table 3-20: Analog AGL Indication Designed Parameters

Major Tick Marks
0', 50', 100', 500', and 1,000'
Minor Tick Marks
10', 20', 30', 40', 60', 70', 80', 90', 200', 300', and 400'
Color-filled column is not displayed when AGL altitude is invalid. Analog indication of AGL altitude (including scale) is not displayed when its source is barometric and indicated airspeed is in the noise range (less than 20 KIAS) due to rotor wash effects.

3.7.10. Decision Height Indication

AGL indication includes a display of the set decision height altitude as described in § 3.3.3.

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 tables and notes to determine what feature or function is affected by one or more of the three sensors failed conditions. Examples follow with the 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: Reversionary Mode Status (PFD)

PFD Functions	Mode							
	0	1	2	3	4	5	6	7
Airspeed	OK	OK	19	OK	19	OK	19	19
Altimeter	OK	OK	19	OK	19	OK	19	19
Altimeter Set Display	OK	OK	-	OK	-	OK	-	-
Bank Scale	OK	OK	OK	-	OK	-	-	-
CDI	OK	1 + 20	OK	OK	20	20	OK	20
Runway	OK	1	25	-	-	-	-	-
Waypoint Pointer	7	1	7	7	-	-	7	-
Heading Scale	7	7	7	7	7	-	7	-
AGL Ind.	OK	2	4	OK	11	11	4	-
Flight Path Marker	OK	1 + 14	-	-	-	-	-	-
Hover Vector	OK	-	-	-	-	-	-	-
Ground Track	7	1	7	7	-	-	7	-
Heading Indicator	7	7	7	-	7	-	-	-
Horizon	OK	OK	OK	-	OK	-	-	-
Mini-Map	7	1	7	7	-	-	7	-
Pitch Scale	OK	OK	OK	-	OK	-	-	-
Highway in the Sky	OK	1 + 15	-	-	-	-	-	-
Terrain/Obstructions	OK	-	25	-	-	-	-	-
Clock Functions	OK	OK	OK	OK	OK	OK	OK	OK
VSI	OK	OK	-	OK	-	OK	-	-
Waterline Symbol	22	22	5	13	5	13	13	13
Waypoint Symbol	OK	1	-	-	-	-	-	-
Waypoint Brg./Dist.	OK	1	OK	OK	-	-	OK	-
Traffic	OK	OK	OK	-	-	-	-	-
Traffic Thumbnail	OK	OK	OK	OK	OK	OK	OK	OK
Speed Trend	OK	OK	-	-	-	-	-	-

Table 4-2: Reversionary Mode Status (ND)

ND Functions	Mode							
	0	1	2	3	4	5	6	7
Aircraft Position	OK	1	OK	OK	-	-	OK	-
Special Use Airspace	9	1	6	9	-	-	6 + 9	-
Waypoint Pointer	9	1	9	9	-	-	9	-
Active Flight Plan Path	9	1	9	9	-	-	9	-
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	-	-

Table 4-3: Reversionary Mode status (Output Functions)

Output Functions	Mode							
	0	1	2	3	4	5	6	7
Air/Ground Output	16	16	17	16	17	16	17	17
Autopilot EFIS Valid	16	16	16	-	-	-	-	-
TAWS Alarm Output	16	16	16	16	16	16	16	16
TCAS-II RA Display Valid	16	16	-	16	-	16	-	-
TCAS-II TA Display Valid	16	16	16	16	16	16	16	16
Transmit Enabled	16	16	16	16	16	16	16	16
Warning Light Output	16	16	16	16	16	16	16	16
Caution Light Output	16	16	16	16	16	16	16	16
Mstr. Caut. Light Output	16	16	16	16	16	16	16	16
MDA/DH Output	16	16	18	16	18	16	18	18
Altitude Capture Output	16	16	-	16	-	16	-	-
IAS Switch Output	16	16	-	16	-	16	-	-

- Note 1: Presented using inertial dead-reckoning based on last known wind information. If unable to dead-reckon (e.g., heading is failed or true airspeed cannot be calculated) then function is disabled.
- Note 2: Only radar altitude presented when available.
- Note 3: Last known wind is saved during GPS/SBAS failure.
- Note 4: Either radar altitude or geodetic altitude less database elevation.
- Note 5: Waterline symbol expanded to large attitude bars. Rotorcraft versions (Part 27 or Part 29 airspeed scale), use full-time large attitude bars and do not show the waterline symbol.
- 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 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: See IDU SCC Card and Limits Requirements for activation requirements.
- Note 17: Defaults to AIR unless Weight on Wheel/Weight on Ground discrete input 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: Rotorcraft versions (Part 27 or Part 29 airspeed scale) use full-time large attitude bars and do not show the waterline symbol.
- 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, then 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

OAT FAIL	In addition, the equipment has an OAT sensor failure mode. With the OAT sensor failed, the display of wind, OAT, density altitude, and true airspeed on the ND is disabled.
OAT1 FAIL	
OAT2 FAIL	
OAT1/2 FAIL	

Figure 4-1: OAT Sensor Fail

4.1.2. Heading Failure Mode

In addition, the equipment 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.



In this failure mode, the PFD heading scale includes “GPS TRK” around the track marker to clearly delineate the failure mode.

Figure 4-2: GPS TRK

4.1.3. PFD Screen 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 must have the ability to sense when the PFD has failed and take over the PFD function automatically. The manner in which this occurs is as follows:

When an MFD (IDU #2, 3, or 4) becomes the transmit-enabled IDU, the MFD automatically switches to Essential mode showing a PFI screen in the top area. In addition, if an EICAS is defined, Essential mode shows the EICAS screen in the bottom area. If an EICAS is not defined, the bottom area of Essential mode is free to show any MFD screen as defined. To change the MFD back to Normal mode after the automatic switch, press **TO MFD/TO ESSNTL (R5)**.

4.1.4. EICAS Screen Single-Action Reversion



When configured with an EICAS, it is a design goal for the pilot to select the display of EICAS on an alternate IDU with a single pilot action. This mitigates the hazards associated with losing the primary display of EICAS. The manner in which this occurs on the IDU-680 is as follows.

To mitigate the hazards associated with losing the primary display of EICAS, the pilot may select EICAS on an alternate IDU with a single action. Press **TO NORMAL/TO ESSNTL (R5)** on the PFD or **TO MFD/TO ESSNTL (R5)** on the MFD to alternate between Normal and Essential modes. Essential mode consists of a PFI in the top area and ENGINE in the bottom area. Thus, access to an OASIS EICAS display on any IDU only requires a single pilot action.

4.1.5. 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: LOI Caution

Further GPS degradation causes the EFIS to lose GPS updating of aircraft position, ground speed, and ground track, and the ability to calculate the wind information.

- 1) **LOI** (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:

The image shows a portion of an EFIS display. The top line displays '2. ONM' on the left and '347° A' on the right, with several small circles between them. The bottom line displays 'NAV: FMS1' on the left, 'LON' in the center, and 'HDG: BUG' on the right.

- 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: Genesys Aerosystems 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 would 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 page to see the system-reported accuracy.

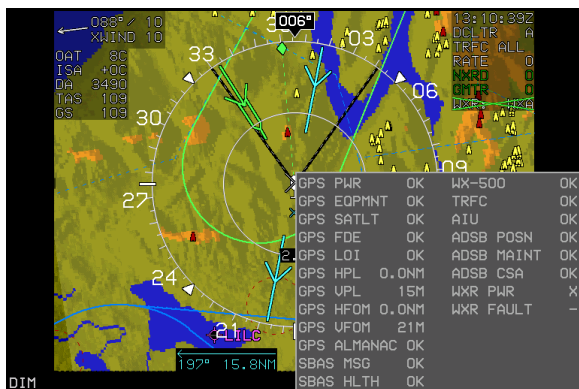


Figure 4-4: FAULTS Page on PFD or MFD

- 4) DR (Dead Reckoning)
 - a) If a GPS position cannot be calculated, a dead reckoning solution is provided with a timer, **DR 01:23**. This solution is calculated from heading and TAS derived from the AHRS and ADC.
- 5) Loss of Vertical Navigation



Figure 4-5: Loss of Vertical Navigation (VLON)

In the event the navigation equipment is no longer adequate to conduct or continue the LNAV/VNAV approach, “VLON” appears within one second (as shown) 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 0.3 NM 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.

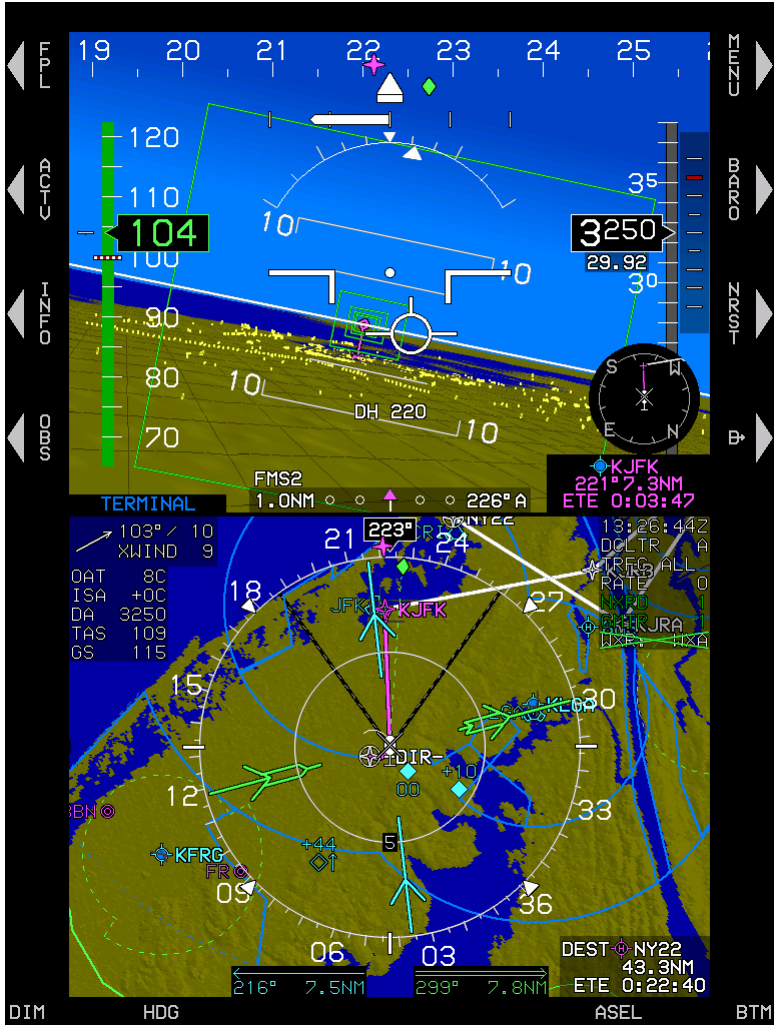
4.1.6. PFD EICAS Automatic Reversion

If CPU#2 (MFD) is not in Essential mode, automatic reversion of the PFD to Essential mode happens when CPU#2 (MFD) is switched from showing an OASIS EICAS to not showing an OASIS EICAS. Both top and bottom areas are considered.

4.2. PFD and MFD Failure Mode Examples

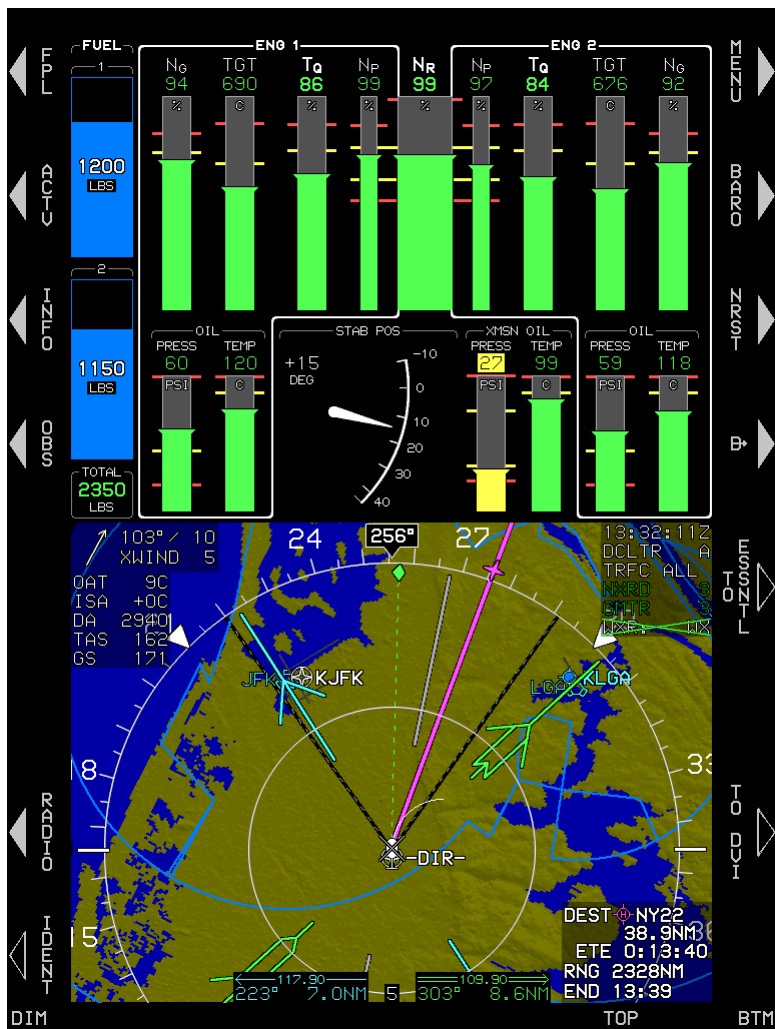
GPS failure results in the EFIS operating in dead reckoning mode. The EFIS continues to provide navigational position, groundspeed, and ground track information, based upon the last known wind, current air data, and heading. The IDU-680 PFD and MFD are affected as follows.

4.3. PFD Failure Mode 0 (Normal Mode)



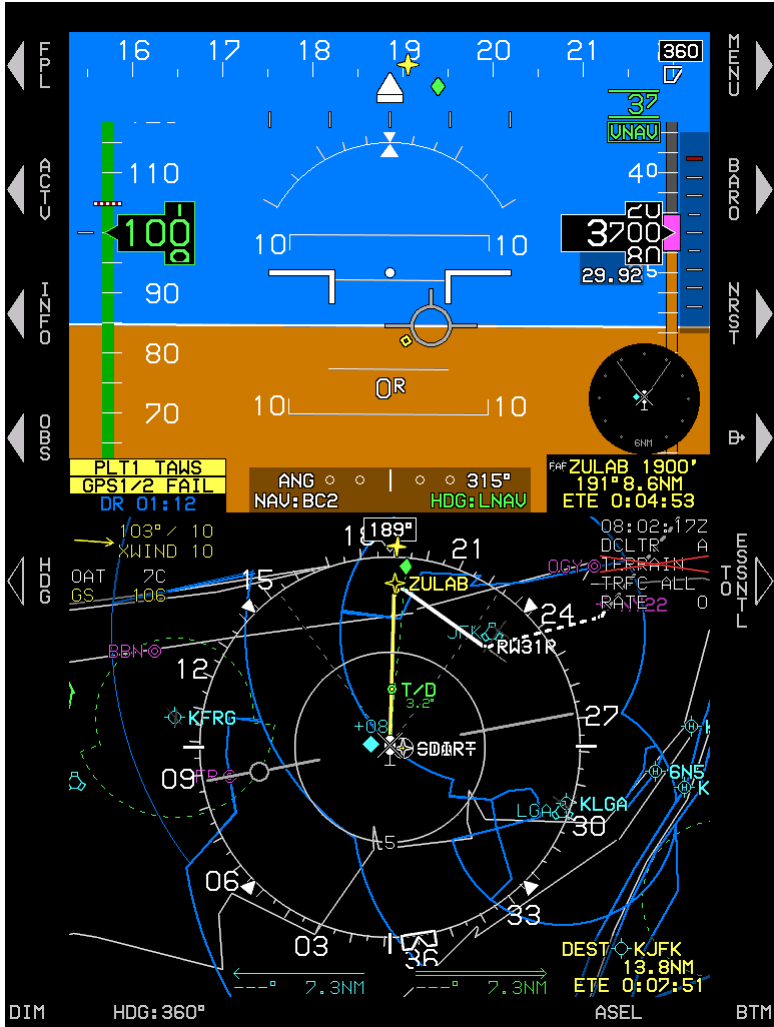
**Figure 4-6: PFD Failure Mode 0 (Normal Mode)
GPS, ADC and AHRS Normal**

4.3.1. MFD Failure Mode 0 (Normal Mode)



**Figure 4-7: MFD Failure Mode 0 (Normal Mode)
GPS, ADC and AHRS Normal**

4.4. PFD Failure Mode 1 (Normal Mode)



**Figure 4-8: PFD Failure Mode 1 (Normal Mode)
GPS/SBAS Failed, ADC and AHRS Normal**

4.4.1. PFD Failure Mode 1 (Essential Mode)

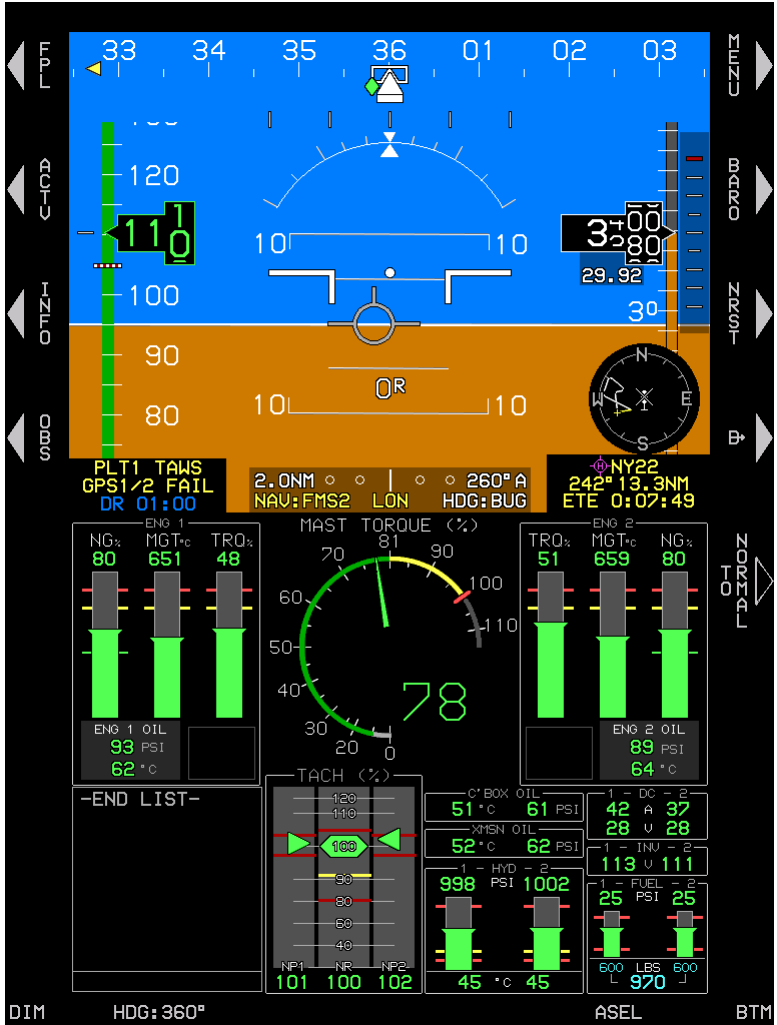
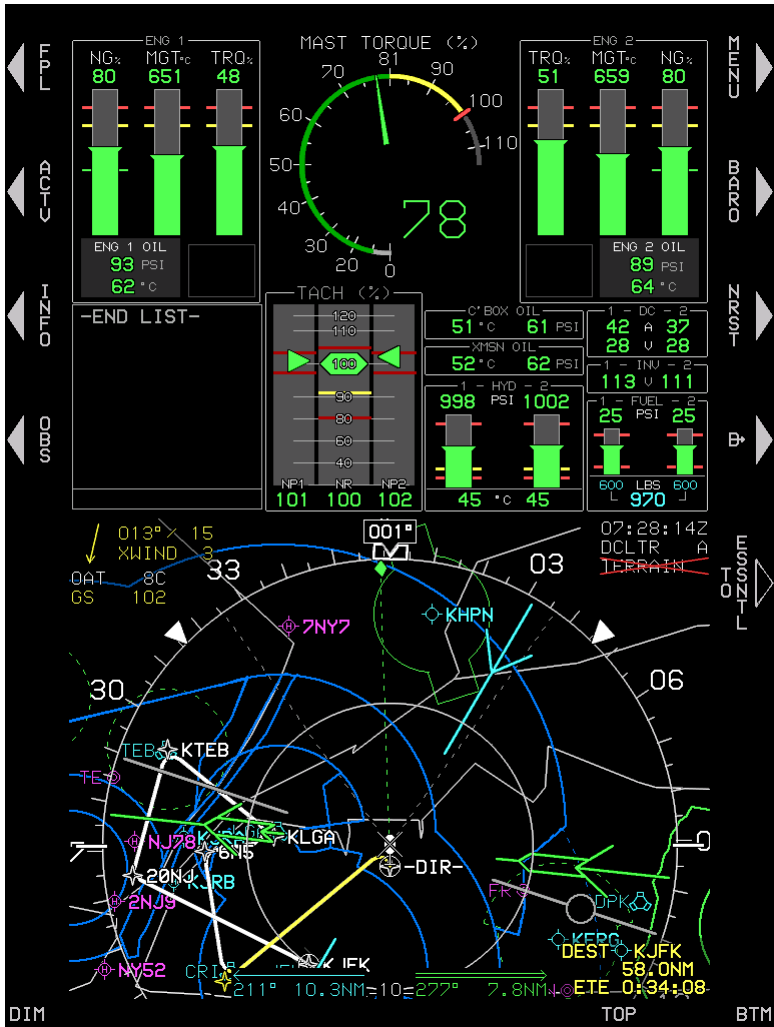


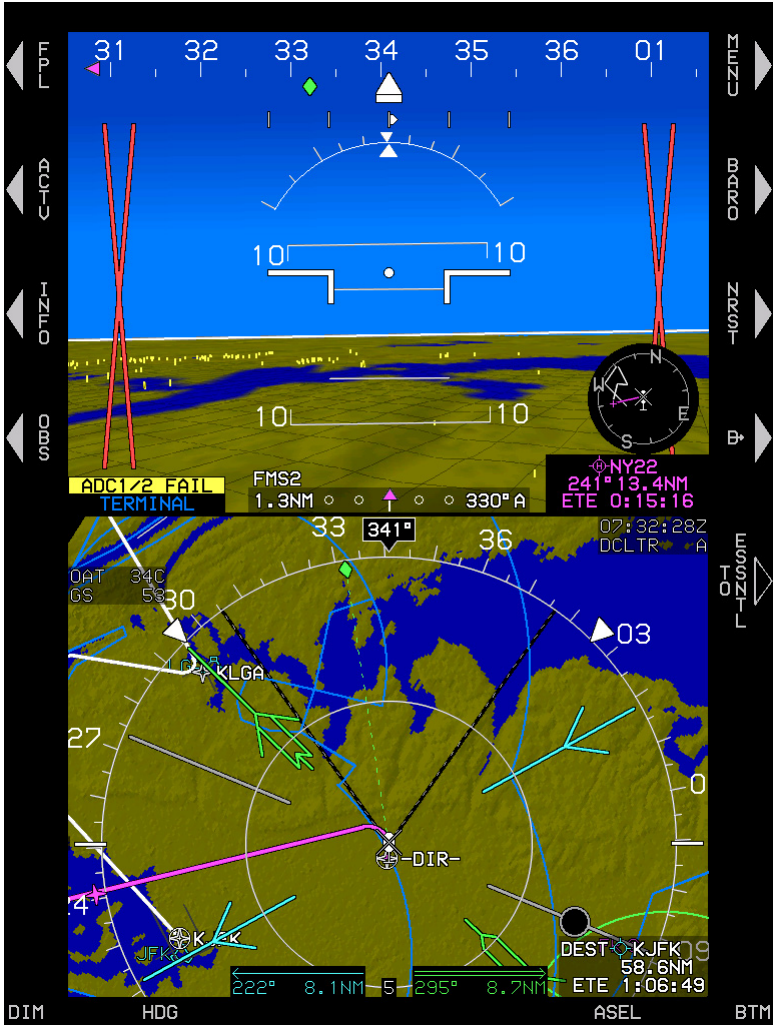
Figure 4-9: PFD Failure Mode 1 (Essential Mode)
GPS/SBAS Failed, ADC and AHRS Normal

4.4.2. MFD Failure Mode 1 (Normal Mode)



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

4.5. PFD Failure Mode 2 (Normal Mode)



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

4.5.1. MFD Failure Mode 2 (Normal Mode)



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

4.5.2. MFD Failure Mode 2 (Essential Mode)

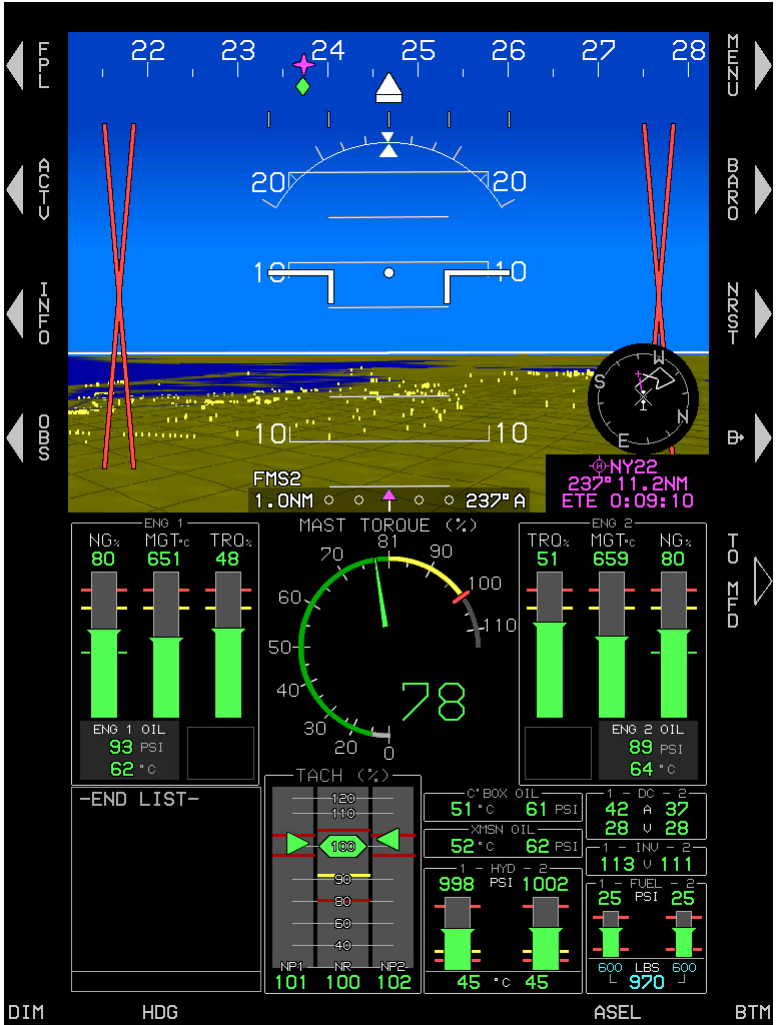


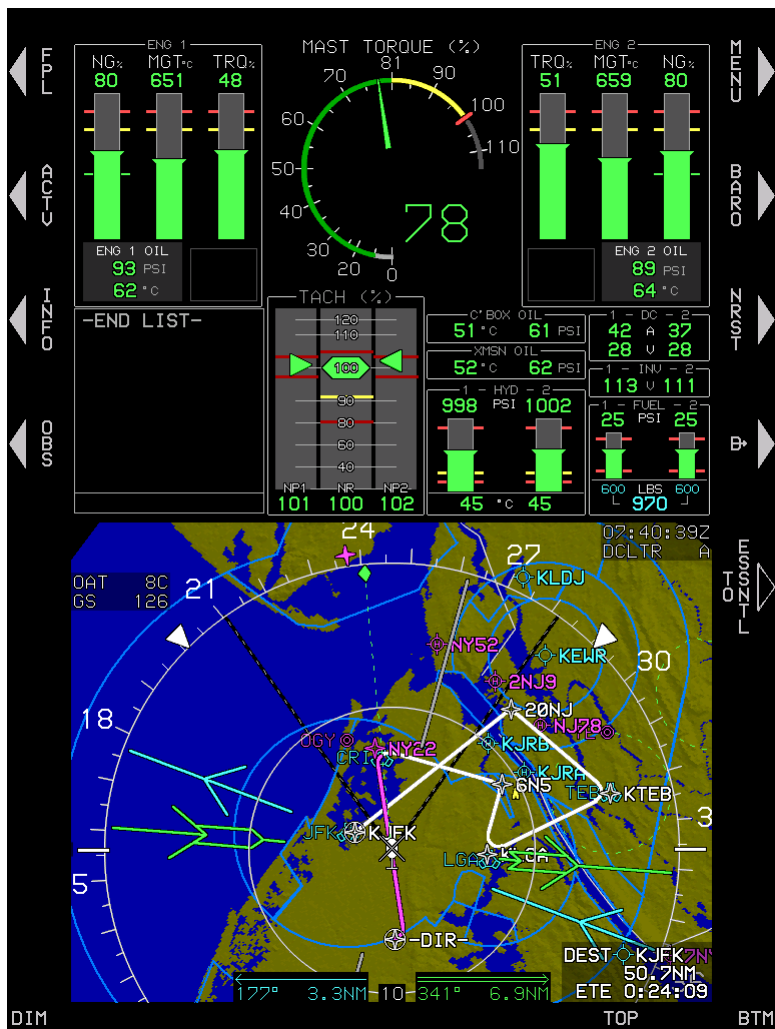
Figure 4-13: MFD Failure Mode 2 (Essential Mode)
ADC Failed, GPS/SBAS and AHRs Normal

4.6. PFD Failure Mode 3 (Normal Mode)



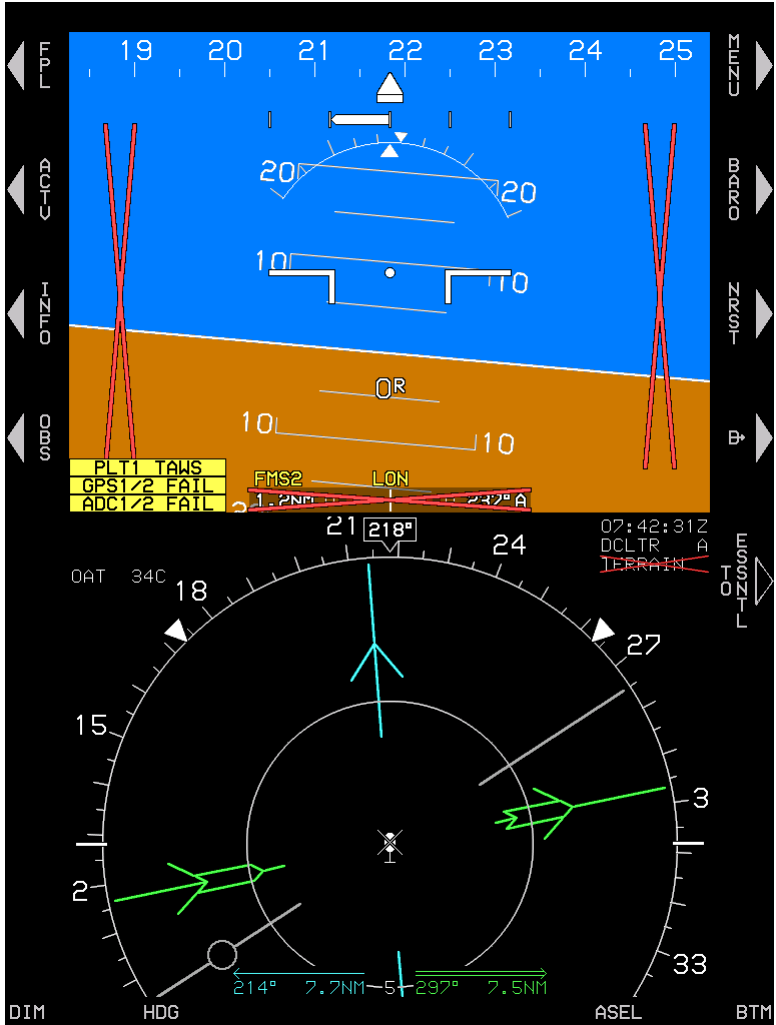
**Figure 4-14: PFD Failure Mode 3 (Normal Mode)
AHRS Failed, GPS/SBAS and ADC Normal**

4.6.1. MFD Failure Mode 3 (Normal Mode)



**Figure 4-15: MFD Failure Mode 3 (Normal Mode)
AHRs Failed, GPS/SBAS and ADC Normal**

4.7. PFD Failure Mode 4 (Normal Mode)



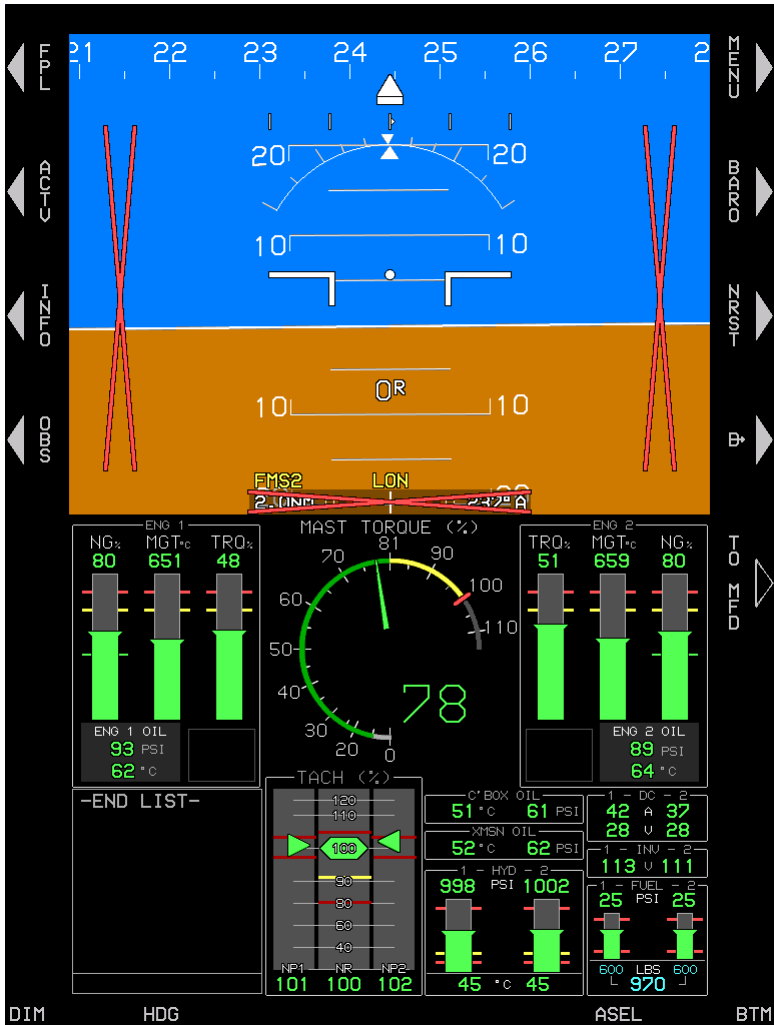
**Figure 4-16: PFD Failure Mode 4 (Normal Mode)
GPS/SBAS and ADC Failed, AHRS Normal**

4.7.1. MFD Failure Mode 4 (Normal Mode)



**Figure 4-17: MFD Failure Mode 4 (Normal Mode)
GPS/SBAS and ADC Failed, AHRS Normal**

4.7.2. MFD Failure Mode 4 (Essential Mode)



**Figure 4-18: MFD Failure Mode 4 (Essential Mode)
GPS/SBAS and ADC Failed, AHRS Normal**

4.8. PFD Failure Mode 5 (Normal Mode)

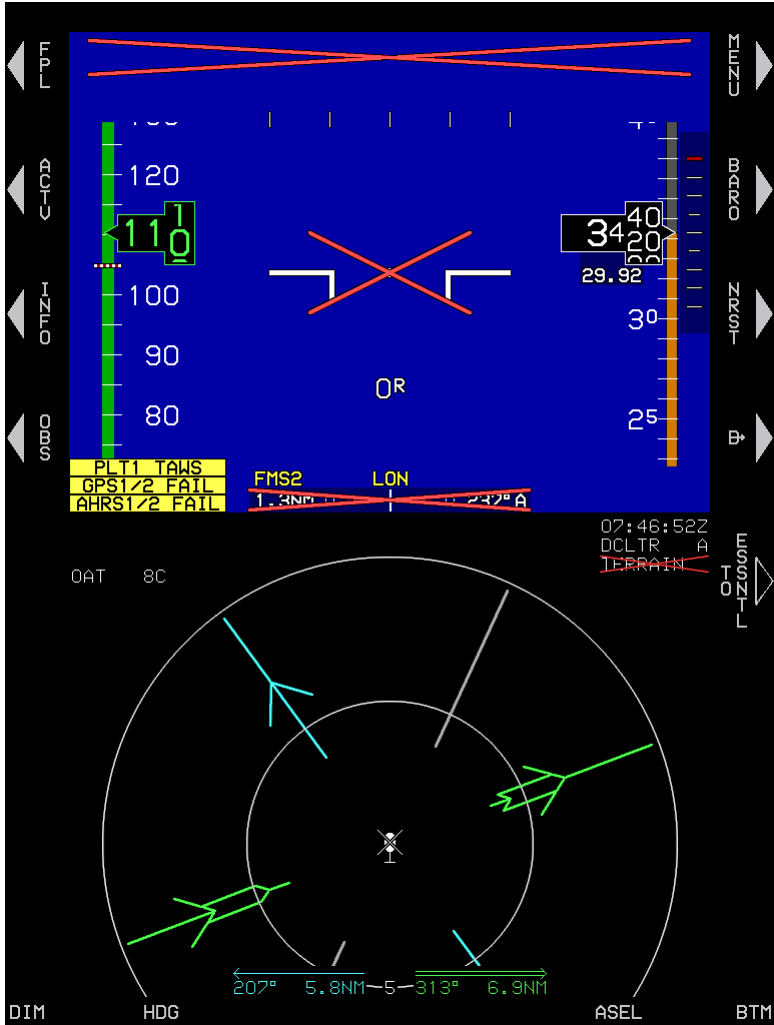
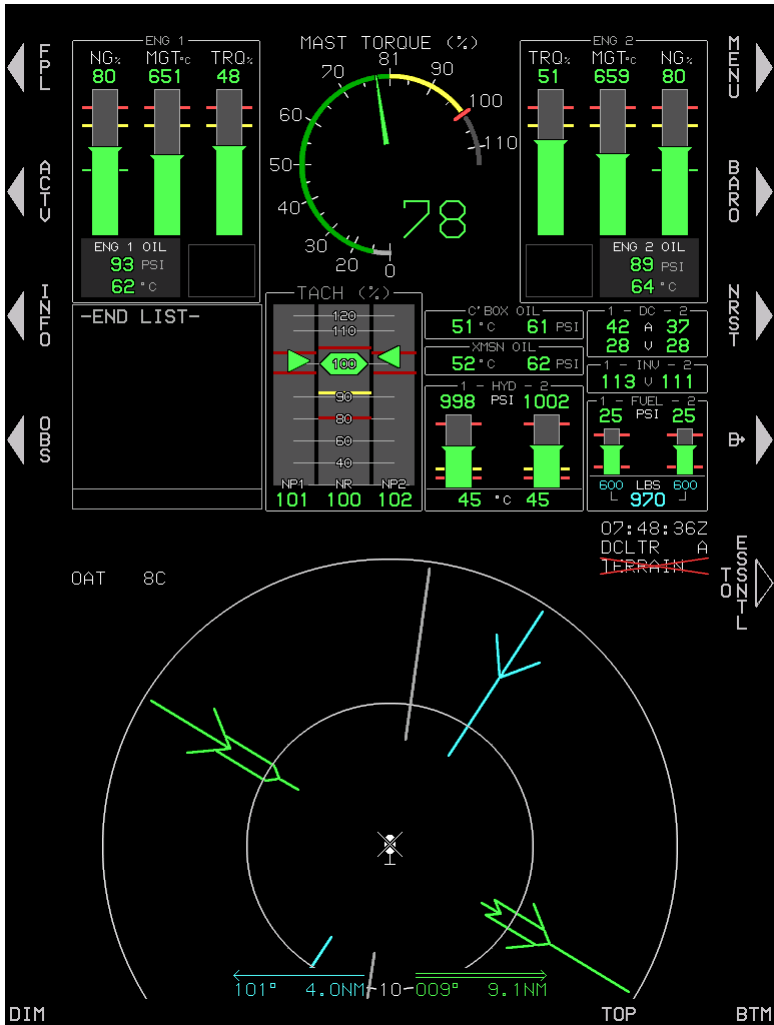


Figure 4-19: PFD Failure Mode 5 (Normal Mode)
GPS/SBAS and AHR Failed, ADC Normal

4.8.1. MFD Failure Mode 5 (Normal Mode)



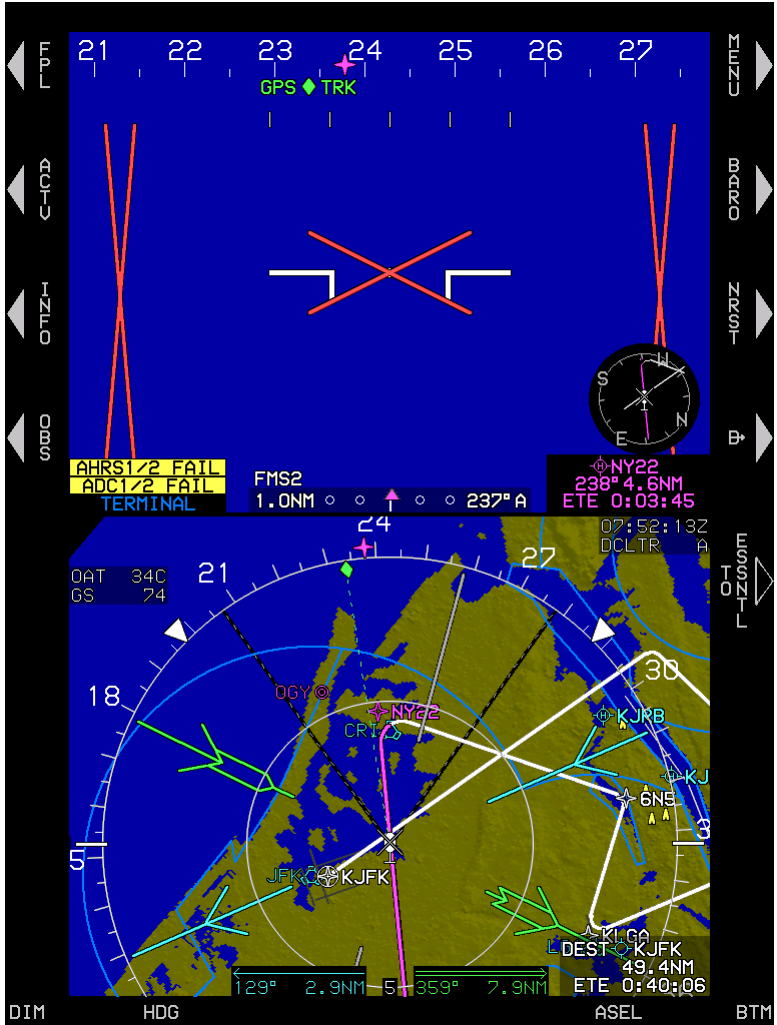
**Figure 4-20: MFD Failure Mode 5 (Normal Mode)
GPS/SBAS and AHRs Failed, ADC Normal**

4.8.2. MFD Failure Mode 5 (Essential Mode)



**Figure 4-21: MFD Failure Mode 5 (Essential Mode)
GPS/SBAS and AHRs Failed, ADC Normal**

4.9. PFD Failure Mode 6 (Normal Mode)



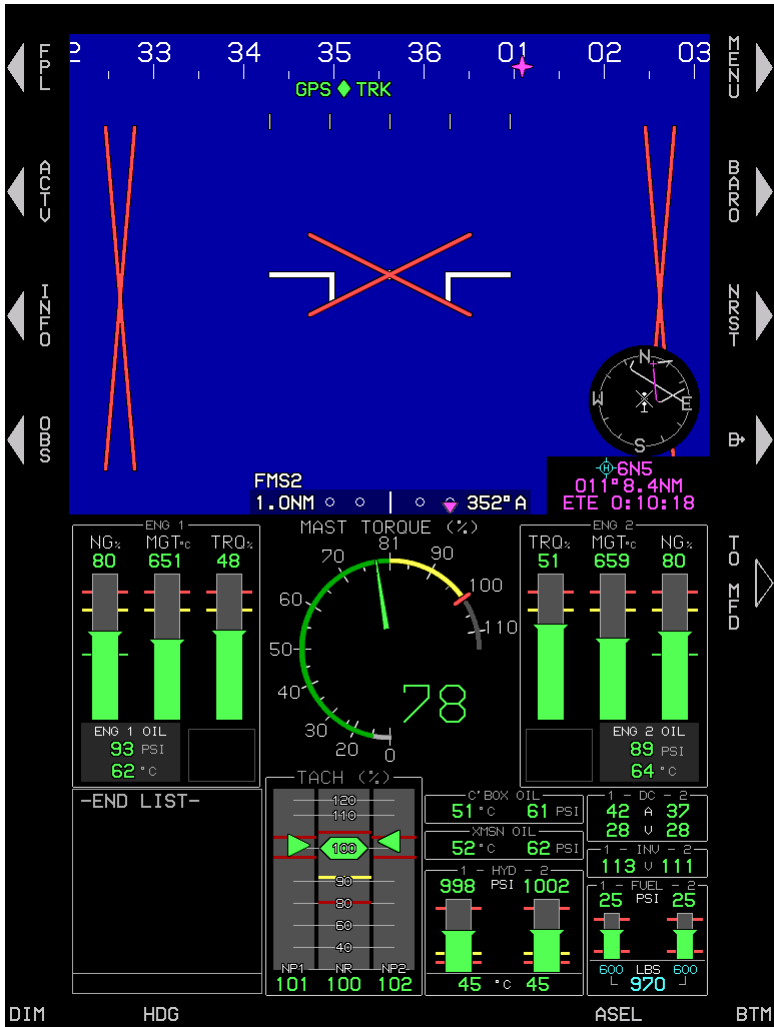
**Figure 4-22: PFD Failure Mode 6 (Normal Mode)
ADC and AHR Failed, GPS/SBAS Normal**

4.9.1. MFD Failure Mode 6 (Normal Mode)



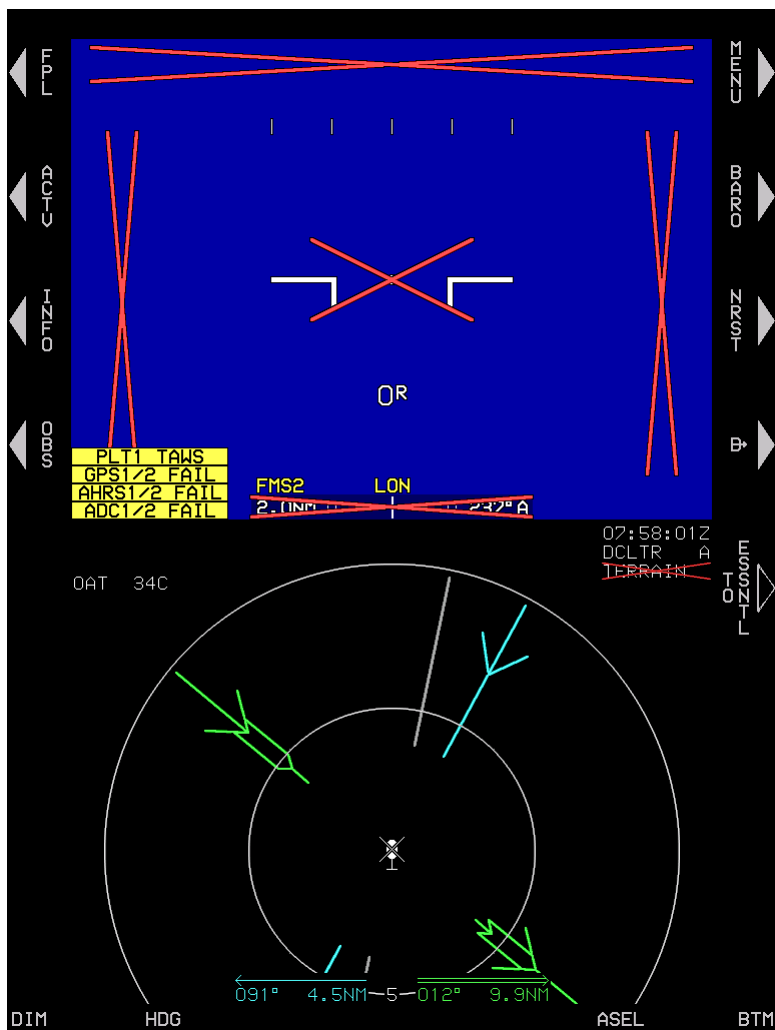
**Figure 4-23: MFD Failure Mode 6 (Normal Mode)
ADC and AHRS Failed, GPS/SBAS Normal**

4.9.2. MFD Failure Mode 6 (Essential Mode)



**Figure 4-24: MFD Failure Mode 6 (Essential Mode)
ADC and AHRS Failed, GPS/SBAS Normal**

4.10. PFD Failure Mode 7 (Normal Mode)



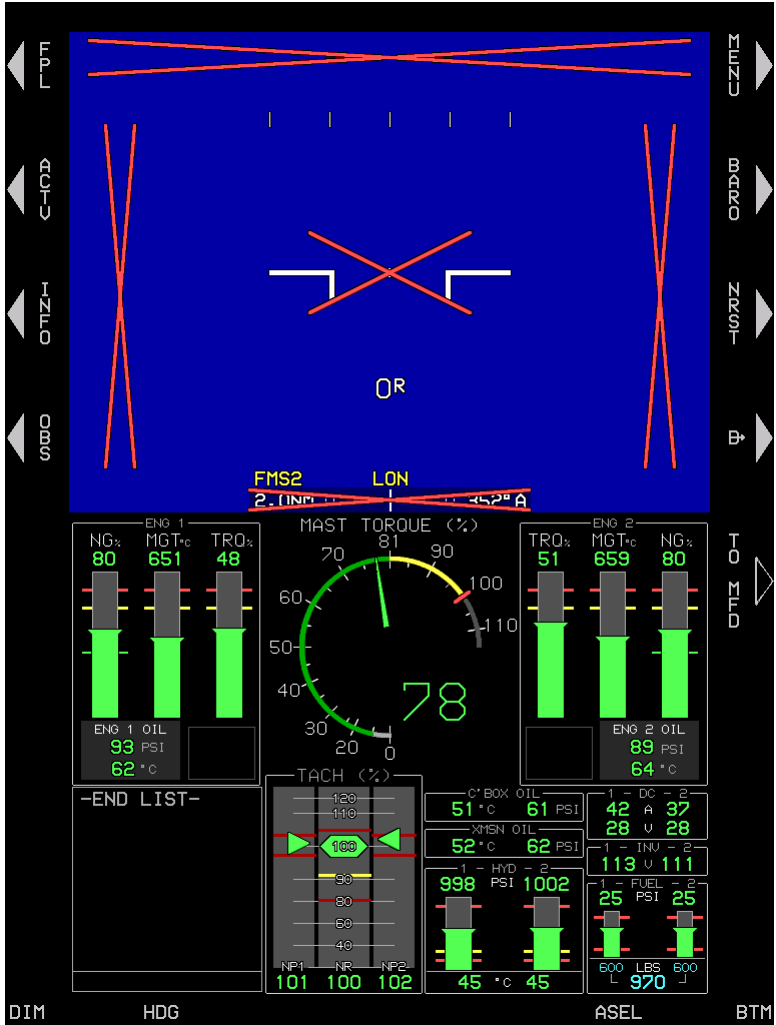
**Figure 4-25: PFD Failure Mode 7 (Normal Mode)
GPS/SBAS, ADC and AHRs Failed**

4.10.1. MFD Failure Mode 7 (Normal Mode)



**Figure 4-26: MFD Failure Mode 7 (Normal Mode)
GPS/SBAS, ADC and AHRs Failed**

4.10.2. MFD Failure Mode 7 (Essential Mode)



**Figure 4-27: MFD Failure Mode 7 (Essential Mode)
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 four encoders (④, ③, ②, and ①), except ④ 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 encoder when appropriate.

Selection list: Menus adjacent to encoders are frequently a selection list. Within lists, a two-dot trailer indicates further menu levels. Lists too long to be presented in the space available provide an indication of location within the list. Menu messages are displayed for five seconds but are cleared if any IDU button is pressed or encoders ❶, ❷, or ❸ are pushed or scrolled.

Indication of further menu levels: A filled triangle next to a menu legend means the button press leads to a further menu level. An empty triangle next to a menu legend means the button press is a final action.

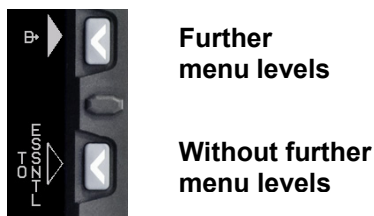


Figure 5-2: Indication of Further Menu Levels

5.1.2. Avoidance of Autonomous Behavior

The displays are designed to be under the control of the pilot to ensure critical functions are placed at the top level (i.e., **TO ESSENTL**). 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 rotorcraft, 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. IDU #1 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. Essential mode incorporates both a PFI page (satisfying the regulatory requirement) and the essential EICAS display to enable continued operation of the aircraft.

TAWS/HTAWS 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-C194 for Enhanced HTAWS and is enabled in the other TAWS/HTAWS options integrated in the EFIS software. (See Section 8 Terrain Awareness Warning System for details.)

Traffic popups: When a traffic alert is generated, a popup function displays traffic on the PFI and moving map page and the traffic thumbnail on the PFI.

5.2. Menu Synchronization

System settings changed by the menu system are synchronized between multiple IDUs and between top and bottom areas of an IDU-680 in MFD-MFD mode as in Table 5-1. All parameters for rotorcraft are included. Each appendix for Audio/Radio Management, Datalink, Strikes, RBP, Traffic, Video, and Weather Radar contains specific limitations for menu synchronization for that feature.

Table 5-1: Menu Synchronization

Menu Parameter	Notes
<i>The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.</i>	
AHRS 1 and 2 mode and slewing values	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
Inter-System Audio-Radio Device Parameters	
Fuel Totalizer Quantity	
VNAV Climb Angle	
Countdown Timer Start Time	
Countdown Timer Default Value	
Remote Tune Frequencies	
VNAV Descent Angle	
Decision Height Setting	Used when “Dual Decision Height Flag” set in EFIS Limits.
Emergency and Minimum Fuel Settings	
Heading Bug and Heading Sub-Mode	
Minimum Altitude Bug Value	
VLOC OBS Settings	
Airspeed Bug Setting	
Target Altitude Bug Setting	
Timer Starting Signal	
Traffic Filter Setting	
True North Mode	
UTC Offset	
VSI Bug Setting	
Crosslink Synchronization Status	
<p><i>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.</i></p>	
Active Flight Plan Parameters	
Runway Display Parameters	
<p><i>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.</i></p>	
Sensor Selections	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
Transition Altitude	
Intra-System Audio-Radio Device Parameters	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Decision Height Setting	Used when “Dual Decision Height Flag” set in EFIS Limits.
Navigation Source	
Horizon Synchronization Parameters	
PFD Basic Mode	
PFD Zoom Mode	
PFD Analog AGL	
PFD Full-time Bank Scale Flag	
PFD Flight Director Show Flag	
PFD Generic EICAS Overlay Show Flag	
PFD Mini-map Show Flag	
PFD Altitude (meters) Show Flag	
PFD Traffic Thumbnail Show Flag	
PFD OASIS Overlay Show Flags	
PFD Skyway Show Flag	
PFD Terrain Show Flag	
Rate of Turn Indication flag	
WX RDR 2XXX Radar Control Menu parameters	
<i>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.</i>	
CPU Type	To support mixed CPU Type installations
MFD Datalink Page Settings	Independent between top and bottom MFD areas
DVI Mode Status	Support for with DVI option

Table 5-1: Menu Synchronization

Menu Parameter	Notes
680 Essential Mode Status	Support for reversion
MFD Hover Page Scale	Independent between top and bottom MFD areas
MFD Selected Page	Independent between top and bottom MFD areas. Parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map and HSI Page Pointer Settings	Independent between top and bottom MFD areas
MFD Map Page Settings	Independent between top and bottom MFD areas. Map scale is transmitted onside to support weather radar range selection.
680 Forced OASIS Minimize	Supports reversion and certain menus. Independent between top and bottom MFD areas.
OASIS CAS Box Render Status	Supports integrated OASIS CAS area. Independent between top and bottom MFD areas.
MFD Map Function Declutter Settings	Independent between top and bottom MFD areas
MFD OASIS Overlay Show Flags	
MFD Show ETA Flag	
MFD Map NavData® Symbol Declutter Settings	Independent between top and bottom MFD areas

5.3. Top-Level Menu

The top-level menu consists of soft menu options along with option labels for the encoders.

5.3.1. IDU-680 PFD Normal Mode Top-Level Menu

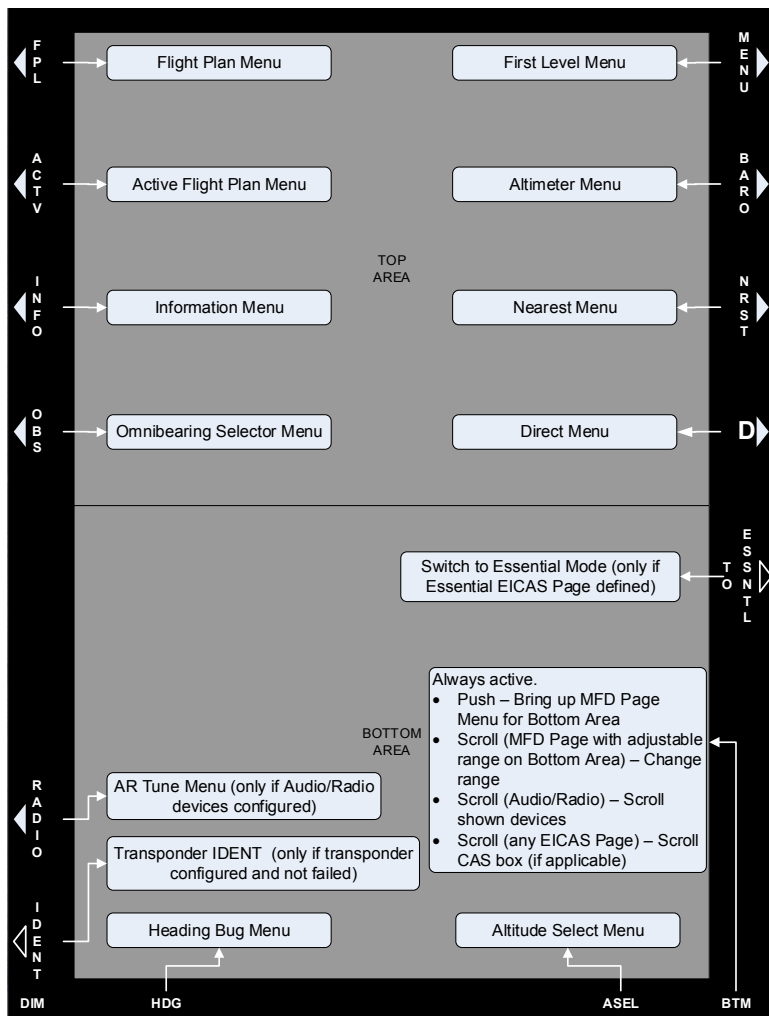


Figure 5-3: PFD Normal Mode Top-Level Menu

5.3.2. IDU-680 MFD Normal Mode Top-Level Menu

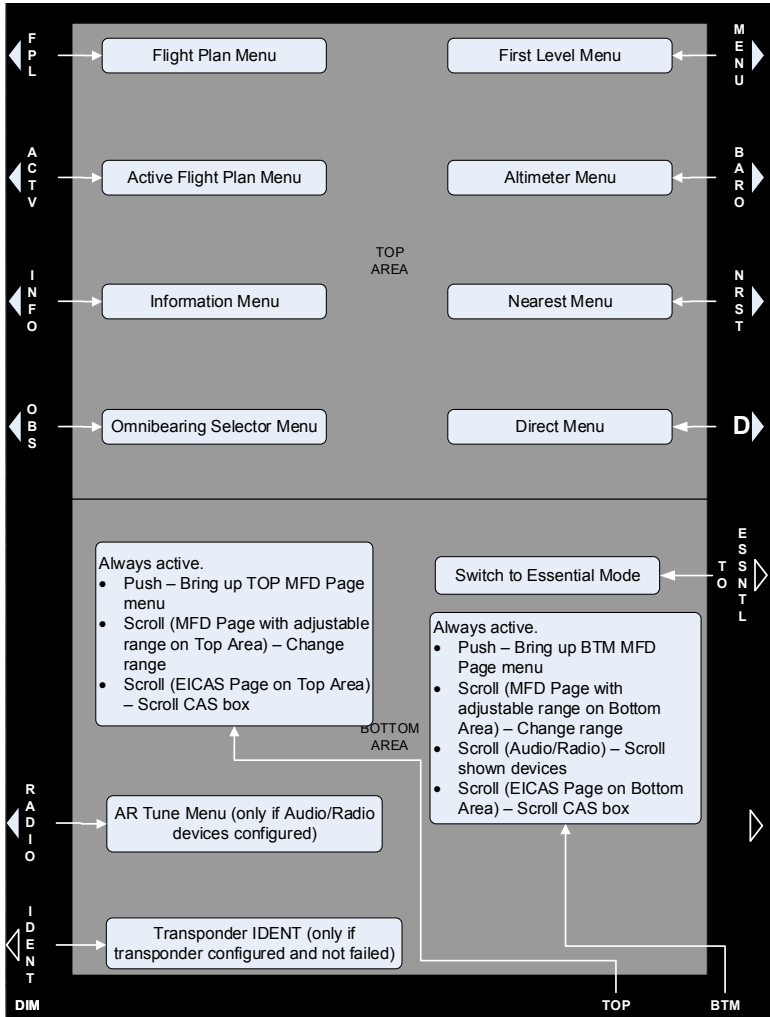


Figure 5-4: MFD Normal Mode Top-Level Menu

5.3.3. IDU-680 PFD or MFD Essential Mode Top-Level Menu

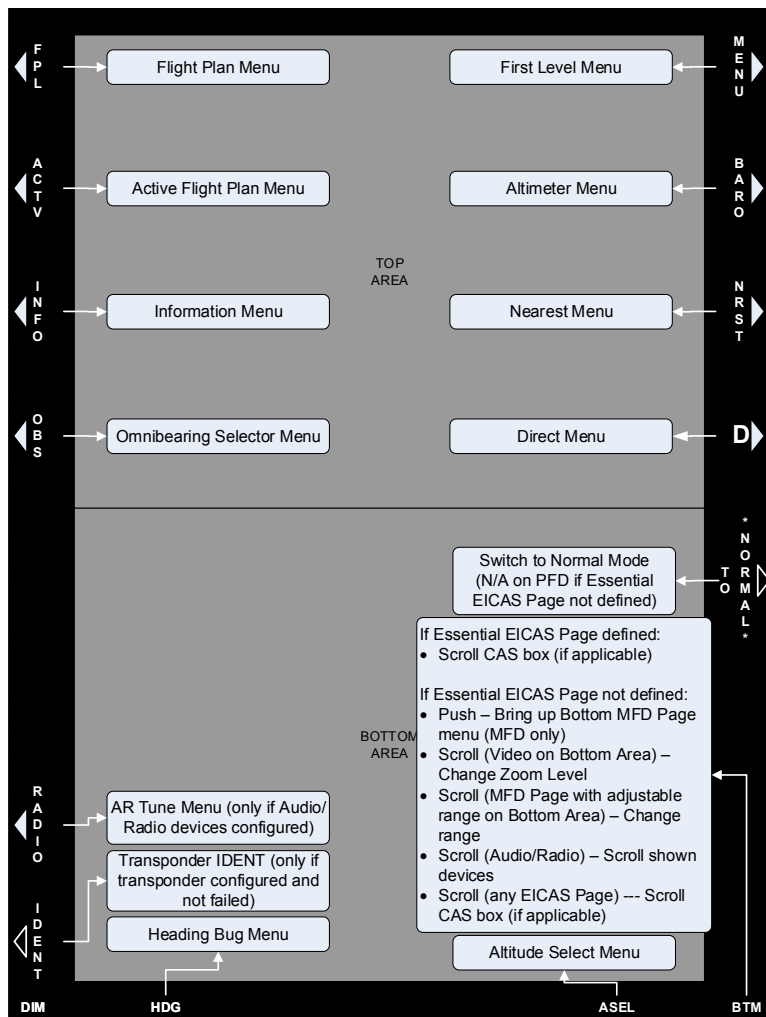









Figure 5-5: PFD or MFD Essential Mode Top-Level Menu

5.3.4. Top-Level Menu Option Descriptions

- 1) **FPL (L1):** Flight plan menu.
- 2) **ACTV (L2):** Active flight plan menu.

- 3) **INFO (L3)**: Information menu.
- 4) **OBS (L4)**: Omnibearing selector menu.
- 5) **RADIO (L7)**: Activates the AR tune menu option. (When enabled)
- 6) **IDENT (L8)**: Enables IDENT feature of the transponder. (When enabled)
- 7) **MENU (R1)**: First-level associated with the current display page and automatically times out after ten seconds if there are no subsequent pilot actions.
- 8) **BARO (R2)**: Altimeter menu option.
- 9) **NRST (R3)**: Nearest menu option.
- 10) ** (R4)**: Direct menu option.
- 11) **TO ESSNTL/TO NORMAL (PFD) or TO MFD (MFD) (R5)**: Switches between Normal and Essential modes.
- 12) **DVI (R7)**: Switches control of the screen to an external DVI source if configured and there is no discrete input configured to perform this function.
- 13) ** Encoder**: Function depends upon IDU number and mode (Normal vs. Essential) as follows:
 - a) On a PFD (IDU #1), push **** to sync current heading and scroll to activate the heading menu when labeled **HDG**. Either push **** to accept changes or press **EXIT (R1)**.
 - b) On an MFD (IDUs other than #1) operating in Essential mode, push **** to sync current heading and scroll to the heading menu when labeled **HDG**. Either push **** to accept changes or press **EXIT (R1)**.
- 14) ** Encoder**:
 - a) On a PFD (IDU #1), any encoder action activates the altitude bug menu. Encoder is labeled **ASEL**.
 - b) On an MFD (IDUs other than #1) operating in normal mode, if the top area is showing a page with an adjustable display scale (e.g., ND, Strike, Traffic, Datalink, Hover, Video, or

Weather Radar), scroll ② to change the display scale (CW to increase scale, CCW to decrease scale).

- c) On an MFD (CPU's other than #1) operating in Normal mode, if the top area is showing a video page, scroll ② to change the zoom level (CW to increase zoom, CCW to decrease zoom).
- d) On an MFD (CPU's other than #1) operating in Normal mode, if the top area is showing an OASIS page with a CAS box, scroll ② to progress the CAS box.
- e) On an MFD (IDUs other than #1) operating in Normal mode, if the top area is showing an EICAS with a CAS box, scroll ② to progress the CAS box.
- f) On an MFD (IDUs other than #1) operating in Normal mode, push the encoder to activate the TOP MFD Page menu as described in § 5.22. The TOP MFD Page menu is above ②, unlike other menu lists. The pilot may select a full screen EICAS in the bottom area consuming both the top and bottom areas. In this case, completion of the MFD Page menu action automatically switches the EICAS in the bottom area to its related backup displays.
- g) On an MFD (IDUs other than #1) operating in Essential mode, ② is labeled TOP when either an encoder scroll or push has an effect.
- h) On an MFD (IDUs other than #1) operating in essential mode, any encoder action activates altitude bug menu function. ② is labeled **ALT SEL**.

15) ① **Encoder:**

- a) On a PFD or MFD operating in Normal mode, if the bottom area is showing a page with an adjustable display scale (e.g., ND, Strike, Traffic, Datalink, Video or Weather Radar), scroll ① to change the display scale (CW to increase scale, CCW to decrease scale).
- b) On a PFD or MFD operating in Essential mode with an Essential EICAS page configured, if the Essential EICAS page includes a CAS box, scroll ① to progress the CAS box.

- c) On a PFD or MFD operating in Normal mode, if the bottom area is showing an audio/radio page configured with more than the maximum number of displayed devices, scroll **1** to progress through the shown devices (CW to scroll down the list, CCW to scroll up the list).
- d) In Normal or Essential mode without an Essential EICAS page configured, push **1** to activate the MFD bottom page menu option. It is possible to have selected a full screen OASIS page in the top area that consumes both the top and bottom areas. In this case, completion of the MFD Page menu action automatically switches the OASIS page in the top area to its related backup display.
- e) **1** is labeled **BTM**. Not labeled if in Essential mode with an Essential EICAS page configured, but the page does not include a CAS box.

5.3.5. Top-Level Menu Automatic Pop-Up Function Descriptions

Soft menu tiles appear adjacent to pushbuttons under the specified conditions.

Table 5-2: Top-Level Auto Pop-Up Function Descriptions

Note		Precedence, Tile Legend and Action
1	2	
L1	L5	1) As specified in Section 8 TAWS, RESET appears when a terrain popup occurs during a TAWS FLTA alert. (N/A MFD) 2) When ND page with pan mode enabled, PN OFF appears. Press to disable pan mode. RESET has precedence over PN OFF . 3) When display is transmit enabled, MISS appears upon transitioning the FAF. Press to activate missed approach procedure. RESET and PN OFF have precedence over MISS . 4) When display is transmit enabled, LNAV appears when there is an active flight plan, heading bug sub-mode is active, and system is integrated with an analog autopilot. Press to deactivate heading bug sub-mode and resume guidance to active

Table 5-2: Top-Level Auto Pop-Up Function Descriptions

Note		Precedence, Tile Legend and Action
1	2	
		<p>flight plan path. RESET, PN OFF, and MISS have precedence over LNAV.</p> <p>5) When display is transmit enabled, HDG appears when LNAV sub-mode is active and system is integrated with an analog AP with HDG mode engaged. Press to deactivate LNAV sub-mode and resume guidance to heading bug. RESET, PN OFF, and MISS have precedence over HDG.</p>
L2	L6	<p>1) When ND page with: (a) pan mode enabled; (b) information for the nearest highlighted waypoint being shown; and (c) airport weather information present in the information block; WX appears to allow the display of textual METAR and TAF data for the airport.</p> <p>2) When the display is transmit enabled and HRZ SYNC is armed, HS ON appears. Pressed to engage HRZ SYNC mode apply the appropriate offset to displayed pitch attitude. WX have precedence over HS ON.</p> <p>3) When the display is transmit enabled and HRZ SYNC is engaged, HS OFF appears. Press to cancel HRZ SYNC mode. UP and WX have precedence over HS OFF. HRZ SYNC is also cancelled automatically by flying beyond the arming range. In most cases, it is anticipated that HRZ SYNC is cancelled automatically by accelerating through the arming speed rather than by pressing HS OFF.</p> <p>4) When the display is transmit enabled, CONT appears when in a holding pattern with further active flight plan legs after the holding pattern. Press to re-enabled automatic waypoint sequencing to allow normal sequencing to the leg after the holding pattern. HS ON and HS OFF have precedence over CONT.</p> <p>5) When the display is transmit enabled, RESUME appears when the following leg is a manual leg and the FMS is in FROM operation. Press to</p>

Table 5-2: Top-Level Auto Pop-Up Function Descriptions

Note		Precedence, Tile Legend and Action
1	2	
		activate a Direct-To the waypoint after the manual leg. HS ON and HS OFF have precedence over RESUME . 6) When display is transmit enabled, VNAV appears when VNAV guidance is valid, selected altitude sub-mode is active, and the system is integrated with an analog autopilot. Press to deactivate selected altitude sub-mode and resume guidance to VNAV path. WX , HS ON , HS OFF , CONT , and RESUME have precedence over VNAV . 7) When display is transmit enabled, ARM appears when on final approach segment (between FAF and MAP). Press to arm missed approach procedure to automatically activate upon sequencing MAP. WX , HS ON , HS OFF , and VNAV have precedence over ARM .
L3	L7	When ND page with pan mode enabled, NORTH appears. Press to shift the center of the page in the specified direction.
L4	L8	When ND page with pan mode enabled, SOUTH appears. Press to shift the center of the page in the specified direction.
R2	R6	When ND page with pan mode enabled, INFO or HIDE appears. Press to toggle information for nearest highlighted waypoint. See § 5.9 for amount and type of information presented.
R3	R7	When ND page with pan mode enabled, EAST appears. Press to shift the center of the page in the specified direction.
Note 1: Function tied to page in top area. Note 2: Function tied to page in bottom area or transmit enabled.		

5.4. First Page (PFD)

Top area of IDU #1 is fixed to the PFD page. Select Essential mode on other IDUs to show the PFD page in the top area. PFD page first-level options are shown adjacent to the top eight pushbuttons. Options may also appear on the bottom eight pushbuttons as appropriate to the page shown in the bottom area. When an identical option is shown adjacent to both the top area and bottom area, the option is only shown adjacent to the top area.

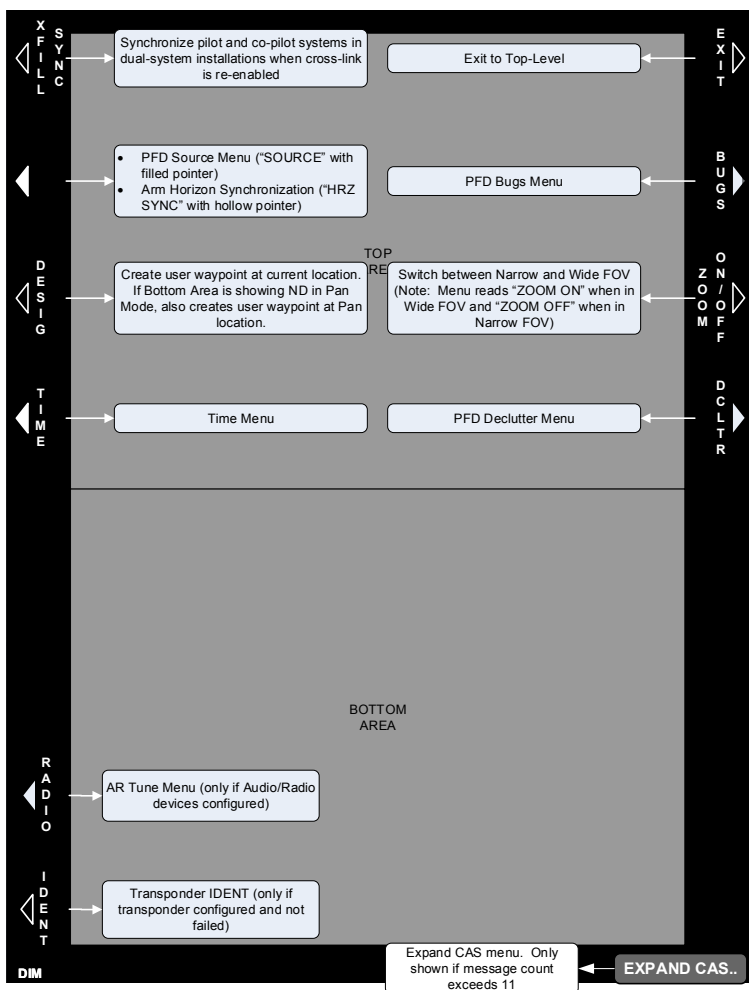


Figure 5-6: First Page PFD

5.4.1. PFD Page First-Level Option Descriptions

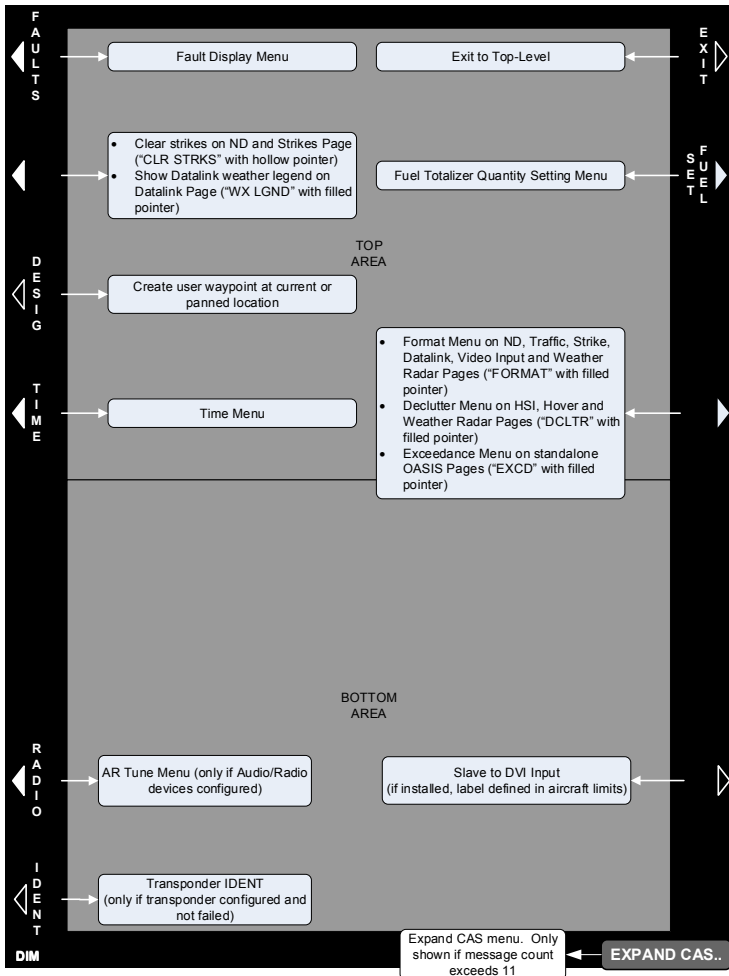


Figure 5-7: First Page PFD First-Level

- 1) **XFILL SYNC (L1):** Appears in dual-system installations where the pilot and co-pilot systems are not synchronized, but crosslink is enabled. Press to synchronize the pilot and co-pilot active flight plan parameters to the system where the button press occurred. **HRZ SYNC (L2)** appears when transmit enabled and HRZ SYNC function is available for arming.

Table 5-3: 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)	Synchro- nized	None	None	None	No action required. Pilot and co-pilot sides already synchronized
Enabled (Cond.2)	Not Synchro- nized (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 Synchro- nized	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. The 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.

- 2) **SOURCE (L2)**: When transmit enabled, activates PFD source menu option, HRZ SYNC has precedence.
- 3) **DESIG (L3)**: Creates a user waypoint at the current aircraft location. When pressed and an ND page is operating in panning mode a user waypoint is created at the panning location. User waypoint at current aircraft location is automatically named "OF###," where ### is the next available over-fly user waypoint number. User waypoint at panning location is automatically named "PN###," where ### is the next available panning user waypoint number. When **DESIG (L3)** is pressed and the number of user waypoint count is more than 998, the EFIS displays **USER WPTS FULL** message.
- 4) **TIME (L4)**: Activates the time menu option.
- 5) **RADIO (L7)**: Activates the AR menu option when enabled.
- 6) **IDENT (L8)**: When transponder is not failed and not in standby mode enables the IDENT feature of transponder.
- 7) **BUGS (R2)**: Activates the PFD bug set menu option.
- 8) **ZOOM ON/ZOOM OFF (R3)**: Toggles between wide FOV and narrow FOV modes.
- 9) **DCLTR (R4)**: Activates the PFD declutter menu option.
- 10) **EXPAND CAS (R1)**: Activates the Expand CAS menu option only when there are more than 11 active CAS messages.

5.5. First Level (MFD)

The bottom area of all IDUs always shows the MFD page in all modes (essential EICAS page is a type of MFD page). IDUs other than IDU#1 may also show the MFD page in the top area in Normal mode. 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 screen are not identical.) The MFD page first-level options are as follows.

NOTE:

All possible options shown adjacent to the top area are for illustrative purposes.

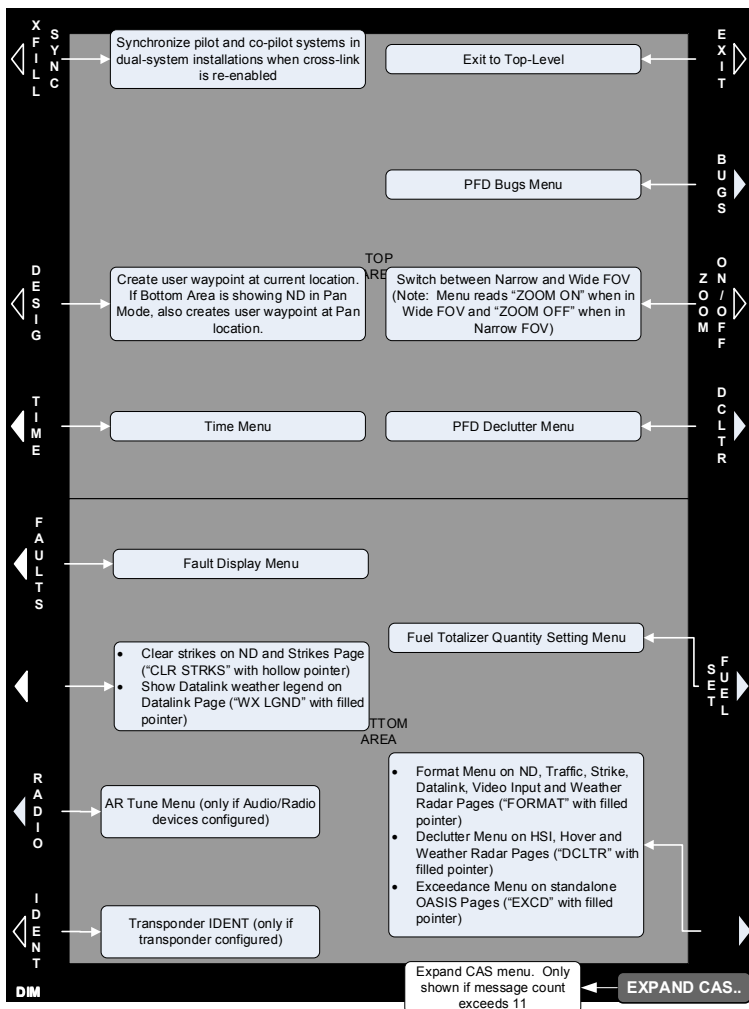


Figure 5-8: First-Level PFD in Normal Mode and MFD Page in Bottom Area

5.5.1. First Level (MFD IDU other than #1) Normal Mode

First level (MFD IDU other than #1) in Normal mode with an MFD Page in both areas.

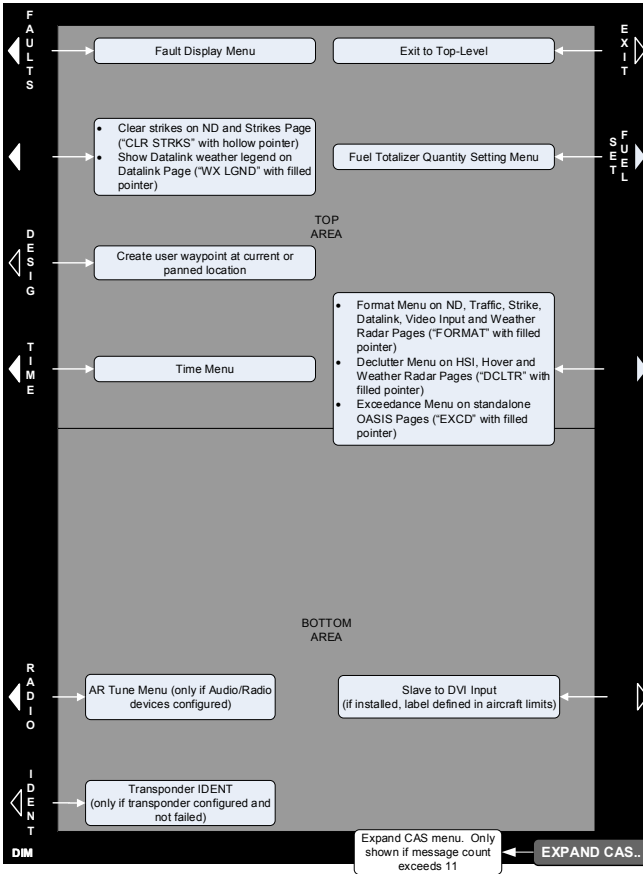


Figure 5-9: First Level (MFD IDU other than #1) Normal Mode

5.5.2. MFD Page First-Level Option Descriptions

- 1) **FAULTS (L1):** Activates the fault display menu option.
- 2) **DESIG (L3):** Same function as PFD Page First-level.
- 3) **TIME (L4):** Same function as PFD Page First-level.

- 4) **RADIO (L7)**: Same function as PFD Page First-level.
- 5) **IDENT (L8)**: Same function as PFD Page First-level.
- 6) **SET FUEL (R2)**: Activates fuel totalizer set menu option.
- 7) **PAGE**: On MFD, push **1** and or **2** to perform function at top-level.
- 8) **FORMAT: DCLTR (R8) or EXCD (R8)**: On the ND, activates the appropriate page format menu option.
 - a) **FORMAT**: On the ND, Traffic, Strike, Datalink, Video input, and Weather Radar pages activate the appropriate page format menu option. On the weather radar page, **FORMAT** appears when an RDR-2000 or RDR-2100 is installed but a radar control panel is not installed.
 - b) **DCLTR**: On the HSI page with optional VOR or ADF symbology enabled or declutterable OASIS overlays, **DCLTR** activates HSI declutter menu option. On the Hover page with declutterable OASIS overlays, **DCLTR** activates Hover declutter menu option. On the Weather Radar page with declutterable OASIS overlays or in horizontal profile mode, **DCLTR** activates weather radar declutter menu option.
 - c) **EXCD**: On a stand-alone OASIS page, **EXCD** appears if exceedances are logged and activates the EICAS Exceedance menu option.
- 9) **TO DVI (R7)**: (With DVI input only) Switch control of the screen to an external DVI source. If discrete input is configured to perform this function, this menu option does not appear.
- 10) **EXPAND CAS (1)**: Activates the Expand CAS menu option only when there are more than 11 active CAS messages.

5.5.3. IDU-680 EICAS Page First-Level in Essential Mode

The bottom area of the IDU-680 shows the EICAS page. In Normal mode on IDUs other than #1, the EICAS page may be shown in the top area (full-screen EICAS page using both the top and bottom areas is considered a top area page). IDU-680 EICAS page first-level options are shown adjacent to the area in which the EICAS page resides. When an identical option is shown adjacent to both

the top area and bottom area, the option is only shown adjacent to the top area.

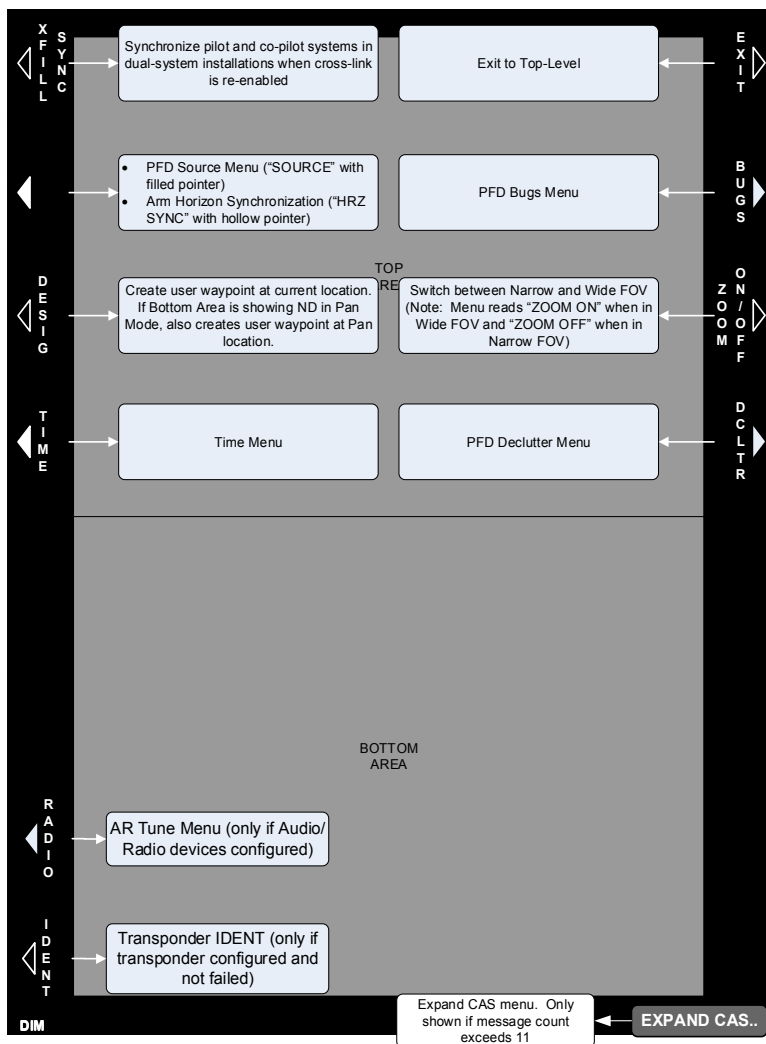
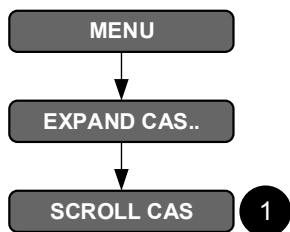


Figure 5-10: PFD Page in Top Area and Essential Mode EICAS Page in Bottom Area

5.5.4. EICAS Page First-Level Option Descriptions

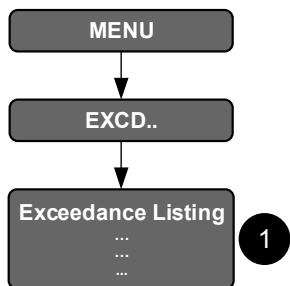
- 1) **SET FUEL (R2)**: Same function as MFD Page First-level.
- 2) **PAGE 1 through PAGE 5** (only in Normal mode): Options are only shown if more than one EICAS page is configured.



- 3) **EXPAND CAS (1)**: Activates the Expand CAS menu option only when there are more than 11 active CAS messages. See § 5.5.5 for more information.

Figure 5-11: Expand CAS Menu

- 4) **EXCD..**: Activates the EICAS Exceedance menu option and only appears if exceedances are logged.



Scroll **1** to view each line. The format for each exceedance line is the following:

- 1) Exceedance element name;
- 2) Logged peak value in element units; and
- 3) Logged duration in hh:mm:ss format.

Figure 5-12: EICAS Exceedance Menu

5.5.5. Expand CAS Menu (Step-By-Step)

MORE-PRS MENU

- 1) When more than 11 CAS messages are available, press **MENU (R1)**.

EXPAND CAS..

- 2) Scroll **1** to view additional CAS messages.

↓5

- 3) This example indicates there are an additional five messages below.

↑1 ↓4

- 4) This example indicates there is one message above and four below.

5.6. Lower-Level Menu (Below First-Level)

The pushbuttons and encoders, which control the top-level and first-level menus, called lower-level menu, are described in this section. In the following diagrams, button and encoder numbers are as seen in Figure 5-1.

5.7. 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, **CREATE-EDIT..** encoder message is issued. 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.



Figure 5-13: Select from Option List

Flight Plan Limits: Flight plans are stored routes (100 maximum) may be used repeatedly 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 40 waypoints. Flights requiring more than 40 waypoints are divided into two or more flight plans.

5.7.1. Flight Planner Page

The flight planner page is used for detailed operations on pilot-modifiable elements in the IDU database. Perform the following types of functions through the flight planner page in the bottom area:

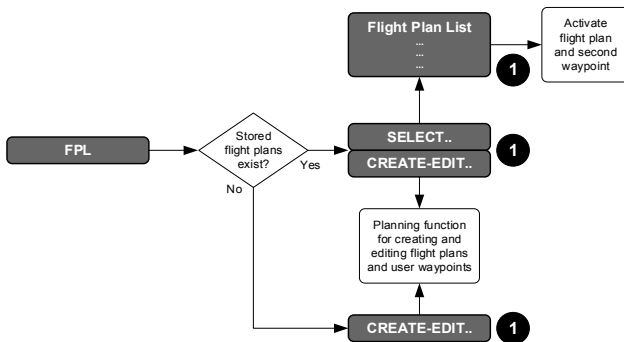


Figure 5-14: Flight Plan Menu

- 1) Managing stored flight plans (activating, creating, editing, deleting, and reversing); and
- 2) Managing user waypoints (creating, editing, and deleting); and
- 3) Performing 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 page taking over the IDU's controls and disabling the menu operations described in this document (other than the automatic EICAS page reversion). Normal menu operation and IDU control function are restored upon:

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

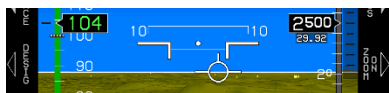
NOTE:

If the pilot selected a full-screen EICAS in the top area consuming both the top and bottom areas, the top area automatically switches to the Essential mode EICAS page.

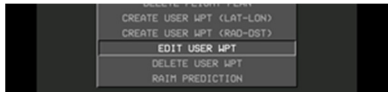
NOTE:

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

5.7.2. To Create an Overfly User Waypoint



- 1) When flying over intended waypoint, press **MENU (R1)** then **DESIG (L3)** on the PFD or MFD.
- 2) A user waypoint is created at the present position and automatically named "OF###," where ### is the next available overfly user waypoint number.



- 3) Use **EDIT USER WPT** function to change the waypoint name.

NOTE:

A maximum of 998 user waypoints may be created and stored.

If a discrete input has been enabled as “Remote User Waypoint Designate,” it may be used to easily create a user waypoint.

5.7.3. Flight Plan (FPL) Menu Selecting (Step-By-Step)



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



- 2) Scroll **1** to desired flight plan and push to enter.

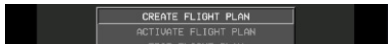
5.7.4. Flight Plan (FPL) Menu Create-Edit (Step-By-Step)



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



- 2) Scroll **1** to **CREATE-EDIT..** and push to enter.



- 3) Push **1** to enter.

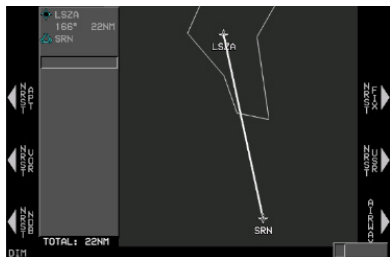


- 4) Press **ADD (R8)** to create first waypoint.

5.7.5. Flight Plan (FPL) Menu Selection (Step-By-Step)



- 1) Press **MENU (R1)** and **FLP (L1)** the scroll **1** to **CREATE—EDIT** and push to enter.



2) Press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, **NRST USR (R7)**, or **AIRWAY (R8)** to view applicable list, scroll **1** to desired selection. Push to insert into flight plan.



3) Once the desired selection “KBDR” appears as the first waypoint, continue with adding more waypoints.

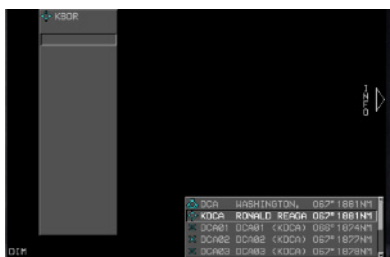


4) If necessary, scroll up to KBDR.



5) Press **INFO (L7)** and view information about selected waypoint.

5.7.6. Flight Plan (FPL) Creation (Step-By-Step)



1) Scroll **1** to next space and add another waypoint. Push to enter waypoint.



2) View current flight plan and press **SAVE (R8)** if accepted or press **ADD (R6)** to create additional waypoints.

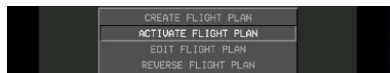
5.7.7. Activate Flight Plan (Step-By-Step)



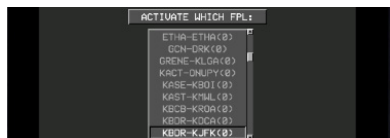
1) Press **FPL (L1)**.



2) Scroll **1** to **CREATE-EDIT..** and push to enter.



3) Scroll **1** to **ACTIVATE FLIGHT PLAN**. Push to enter.



4) Scroll **1** to desired saved flight plan and push to enter.



5) Press **EXIT (R1)** if no other action is necessary.

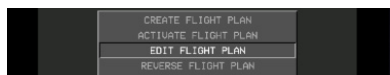
5.7.8. Edit Flight Plan (Step-By-Step)



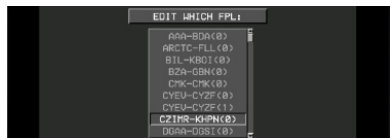
1) Press **FPL (L1)**.



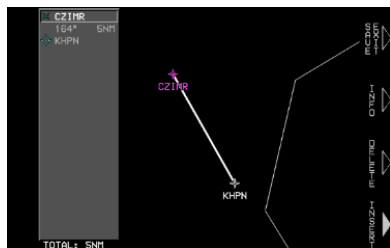
2) Scroll **1** to **CREATE-EDIT..** and push to enter.



3) Scroll **1** to **EDIT FLIGHT PLAN** and push to enter.



4) Scroll **1** to desired flight plan and push to enter.



5) Edit flight plan by adding or deleting waypoints as appropriate.



6) Press **SAVE (R8)** to save and exit.



7) Press **EXIT (R1)**, if no other action is necessary.

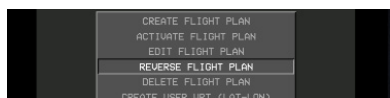
5.7.9. Reverse Flight Plan (Step-By-Step)



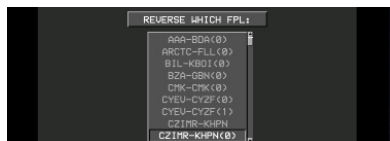
1) Press **FPL (L1)**.



2) Scroll **1** to **CREATE-EDIT..** and push to enter.



3) Scroll **1** to **REVERSE FLIGHT PLAN** and push to enter.



4) Scroll **1** to desired flight plan and push to enter.



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

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



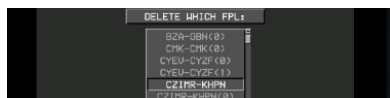
1) Press **FPL (L1)**.



2) Scroll **1** to **CREATE-EDIT..** and push to enter.



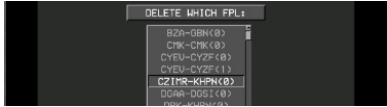
3) Scroll **1** to **DELETE FLIGHT PLAN** and push to enter.



4) Scroll **1** to desired flight plan to delete. Push to enter.



5) Push **1** to **CONFIRM DELETE FPL**.



6) The next flight plan is highlighted.



7) If no further deletions, press **EXIT (R1)**.

5.7.11. Create User Waypoint (LAT-LON) (Step-By-Step)

User waypoints may be created with three methods:

- 1) Latitude and longitude
- 2) Radial and distance
- 3) Overfly (Designate)



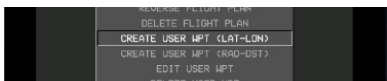
To create a user waypoint using latitude and longitude follow this step-by-step procedure.



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



2) Scroll **1** to **CREATE-EDIT..** and push to enter.



3) Scroll **1** to **CREATE USER WPT (LAT-LON)** and push to enter.



4) To name a new user waypoint, scroll **1** and push to enter all five character spaces.



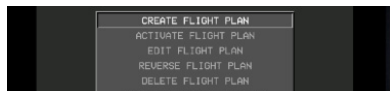
5) With new user waypoint name created, push **1** to proceed through all fields as necessary.

Approach bearing preloading depends on mode of flight as follows:

On Ground: Preloaded with current heading

In Flight: Preloaded with “OFF” value.

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 (R8)** to save user waypoint and return to editing screen.

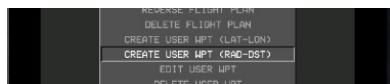
5.7.12. Create User Waypoint (RAD-DST) (Step-By-Step)



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



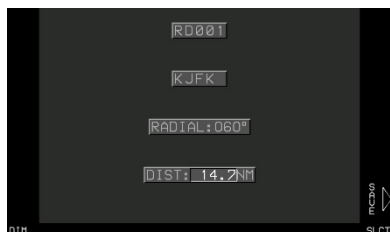
- 2) Scroll **1** to **CREATE-EDIT..** and push to enter.



- 3) Scroll **1** to **CREATE USER WPT (RAD-DST)** and push to enter



- 4) Identifier is automatically named “RD###” where ### is the next available radial distance waypoint number.
- 5) Scroll **1** to enter identifier for reference waypoint. If a single search result, menu advances to radial entry box. If multiple search results appear, a list appears. **INFO (R6)** appears to verify each waypoint information.



- 6) Scroll **1** to enter the radial entry and distance as the KJFK. 060° at 14.7 NM.

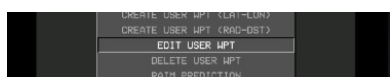
5.7.13. Edit User Waypoint (Step-By-Step)



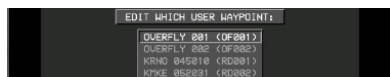
- 1) Press **FPL (L1)**.



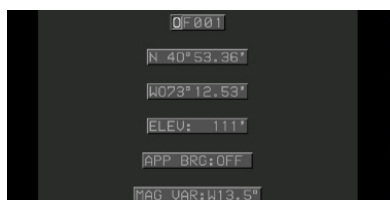
- 2) Scroll **1** to **CREATE-EDIT..** and push to enter.



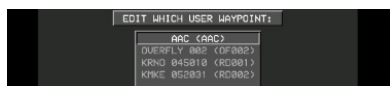
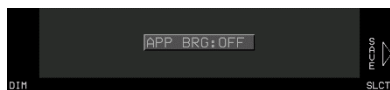
- 3) Scroll **1** to **EDIT USER WPT** and push to enter.



- 4) Scroll **1** to waypoint to be edited. Push to enter.



- 5) Use **1** to enter alphanumeric characters. Follow on-screen prompts to edit information. Push **1** to step through all character spaces. To back up, press **BACK (L1)** and continue to the end of all character spaces. Press **SAVE (R8)** to save all changes.



- 6) Select another USR WPT to edit or press **EXIT (R1)** to save changes.

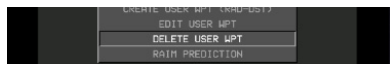
5.7.14. Delete User Waypoint (Step-By-Step)



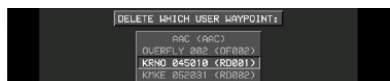
1) Press **FPL (L1)**.



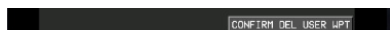
2) Scroll **1** to **CREATE-EDIT..** and push to enter.



3) Scroll **1** to **DELETE USER WPT** and push to enter.



4) Scroll **1** to desired waypoint to be deleted.



5) Push **1** to confirm **DEL USER WPT**.



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

NOTE:

Alterations of user waypoint parameters while in flight are not automatically updated to an active flight plan.

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, which uses the user waypoint.
- 3) Delete the existing waypoint from the flight plan.
- 4) Save and exit.
- 5) Reload the flight plan if it were in use.

5.7.15. RAIM Prediction (Step-By-Step)



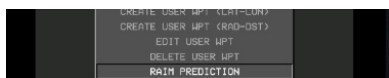
When selected, the RAIM prediction screen is only shown if the GPS/SBAS receiver is capable of performing a RAIM Prediction (not suitable for enroute predictions). This requires there be no faults along with a current almanac in memory. The FAULTS menu may be monitored to determine if the GPS/SBAS receiver is capable of performing a RAIM prediction.



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



- 2) Scroll **1** to **CREATE-EDIT..** and push to enter.

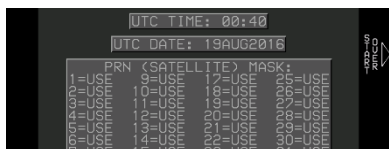


- 3) Scroll **1** to **RAIM PREDICTION**. Push to enter.

SEE NOTE BELOW.



- 4) If another RAIM Prediction is necessary, press **START OVER (R6)** to start again or press **EXIT (R1)** to exit.



NOTE:

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

- 1) Designated Waypoint: Prompted to enter an identifier for the designated waypoint. If there is a single result, advanced to UTC time entry box. If there is no result, re-prompted to enter an identifier. If there are multiple results, a selection list with matching identifiers is presented and, upon selection, is advanced to UTC time entry box. **INFO (R6)** aids in selection and gives access to information for the highlighted results.
- 2) UTC Time Entry: Allows entry of the 24-Hour UTC estimated time of arrival at the designated waypoint.
- 3) UTC Date Entry: Allows entry of the UTC estimated date of arrival at the designated waypoint.
- 4) PRN Mask Entry: Allows specification the PRN number of satellites expected to be unavailable at the destination.
- 5) EXIT: Exit of the RAIM prediction screen at any time.
- 6) Once a designated waypoint and UTC estimated time of arrival are entered, **CALC (R6)** appears to initiate the RAIM Prediction. 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 \pm in 5-minute increments. Once a prediction is complete, press **START OVER (R6)** to perform another prediction without exiting the RAIM Prediction screen.

5.8. Active Flight Plan (ACTV) Menu

See Section 7 IFR Procedures for active flight plan description.

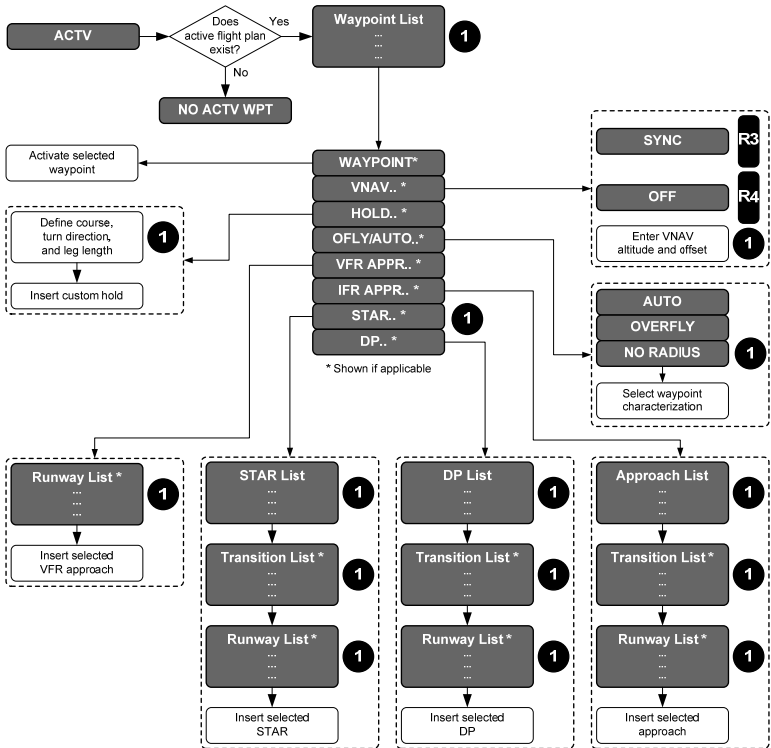


Figure 5-15: Active Flight Plan Main Menu

5.8.1. Active Flight Plan (ACTV) Menu Options

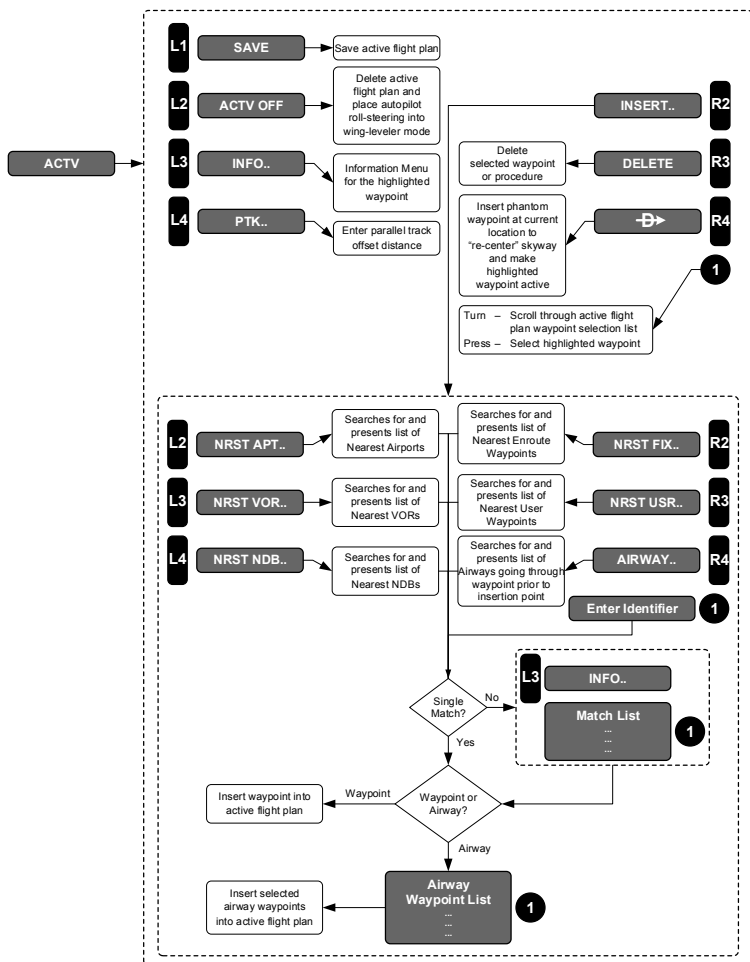


Figure 5-16: Active Flight Plan Menu Options

Various options appear at the same menu level as the Nav Log selection list. The following options allow various modifications to be made to the active flight plan:

- 1) **SAVE (L1):** Saves the active flight plan. Stored flight plans are saved without procedures or phantom waypoint (this is a safety item as procedures potentially change every 28 days). Stored flight plans are named by their first and last waypoints. If the

new stored flight plan has the same start and end points as a previously saved flight plan but has different routing, a number (0 - 9) is appended to the name to uniquely identify up to 10 routings with the same start and end points.

- 2) **ACTV OFF (L2)**: Deletes the active flight plan. Pilot is prompted to confirm deletion prior to completion of the operation.
- 3) **INFO (L3)**: Activates the information menu option for the highlighted waypoint.
- 4) **PTK (L4)**: If the active leg can be offset, allows the pilot to specify a parallel offset distance for non-procedure segments of the active flight plan. The range of parallel offsets are from 20NM left of track to 20NM right of track in 1NM increments.
- 5) **INSERT/ADD (R2)**: Insert or add a waypoint or airway into the active flight plan. If the highlighted position is one position past the end of the active flight plan, the tile reads **ADD**; otherwise, it reads **INSERT**. When the highlighted waypoint is the second or subsequent waypoint of a procedure, the tile does not appear. This prevents corruption of IFR approaches, STARs, and DPs. When activated, the pilot is prompted to enter an identifier. Performing a search for waypoints requires the entry of at least two characters. If only one character is entered, only airways are searched.

For waypoints, if there is a single result from the search, it is inserted or added to the active flight plan. 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. The selected waypoint is inserted or added to the active flight plan. **INFO** appears at this level to give access to information and aid in selection.

For airways, a search is performed for all airways going through the highlighted waypoint and matching the entered identifier (i.e., to get a list of all Victor airways going through the highlighted waypoint, enter an identifier string of "V"). If there is a single result from the search, a list of airway waypoints is shown for the pilot to select the desired exit point. 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 airway identifiers is presented. Upon selection, a list of airway waypoints is shown for the pilot 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.

- 6) **NRST APT (L2)**: Performs a search for 20 airports within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no airports within 240NM with a runway length greater than or equal to the minimum runway length setting), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO** appears at this level to give access to information and aid in selection.
- 7) **NRST FIX (R2)**: Performs a search for 20 fixes within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no fixes within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO** appears at this level to give access to information and aid in selection.
- 8) **NRST NDB (L4)**: Performs a search for 20 NDBs within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no NDBs within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO** appears at this level to give access to information and aid in selection.
- 9) **NRST USR (R3)**: Performs a search for 20 user waypoints within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no user waypoints within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO** appears at this level to give access to information and aid in selection.

- 10) **NRST VOR (L3)**: Performs a search for 20 VORs within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no VORs within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO** appears at this level to give access to information and aid in selection.
- 11) **Identifier Entry Box**: Option to enter an identifier where the encoder message otherwise appears. Performing a search for waypoints requires the entry of at least two characters. After entering two identifier characters, **SEARCH (R8)** appears that allows an immediate search to begin if desired. If there is a single result from the search, the result is inserted or added to the active flight plan. If there is no result from the search, the pilot is re-prompted to enter identifier. If there are multiple results from the search, a selection list with matching identifiers is presented. The selected waypoint is inserted or added to the active flight plan. **INFO** appears at this level to give access to information and aid in selection.
- 12) **DELETE (R3)**: If the highlighted waypoint is a non-procedure waypoint, deletes the highlighted waypoint from the active flight plan. If the highlighted waypoint is part of a procedure, the function deletes the entire procedure from the active flight plan after confirmation. **DELETE (R3)** does not appear if the highlighted waypoint is a non-procedure waypoint, and there are fewer than three non-procedure waypoints in the active flight plan. This is because an active flight plan must always have at least two non-procedure waypoints. **DELETE (R3)** also does not appear when the highlighted waypoint is suppressed, or when the highlighted position is one position past the end of the active flight plan.
- 13) **DIRECT (R4)**: Inserts a phantom waypoint at the current aircraft location and makes the highlighted waypoint active. The phantom waypoint is a fly-over defined entry waypoint, and the leg prior to the phantom waypoint is designated a discontinuity. This assures the skyway is re-centered to provide guidance to the new active waypoint. **DIRECT (R4)** does not appear when the highlighted waypoint is suppressed, or when the highlighted position is one position past the end of the active flight plan.

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



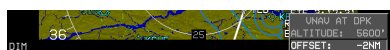
1) Press **ACTV (L2)** to view active flight plan.



2) Scroll **1** to desired waypoint. Push to enter.



3) Scroll **1** to desired option (for example, **VNAV..**) and push to enter.



4) As one option, a VNAV setting is entered. (Be at 5600' 2NM prior to crossing DPK.)



5) As another option, press **DELETE (R3)** to delete the next waypoint (DPK).



6) Push **1** to **CONFIRM DEL WPT.**

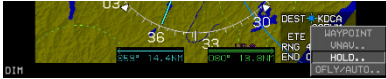


5.8.3. Active Flight Plan (ACTV) Menu (Step-By-Step)

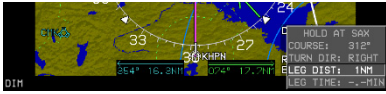


1) With desired flight plan selected and activated, press **ACTV (L2)** to view active flight plan.

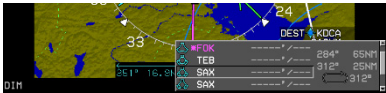
2) Scroll **1** to desired waypoint. Push to enter.



- 1) If a HOLD is desired, scroll **1** to **HOLD** and push to enter.



- 2) Scroll **1** to set inbound course and push to enter. Set leg distance or leg time. Push to enter.



- 3) View active flight plan with holding pattern indicated.

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



- 1) With active flight plan displayed, press **INSERT (R2)** to see NRST options.



- 2) Press **NRST APT (L2)**, **NRST VOR (L3)**, **NRST NDB (L4)**, **NRST FIX (R2)**, **NRST USR (R3)**, or **NRST AIRWAY (R4)** to view applicable list. Scroll **1** to desired selection and push to insert into active flight plan.

5.9. Information (INFO) Menu

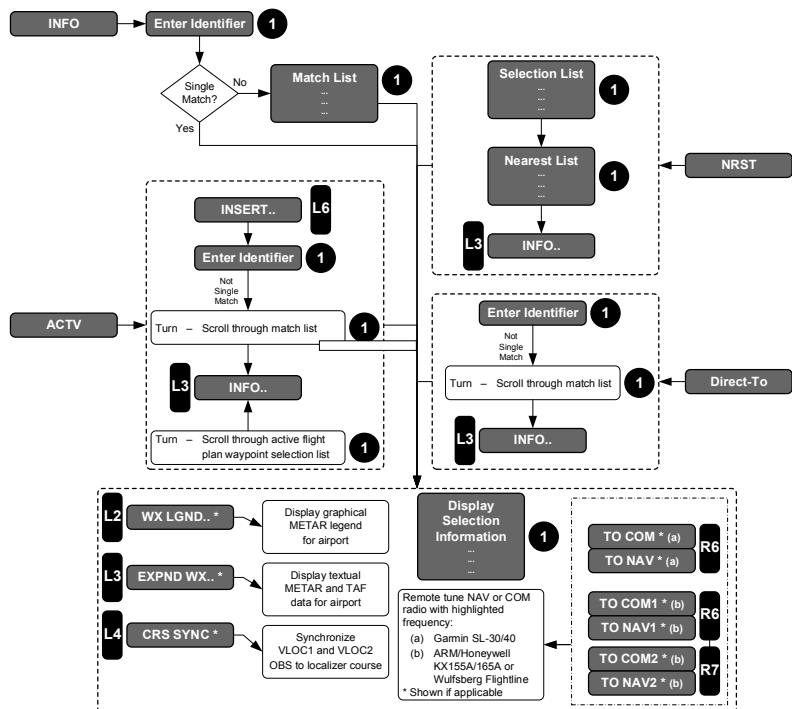


Figure 5-17: Information Menu

If **INFO** is activated from within the **ACTV**, **NRST**, or **Direct** menus, information on the highlighted waypoint is shown. Otherwise, the function checks for an active waypoint. If there is an active waypoint, it becomes the default entry. If there is no active waypoint, then the nearest airport becomes the default entry. If the default entry is accepted, then information for the default entry is shown. If the user rejects the default entry by entering identifier characters, then a search for matching characters is performed. Only two identifier characters are needed prior to searching, therefore after entering two identifier characters, **SEARCH (R4)** appears which allows an immediate search to begin if desired. If there is a single result from the search, information for that result is shown. If there is no result from the search, the user is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented to allow the user to select the desired identifier.

The amount and type of information presented depends upon the type of waypoint as follows:

Table 5-4: INFO Menu Information

Type	NAVAID	Airports	With Datalink Enabled
Waypoint Identifier	NAVAID Type	Communication frequencies	Airport Graphical METAR
Waypoint Type	Frequency	Airport runway data	Current Altimeter setting
Waypoint elevation			Current Wind
Long Name			If textual METAR data is not available, all conditions are followed by "___"
Bearing and distance			
Latitude and longitude			

Table 5-5: INFO Menu (Not Configured for Audio/Radio Management) (Remote Tuning Enabled) ^{(1) (2)}

Single Frequency Associated with Waypoint	Conditions	Frequencies <118 MHz (NAV)	Frequencies >118 MHz (COM)
NAV or COM tiles	More than one frequency with waypoint when highlighted in INFO block	TO NAV1 (R2) TO NAV2 (R3)	TO COM1 (R2) TO COM2 (R3)

(1) Where remote tuning is enabled for Garmin SL-30/40 radios, only a single **TO COM** or **TO NAV** is shown at (R2).

(2) Where remote tuning is enabled for ARM/Cobham CD/Honeywell KX radios, **TO COM1 (R2)** or **TO NAV1 (R2)** and **TO COM2 (R3)** or **TO NAV2 (R3)** appear.

NOTE:

Frequencies are only sent to com or nav radios in the standby position. The pilot must swap frequencies to the active position in the applicable radio unless configured with audio radio management feature as shown in Figure 5-18 and Figure 5-19.

5.9.1. Audio Radio Management**Figure 5-18: Audio Radio Management COM Frequencies****Figure 5-19: Audio Radio Management NAV Frequencies**

When configured for audio radio management, pressing either COM or NAV buttons for ACTIVE or STBY positions sends the frequency accordingly to the devices active or standby radio positions.

When airport weather information is presented in the information block, **WX LGND (L2)** and **EXPND WX (L3)** appears for selection options.

5.9.2. Information Presented for ILS or Localizer Waypoint

When the information presented is for an ILS or localizer waypoint and the current VLOC1 or VLOC2 omnibearing selectors are not synchronized with the localizer course, **CRS SYNC (L4)** allows one-touch synchronization of the VLOC1 and VLOC2 omnibearing selectors to the localizer course.

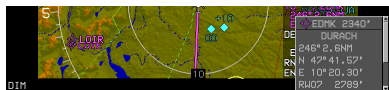


Figure 5-20: CRS SYNC

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



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



- 2) Push **1** to view information.

5.10. Omnibearing Selector (OBS) Menu

OBS menu allows the pilot to control the omnibearing selector for showing course deviations. Press **FMS (L2)** to specify a manual or automatic OBS setting in which the active OBS is controlled by the active flight plan. OBS for VLOC1 allows the pilot to specify the active OBS setting for the VLOC1 navigation function. OBS for VLOC2 allows the pilot to specify the active OBS setting for the VLOC2 navigation function. Manual **FMS, VLOC1, and VLOC2 OBS** settings are settable in increments of 1°. **OBS SYNC (R3)** synchronizes the Manual **FMS, VLOC1, or VLOC2 OBS** settings (depending upon HSI source) to the inbound course or, if the inbound course cannot be determined, to aircraft heading. When HSI source is FMS, **OBS AUTO/OBS MAN (R4)** toggles between automatic and manual OBS settings.

NOTE:

If true north mode discrete input is not configured, the OBS menu allows the pilot to toggle between **TRUE NORTH** and **MAG NORTH** modes.

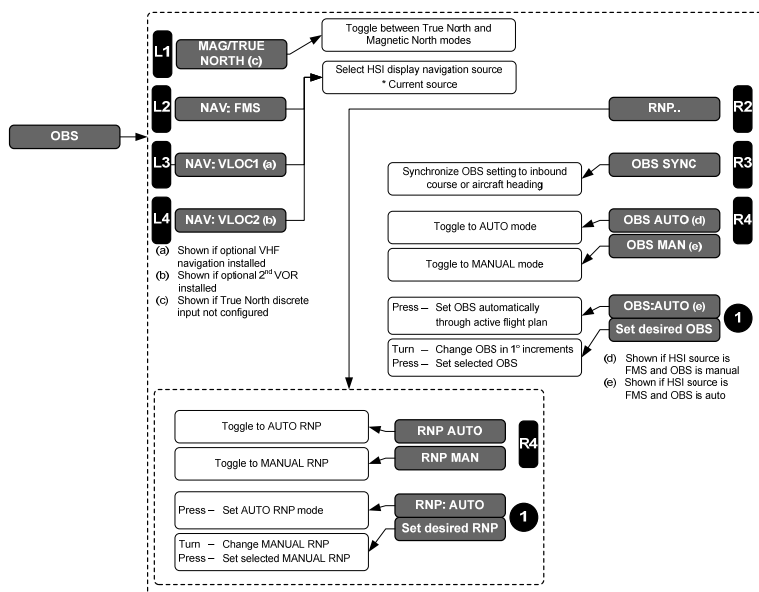


Figure 5-21: Omnibearing Selector (OBS) Menu

With VOR symbology enabled, the OBS function also permits the pilot to select either **FMS**, **VLOC1**, or **VLOC2** as the HSI source. The HSI source selects the navigation source used to generate HSI guidance symbology. The OBS function also permits the pilot to select between manual and automatic RNP settings.

Upon selecting **RNP.. (R2)**, **RNP AUTO/RNP MAN (R4)** toggles between automatic and manual RNP settings. Manual RNP is selectable between 0.10NM and 15NM as follows:

- 1) 0.01NM increments between RNP 0.10 and RNP 0.3
- 2) 0.1NM increments between RNP 0.3 and RNP 2
- 3) 1NM increments between RNP 2 and RNP 15

5.10.1. Omnibearing Selector (OBS) Menu (Step-By-Step)



- 1) Before pressing **OBS (L4)** to make any OBS changes, view the current setting to see **FMS1** is selected.



- 2) Press **OBS (L4)** and select HSI source or change to **OBS MANUAL (R4)**. (There must be an active waypoint selected to use Manual OBS.)



- 3) When the OBS is set to FMS, VLOC1, or VLOC2, scroll **1** to select new OBS course.



- 4) To select Manual RNP press **OBS (L4)**.



- 5) Press **RNP (R2)**.

- 6) Press **RNP MANUAL (R4)**.

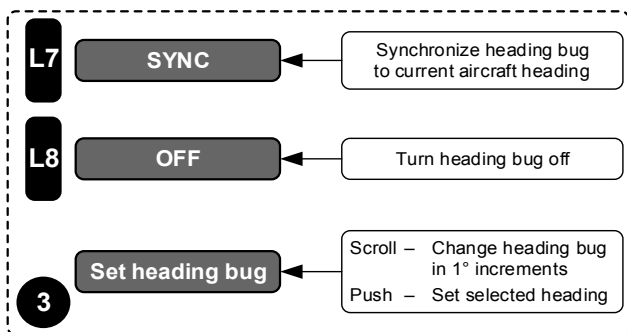


- 7) Scroll **1** to desired FSD and push to enter to view estimate of position uncertainty required in RNP airspace.

RNP: 1.5M
ANP: 0.1

5.11. Heading Bug (HDG) Menu

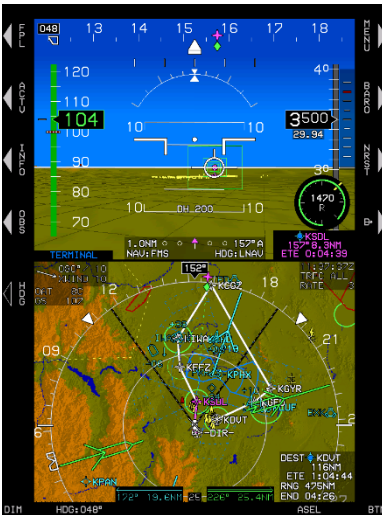
Use the heading bug menu to set the heading bug in increments of 1°, synchronize to current heading, or turn off heading bug.



PFD (Normal and Essential modes)
MFD (Essential Mode only)

Figure 5-22: Heading Bug (HDG) Menu

5.11.1. HDG Bug (HDG) Menu (Step-By-Step)



- 1) Press **HDG (L5)** to exit LNAV mode.
- 2) Scroll **3** to desired heading.
- 3) Press **SYNC (L7)** to synchronize to current heading.

Figure 5-23: Heading Bug with Analog Autopilot or HelisAS-E



- 1) Scroll **3** to enter Heading mode.
- 2) Scroll **3** to change heading bug in 1° increments.
- 3) Push **3** to select new heading or press **SYNC (L7)** to synchronize current heading.
- 4) Press **OFF (L8)** to turn off heading bug.

Figure 5-24: Heading Bug without Analog Autopilot

5.12. Nearest (NRST) Menu

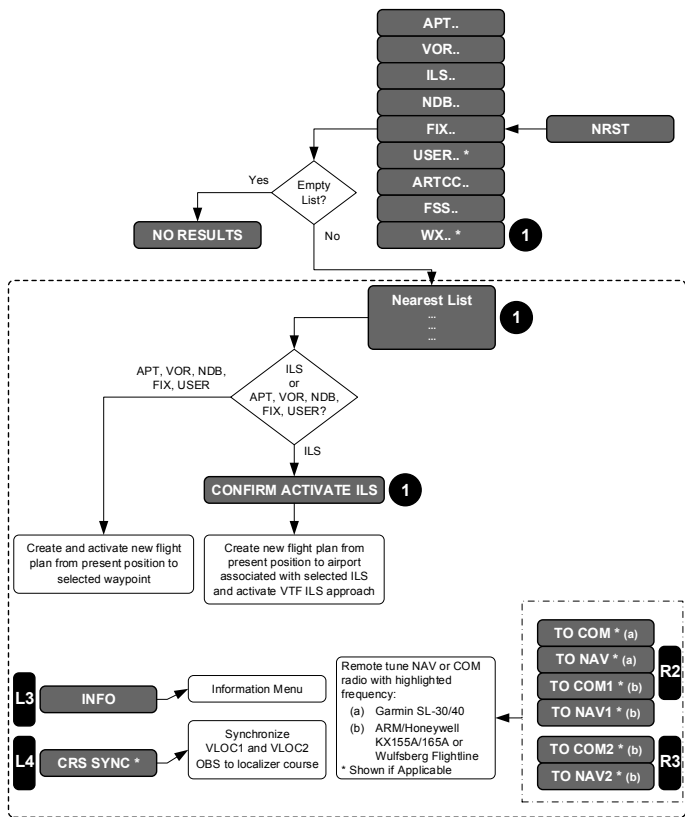


Figure 5-25: Nearest (NRST) Menu

Upon selecting a category from the option list, a list of up to 20 items within 240NM matching the category appears. If the list is empty (i.e., no items within 240NM), **NO RESULTS** is displayed. The selection list includes identifier, bearing, and distance to the item. The list of airports contains only airports with runway length greater than or equal to the minimum runway length setting as configured during installation.

The list for airports, VORs, ILSs, NDBs, ARTCCs, and FSSs includes an associated frequency (CTAF in for airports). Tiles allow transmission of the associated frequency to remote NAV or COM radios. If the frequency is greater than or equal to 118 MHz, tiles

read **TO COM#**, and transmission is addressed to COM radios. If the frequency is less than 118 MHz, tiles read **TO NAV#**, and transmission is addressed to NAV radios, **TO COM1** or **TO NAV1 (R2)**, while a **TO COM2** or **TO NAV2 (R3)** position.

NOTE:

Frequencies are only sent to com or nav radios in the standby position. The pilot must swap frequencies to the active position in the applicable radio. If Garmin SL-30/40 radios are enabled in the EFIS limits, only **TO COM (R2)** and **TO NAV (R2)** appear.

When the results for airports, VORs, NDBs, fixes, and user waypoints are displayed, **INSERT (R2)** inserts a waypoint into the active flight plan at the active waypoint position. This feature facilitates rapid clearance changes from air traffic control. To prevent corruption of IFR approaches, STARs, and DPs, **INSERT (R2)** does not appear if the active waypoint is within a procedure.

When the results for airports, VORs, ILSs, NDBs, fixes, and user waypoints are displayed, **INFO (L3)** provides further information on the highlighted item.

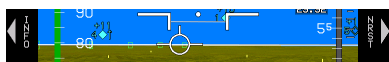
In the case of **NRST ILS** where the current VLOC1 or VLOC2 OBS does not match the localizer course, **CRS SYNC (L4)** synchronizes VLOC1 and VLOC2 OBS to the localizer course.

Upon selecting airport, VOR, NDB, fix, or user waypoint, a new active flight plan is created from present aircraft position to the selected waypoint. Upon selecting ILS, **CONFIRM ACTIVATE ILS** is displayed. When the ILS is confirmed, the following actions occur:

- 1) A direct flight plan to the airport associated with the ILS is created;
- 2) A vectors-to-final ILS approach to the ILS is activated;
- 3) If the heading bug is turned OFF, it is activated to current heading to act as a starting point for receiving vectors (autopilot enabled systems only);
- 4) VLOC1 and VLOC2 OBS settings are set to the associated localizer course;
- 5) HSI source is switched as follows:

- If only one NAV is radio installed, the source for the selecting side is changed to VLOC1, but the other side does not change.
- If two NAV radios are installed, the default sensor for the selecting side controls which source is used. The source for the other side does not change.
- If remote tuning is enabled, connected NAV radios are remote tuned to ILS frequency.

5.12.1. Nearest (NRST) Menu (Step-By-Step)



- Press **NRST (R3)** to enter Nearest menu.



- Scroll **1** to select **APT** from list push to enter.



- Scroll **1** to desired airport and select to **INSERT** or **INFO**, or send frequency to **TO COM1 (R2)** or **COM2 (R3)**. (**TO COM** for Garmin SL-30/40 radios).

- Or if a nav frequency, either:



5.12.2. Nearest (NRST) Menu ILS (Step-By-Step)



- Press **NRST (R3)** to enter Nearest menu.



- Scroll **1** to **ILS..** and push to enter.



- 3) If selection is a LOC, no action is taken. The selection must be an ILS.
- 4) Scroll **1** desired airport and ILS approach then push to select and enter.
- 5) Push **1** to confirm and activate ILS.

5.13. Direct Menu

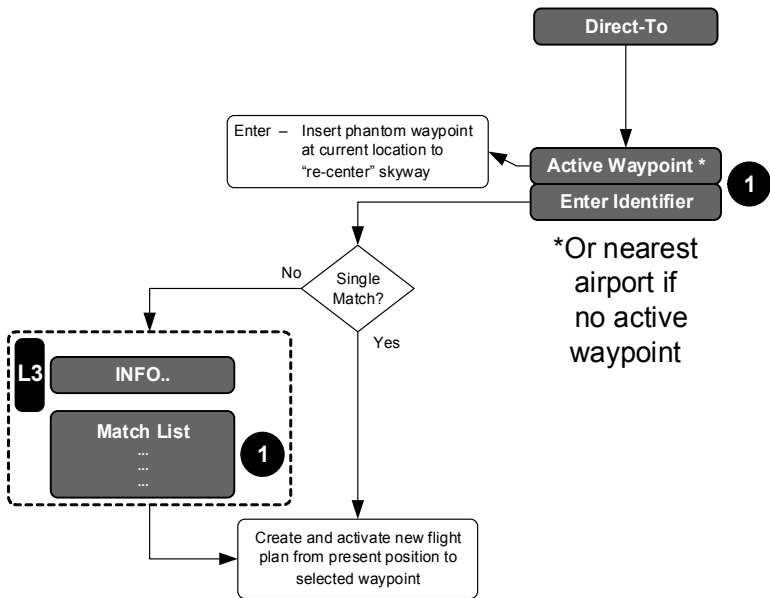


Figure 5-26: Direct Menu

Upon activating the direct menu from the top-level menu, the function checks for an active waypoint and, if found, it becomes the default entry. If there is no active waypoint, the nearest airport becomes the default entry.

If the default entry is the active waypoint and is accepted by the pilot, a phantom waypoint is inserted at the current aircraft location. The phantom waypoint is a fly-over defined entry waypoint, and the leg prior to the phantom waypoint is designated a discontinuity. This

assures the skyway is “re-centered” to provide guidance to the new active waypoint. The rest of the active flight plan remains unchanged.

If the default entry is not the active waypoint and is accepted by the pilot, the resulting action depends upon whether the aircraft is in the air or on the ground. If in the air, a new active flight plan is created from present aircraft position to the selected waypoint. If on the ground, a search is conducted for a database airport within 6NM. If an airport is found, a new active flight plan is created from the found airport to the selected waypoint. Otherwise, a new active flight plan is created from present aircraft position to the selected waypoint.

If the pilot rejects the default entry by entering identifier characters, a search for matching identifiers is performed. If there is a single result, the resulting action depends upon whether the aircraft is in the air or on the ground. If in the air, a new active flight plan is created from present aircraft position to the selected waypoint. If on the ground, a search is conducted for a database airport within 6NM. If an airport is found, a new active flight plan is created from the found airport to the selected waypoint. Otherwise, a new active flight plan is created from present aircraft position to the selected waypoint.

If there is no result, 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. Upon selection, the resulting action depends upon whether the aircraft is in the air or on the ground. If in the air, a new active flight plan is created from present aircraft position to the selected waypoint. If on the ground, a search is conducted for a database airport within 6NM. If an airport is found, a new active flight plan is created from the found airport to the selected waypoint. Otherwise, a new active flight plan is created from present aircraft position to the selected waypoint. **INFO** appears at this level to give access to information and aid in selection.

5.13.1. Direct Menu (Step-By-Step)



- 1) Press  (R4) to enter Direct menu.



- 2) Active or nearest airport waypoint appears.



- 3) Push **1** to insert a phantom waypoint at the current aircraft location or scroll **1** to enter new identifier.



- 4) If identifier is unknown, use **SEARCH (R4)**.



- 5) After creating new identifier, scroll **1** to the end and push to enter. A new active flight plan is created from the present aircraft position



5.14. Time (TIME) Menu

Upon selecting the time menu, a list appears to choose the count up timer, countdown timer, or flight time display. **OFF (R4)** turns off any active timer functions.

If the pilot selects the count up timer, the count up timer is activated. If the countdown timer is selected, the pilot is prompted to enter a start time from which the countdown begins. Shortcut buttons to quickly add or decrease by five-minute increments. After entering a start time, start the countdown timer or press **STORE (R4)** or push **1** to store the start time for later use.

If UTC offset is selected, the pilot is prompted to enter a UTC offset between -12:00 and +14:00 in 15-minute increments follow.

If the pilot selects the flight time display option, the elapsed time since the aircraft transitioned from ground to air mode is displayed for 10 seconds, or until any button is pressed. If the aircraft has not yet transitioned from ground to air mode, select the flight time display option to display the elapsed time as **FLT TM: 00:00:00**.

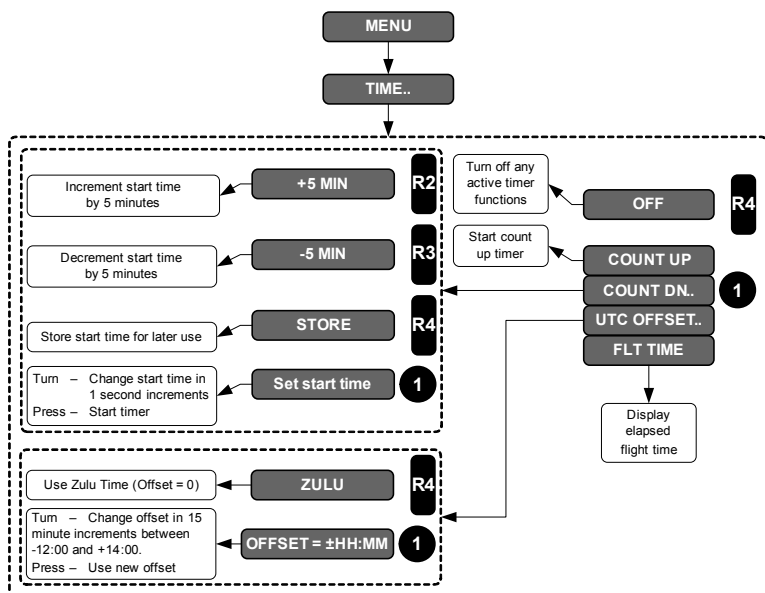


Figure 5-27: Time Menu

5.14.1. Time (TIME) Menu (Step-By-Step)



1) Press **MENU (R1)**.



2) Press **TIME (L4)** to enter the Time menu.



3) Scroll **1** to **COUNT UP**, **COUNT DN..**, **UTC OFFSET..**, or **FLT TIME**. Push to enter.



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



- 5) To turn off timer, press **MENU (R1)**, **TIME (L4)**, then press **OFF (R4)**.



- 6) To set offset for local time scroll **1** to **UTC OFFSET..**, Push to enter.

- 7) Scroll **1** to desired offset value. Push to enter.



- 8) Local time now appears where Zulu time was previously.

5.15. PFD Source (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 discrete input configuration:

- | | |
|-----------|-----------------------|
| 1) ADC1 | 6) EICAS2 |
| 2) ADC2 | 7) GPS1 |
| 3) AHRS1 | 8) GPS2 |
| 4) AHRS2 | 9) Radar Altimeter 1 |
| 5) EICAS1 | 10) Radar Altimeter 2 |



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

Figure 5-28: AHRS SLAVE/AHRS SLEW

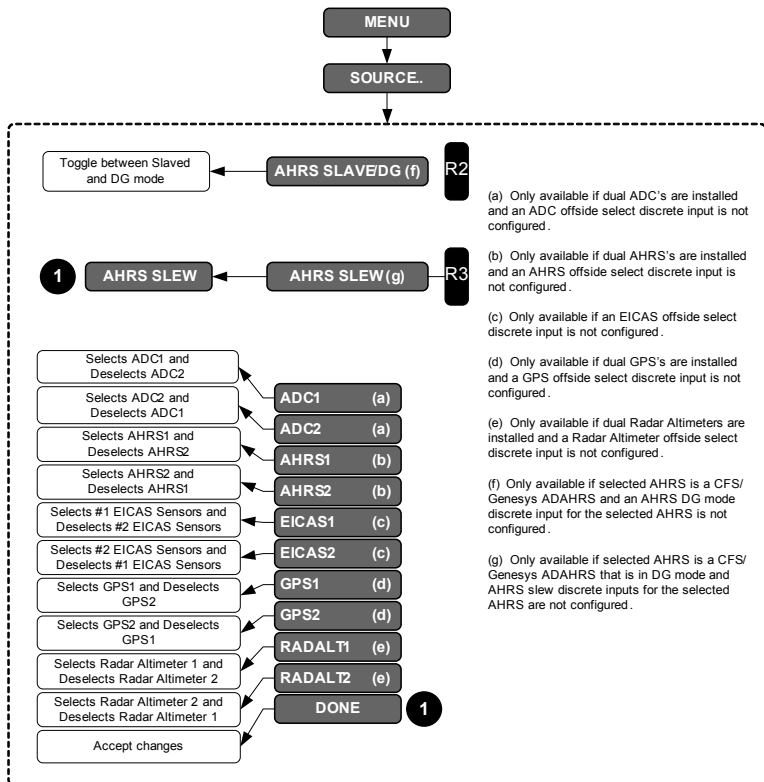


Figure 5-29: PFD Source Menu

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



1) Press **MENU** (R1).



2) Press **SOURCE** (L2).



3) Scroll **1** to check desired source, push to check, scroll to **DONE**, and push to enter.

5.16. PFD Bug (BUGS) Menu

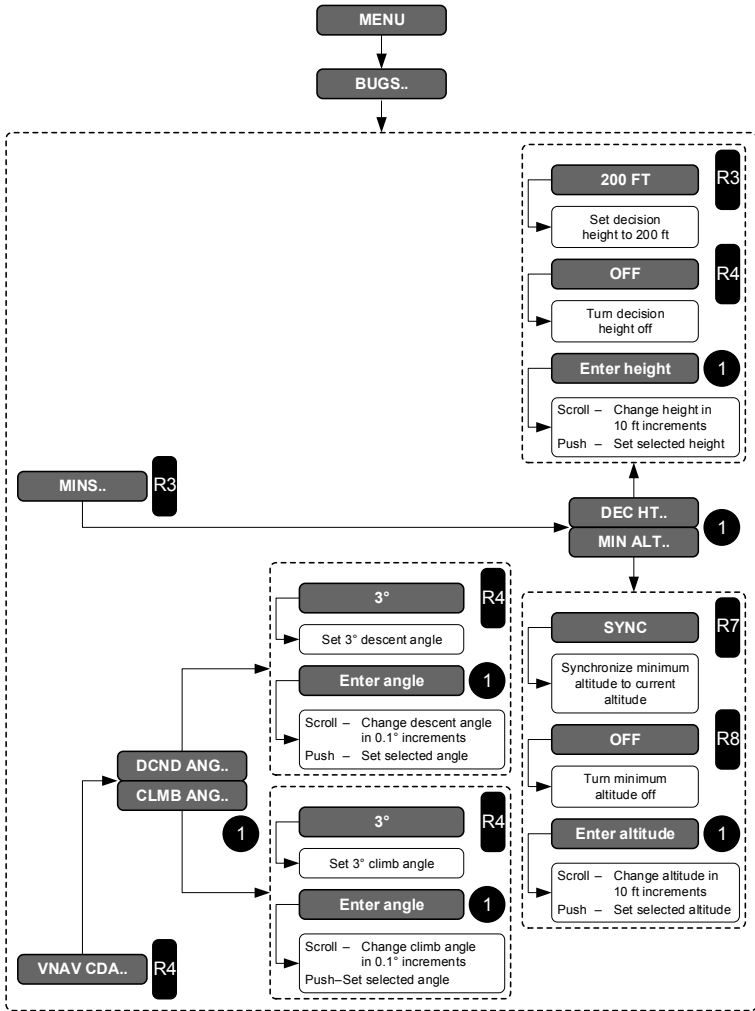


Figure 5-30: PFD BUGS (BUGS) Menu

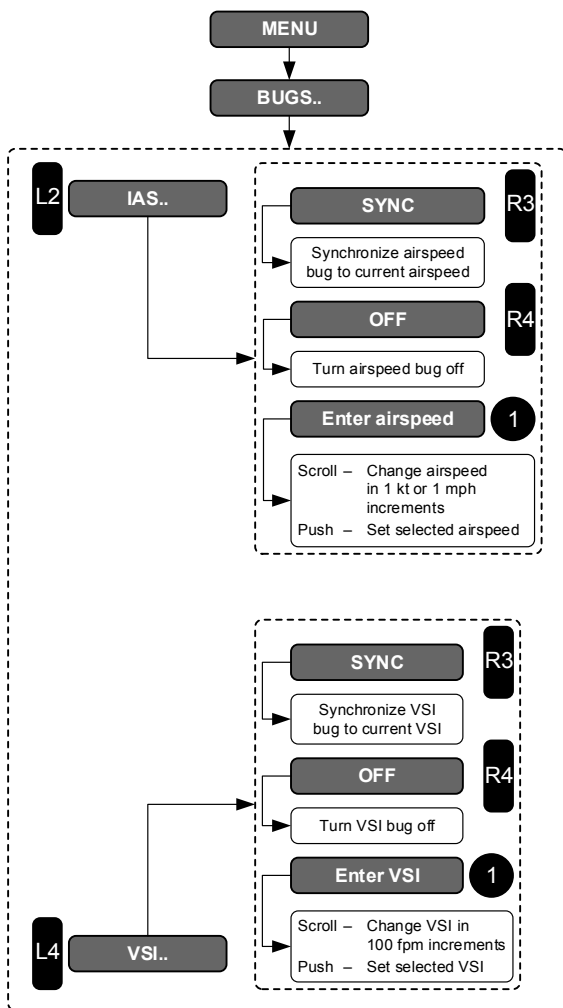


Figure 5-31: PFD BUG (BUGS) Menu (Continued)

Upon selecting the PFD bugs menu, the following options:

- 1) **MINS (R3)**: Push **1** to select **DEC HT..** then **200 FT (R3)** or **OFF (R4)**, or set DH in increments of 10' or;

Scroll **1** to select **MIN ALT..** press **SYNC (R3)** to synchronize minimums to current altitude or scroll **1** to desired minimum altitude in increments of 10';

- 2) **IAS (L2)**: Set airspeed bug to synchronize with current airspeed, turn off, or set the bug in increments of 1 knot IAS). (No higher than **V_{NE}**). (When integrated with HeliSAS-E in the IAS mode, it is not possible to turn off the airspeed bug.)
- 3) **VNAV CDA (R4)**: Set VNAV climb or descent angle (setting either in increments of 0.1° with corresponding feet per nautical mile, or selecting a shortcut for **3° (R4)**);
- 4) **VSI (L4)**: Set vertical speed by synchronizing the VSI bug to the current VSI, turning off the VSI bug, or setting the VSI bug in increments of 100 fpm. (When integrated with HeliSAS-E in VS mode, it is not possible to turn off the VSI bug.)

NOTE:

The airspeed bug and VSI bug are mutually exclusive and therefore selecting one turns off the other.

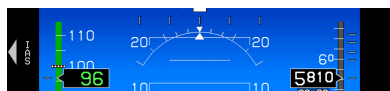
5.16.1. PFD Bug (BUGS) Menu (Step-By-Step)



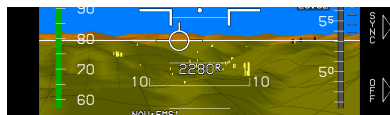
- 1) Press **MENU (R1)** then **BUGS (R2)** to enter the Bugs menu, or use remote bugs panel if equipped (see RBP appendix).



- 2) Press either **IAS (L2)**, **VSI (L4)**, **MINS (R3)**, or **VNAV CDA (R4)**.



- 3) If IAS is pressed, press **SYNC (R3)** or **OFF (R4)** to accept or turn off IAS bug.



- 4) For a different IAS bug, scroll **1** to select desired airspeed. Push to enter.



- 5) If **MINS (R3)** is pressed, scroll **1** to select **DEC HT..** or **MIN ALT..** and push to enter.





6) If **DEC HT..** is pressed, scroll **1** to create new decision height and push to enter.



7) New DH displays on the PFI area below the FPM.



8) If **VNAV CDA (R4)** is pressed, scroll **1** to select **DCND..** or **CLIMB..**. Push to enter.



9) If **DCND..** is pressed, scroll **1** to create the descent angle.



10) Push **1** to enter new descent angle (4.0°) and press **EXIT (R1)** or press **3° (R4)** to select default.

5.17. PFD Declutter (DCLTR) Menu

Upon activation of the PFD declutter menu, an option list of declutter items is shown (Table 5-6).

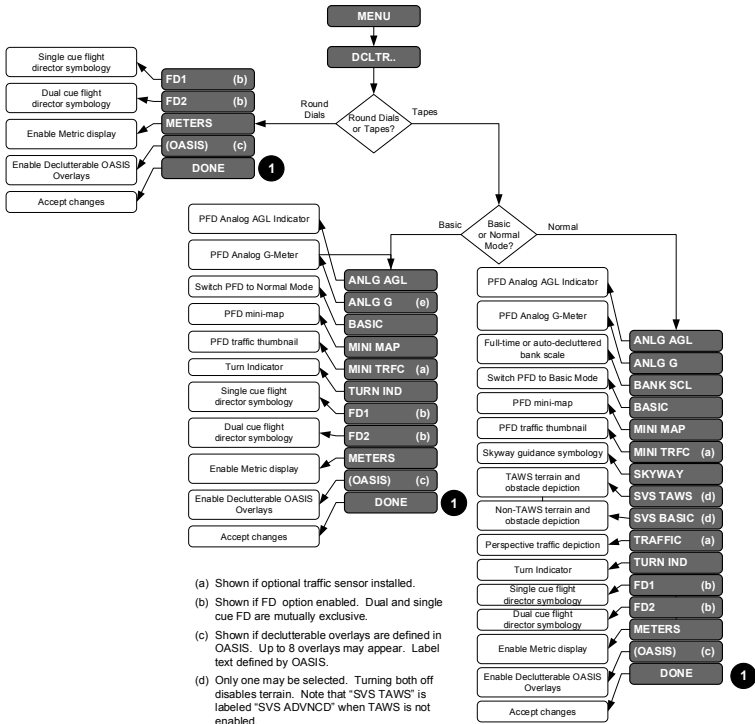


Figure 5-32: PFD Declutter (DCLTR) Menu

Table 5-6: PFD Declutter Options

Option	Configuration		Notes
	Tapes	Basic	
ANLG AGL	✓	✓	Mutually exclusive with MINI MAP, and MINI TRFC
BANK SCL	✓		Always in view while in basic mode
BASIC	✓	✓	
MINI MAP	✓	✓	Mutually exclusive with ANLG AGL, and MINI TRFC

Table 5-6: PFD Declutter Options

Option	Configuration		Notes
	Tapes	Basic	
MINI TRFC	✓	✓	Mutually exclusive with ANLG AGL, and MINI MAP
SKYWAY	✓		
SVS TAWS	✓		SVS TAWS is labeled “SVS ADVNCD” when TAWS is not enabled
SVS BASIC	✓		
TRAFFIC	✓		
TURN IND	✓	✓	
FD1	✓	✓	Mutually exclusive with FD2
FD2	✓	✓	Mutually exclusive with FD1
METERS	✓	✓	In addition to feet
(OASIS)	✓	✓	

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



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



2) Scroll **1** to **ANLG AGL, BANK SCL, BASIC, MINI MAP, MINI TRFC, SKYWAY, SVS TAWS, SVS BASIC, TRAFFIC, TURN IND, FD1, FD2, or METERS.** Push to enter.



3) If **BANK SCL** is unchecked, press **EXIT (R1)** or scroll **1** to **DONE** and push to enter.



4) Bank scale is removed while in level flight.



5.18. Altimeter Menu

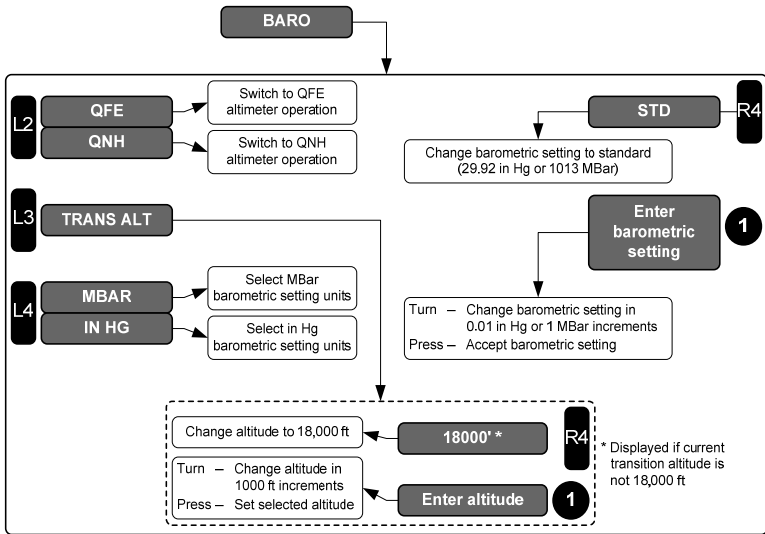


Figure 5-33: Altimeter Menu

Press **BARO (R2)** to activate the altimeter menu. Scroll **1** to increment (CW) or decrement (CCW) the barometric setting and push to accept the new barometric setting. In addition, the following options are available in the altimeter menu:

- 1) **QNH/QFE (L2):** Toggles between QNH and QFE altimeter operation. When in QNH mode, QNE operation is automatically selected when above the transition altitude with a standard altimeter setting. The following definitions:
 - a) **QFE:** Barometric setting resulting in the altimeter displaying height above a reference elevation (e.g., airport or runway threshold).
 - b) **QNE:** Standard barometric setting (29.92 inHg or 1013 mbar) used to display pressure altitude for flight above the transition altitude.
 - c) **QNH:** Barometric setting resulting in the altimeter displaying altitude above mean sea level at the reporting station.
- 2) **TRANS ALT (L3):** Changes transition altitude in units of 500 feet. Transition altitude is used to generate barometric setting

warnings and to determine QNE/QNH operation. If current transition altitude is not 18,000 feet, **18000'** (**R4**) sets the transition altitude as 18,000 feet.

- 3) **MBAR/IN HG (L4)**: Sets barometric setting units (inHg or mbar).
- 4) **STD (R4)**: Sets barometric setting to standard (29.92 inHg or 1013 mbar).

5.18.1. Altimeter Menu (Step-By-Step)



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

- 2) Scroll **1** to set proper QNH and push to enter. In this example, 1009 MBAR is set.



5.19. Altitude Bug (ASEL) Menu

Use the altitude bug menu to synchronize the target altitude of current altitude, turn off the target altitude, or set the target altitude in increments of 100 feet. (With the HeliSAS-E installed, "target altitude" refers to preselected altitude.)

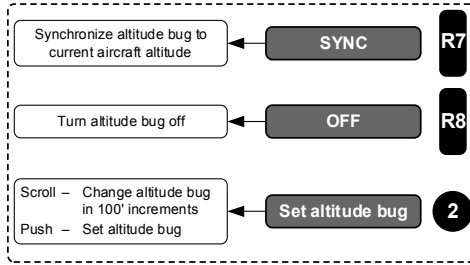


Figure 5-34: Altitude BUG Menu

5.20. Fault Display (FAULTS) Menu

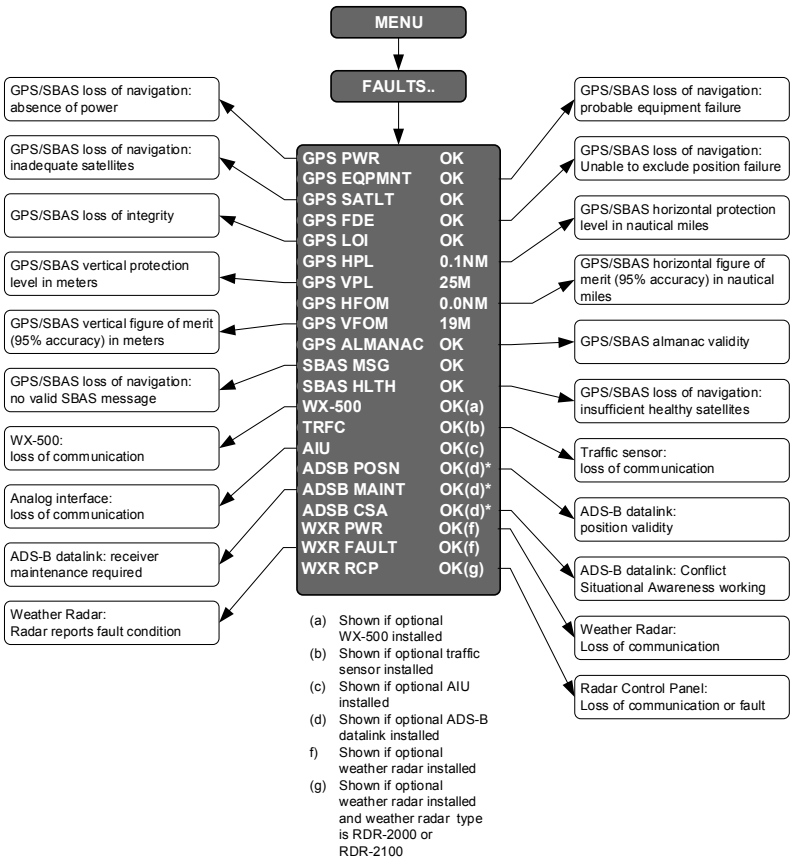


Figure 5-35: Fault Display Menu

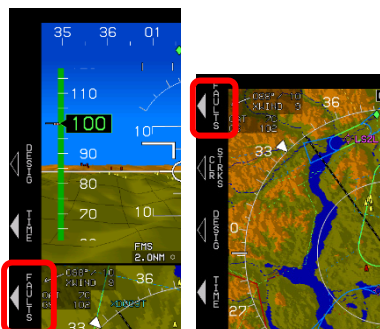
Upon selecting the faults menu, status of the following system parameters are displayed.

- 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).

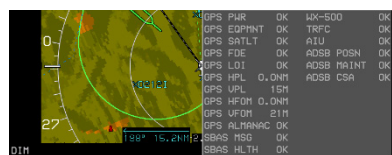
- 11) GPS/SBAS loss of navigation due to no valid SBAS message received for 4 seconds or more (SBAS MSG).
- 12) GPS/SBAS loss of navigation due to insufficient number of SBAS HEALTHY satellites (SBAS HLTH).
 - a) An Attitude or Range Fault Condition exists.
 - b) A Control Fault Condition exists.
 - c) A T/R Fault Condition exists.
- 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 (ARINC 453 label 055 or 171 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 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

- 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.
 - 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 or RDR-2100 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.

5.20.1. Fault Display (FAULTS) Menu (Step-By-Step) (PFD or MFD)



- 1) Press **MENU (R1)** then **FAULTS (L1 (MFD) or L5 (PFD))** to view the faults menu.



- 2) View status of GPS and equipment parameters.

5.21. Fuel Totalizer Quantity Setting (SET FUEL) Menu (PFD or MFD)

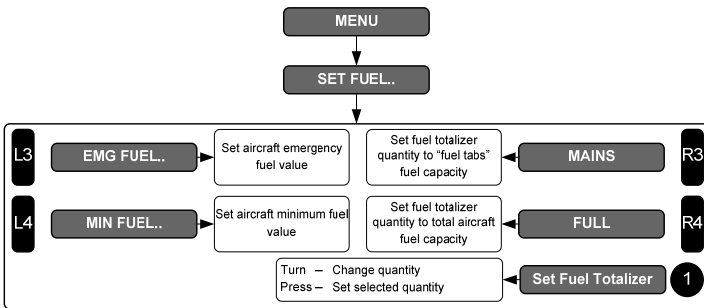


Figure 5-36: Fuel Totalizer Quantity Menu (PFD or MFD)

SET FUEL menu allows the pilot to:

- 1) Set the fuel totalizer quantity in increments of volume units.

If either a fuel totalizer or fuel level sensing (with no unmonitored fuel) is configured in the aircraft limits, set emergency and minimum fuel bugs in increments of volume units.

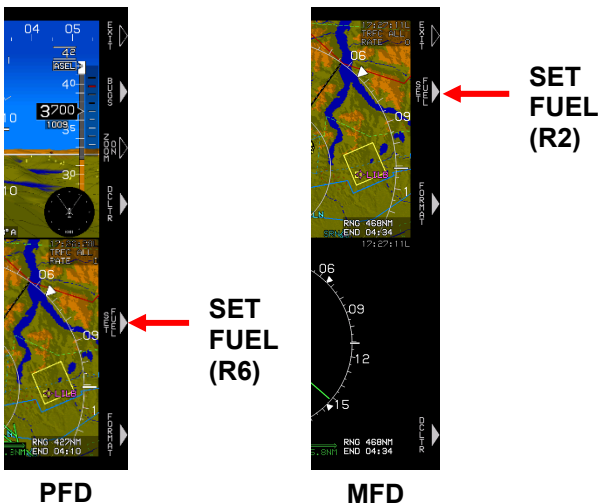


Figure 5-37: PFD/MFD SET FUEL

- 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

5.22. MFD Page (PAGE) Menu

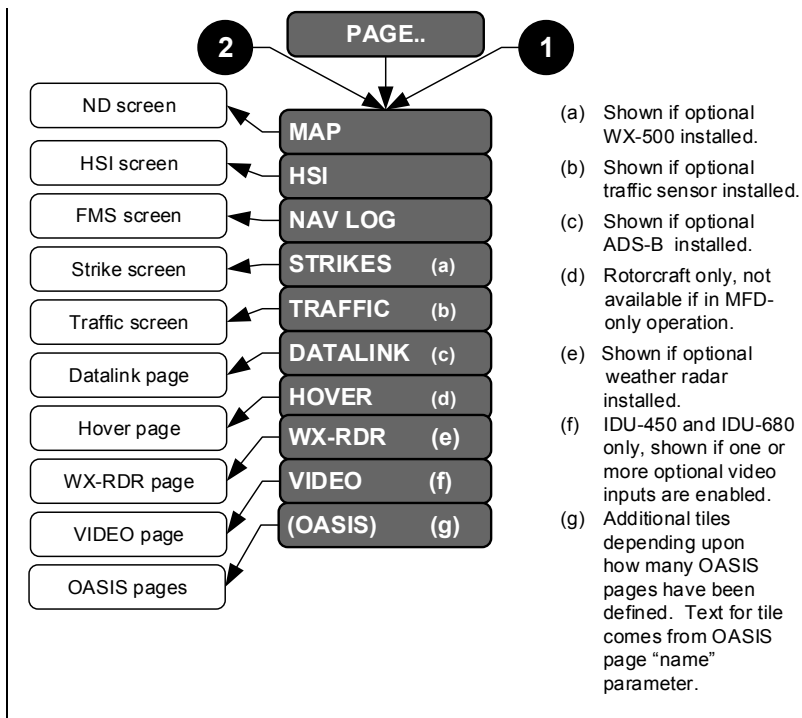


Figure 5-39: MFD Page (PAGE) Menu

When the OASIS file is setup so the TOP area of CPU#2 displays EICAS page full-time in Normal mode, the only page options available for the TOP area are:

- 1) If the EICAS page is minimized to a half page, a tile with appropriate OASIS name appears to restore the page to full size.

Otherwise, PAGE menu allows the pilot to select which MFD page to display:

- 1) **MAP**: ND page
- 2) **HSI**: HSI page
- 3) **NAV LOG**: FMS page. Not shown when in Essential mode when "Essential EICAS Page (MFD Overlay)" is assigned.

- 4) **STRIKES**: Strikes page (See Strikes appendix)
- 5) **TRAFFIC**: Traffic page (See Traffic appendix)
- 6) **DATALINK**: Datalink page (See Datalink appendix)
- 7) **HOVER** : Hover page
- 8) **WX-RDR**: Weather Radar page (See Weather appendix)
- 9) **OASIS**: If OASIS pages are configured. Not available in Essential mode when “Essential EICAS page (MFD Overlay)” is assigned. This option expands to the number of OASIS pages defined one tile per defined name. The tile text comes from the name parameter for the OASIS page. Pages are skipped on the PFD when in Essential mode and when the flight planner is shown.

5.22.1. MFD Page (PAGE) Menu (Step-By-Step)



- 1) Select **TOP** (2) or **BTM** (1) to change MFD pages.



- 2) Push (1) then scroll to **MAP, HSI, NAV LOG, STRIKES, TRAFFIC, DATALINK, HOVER, or VIDEO**. Push to enter.



- 3) Push (2) then scroll to **MAP, HSI, NAV LOG, STRIKES, TRAFFIC, DATALINK, HOVER, WX-RDR, or VIDEO** and push to enter.

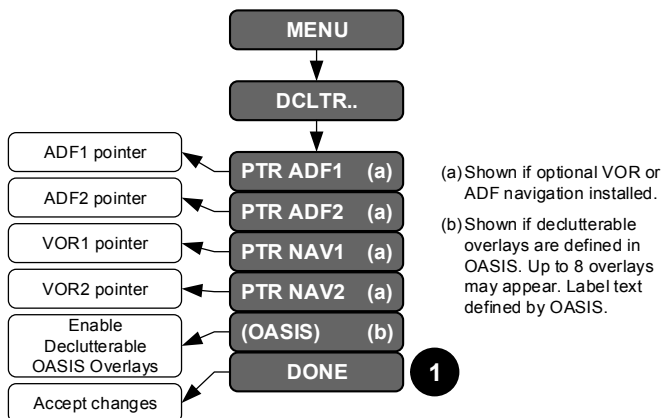
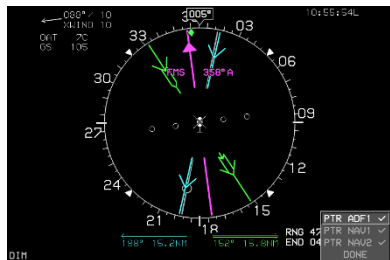
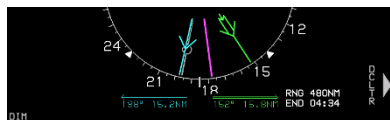


Figure 5-40: HSI Declutter Menu (PFD or MFD)

5.23.1. HSI Declutter (DCLTR) Menu (Step-By-Step)



- 1) Press **MENU (R1)** on MFD or PFD then **DCLTR (R4 or R8)** to enter Pointer menu.



- 2) Scroll **1** or **2** to **PTR ADF1**, **PTR NAV1**, or **PTR NAV2** and push to place check mark, then press **EXIT (R1)** or scroll to **DONE** and push to enter.

5.24. MFD ND Page Format (FORMAT) Menu

Upon selecting the MFD format menu when in the ND page, a list appears with the following options.

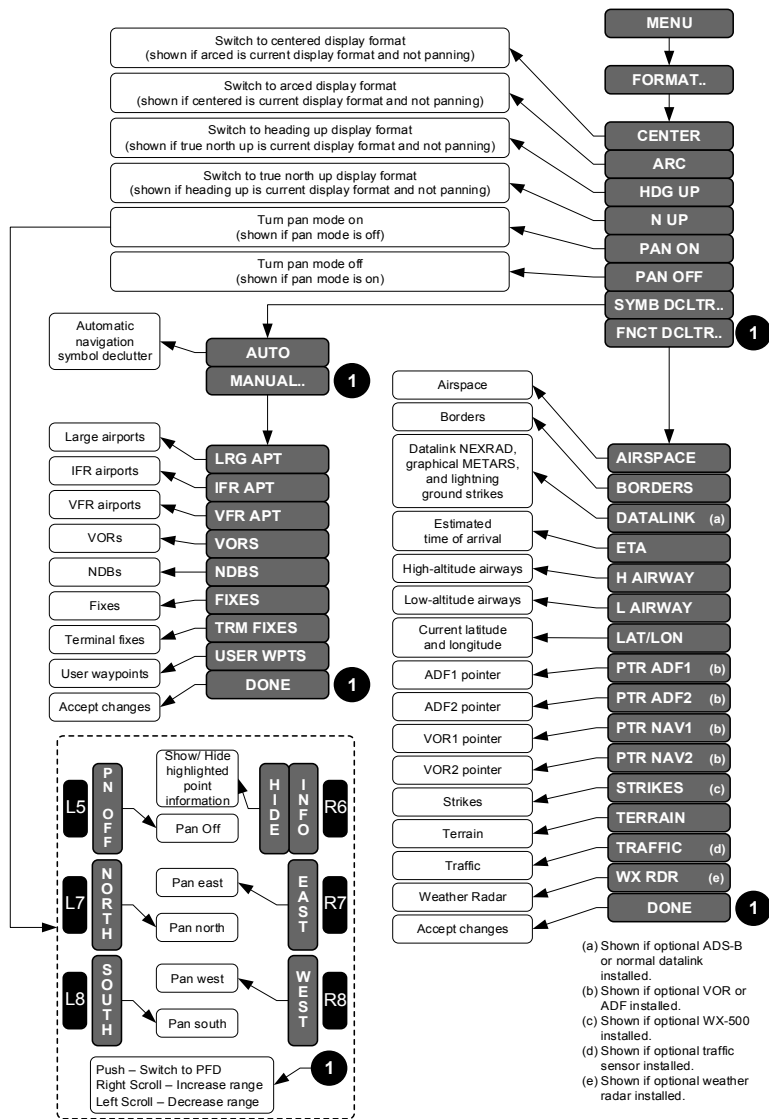


Figure 5-41: MFD ND Page Format (FORMAT) Menu

- 1) **CENTER/ARC:** Toggles between a centered and arced ND display format (if not panning).
- 2) **HDG UP/N UP:** Toggles between a heading up and North up ND display format (if not panning).
- 3) **PAN ON/PAN OFF:** Toggles ND page pan mode.
- 4) **SYMB DCLTR:** Activates a list to choose automatic or manual navigation symbol declutter. If the pilot chooses manual navigation symbol declutter, a list appears to individually select:
 - a) large airports;
 - b) IFR airports;
 - c) VFR airports;
 - d) VORs;
 - e) NDBs;
 - f) fixes;
 - g) terminal fixes; and
 - h) user waypoints.



Figure 5-42: MFD Symbol Declutter

Turning on VFR airports also turns on large and IFR airports. Turning on IFR airports also turns on large airports. Turning off large airports also turns off IFR and VFR airports. Turning off IFR airports also turns off VFR airports.

5) **FNCT DCLTR**: Activates a list to individually toggle display of:

- a) airspace;
- b) borders;
- c) if datalink ADS-B option is enabled;
- d) estimated time of arrival (ETA);
- e) high-altitude airways;
- f) low-altitude airways;
- g) current latitude and longitude display of ADF #1 pointer (if ADF symbology is enabled);
- h) ADF #2 pointer (if dual ADF symbology is enabled);
- i) VOR1 pointer (if VOR symbology is enabled);
- j) VOR2 pointer (if dual VOR symbology is enabled);
- k) Strikes (if WX-500 option is enabled);
- l) Terrain;
- m) Traffic (if traffic option is enabled); and
- n) Weather radar (if weather radar option is enabled).

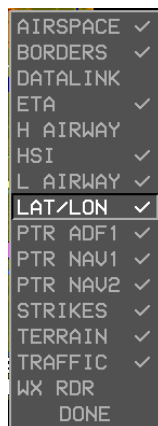


Figure 5-43: MFD Function Declutter

5.24.1. MFD ND Page Format (Step-By-Step)



5.24.1.1. Changing MFD ND Orientation



1) Press **MENU (R1)**.



2) Press **FORMAT (R8)**.



3) If in ARC mode, scroll **1** to **CENTER** and push to center display.



4) If in CENTER mode, scroll **1** to **ARC** and push to change back to ARC mode.



5) If in HDG UP mode, scroll **1** to **N UP** and push to change display to North Up orientation.



6) To enter pan mode, press **MENU (R1)** then **FORMAT (R8)**. Scroll **1** to **PAN ON** and push to enter.



7) To turn off pan mode, either press **PN OFF (L5)** or **MENU (R1)** and **FORMAT (R8)**. Scroll **1** to **PAN OFF** and push to enter.

5.24.1.2. Adding LAT/LON to MFD ND Page



1) Press **MENU (R1)**.



2) Press **FORMAT (R8)**.



3) Scroll **1** to **FNCT DCLTR..** Push to enter.

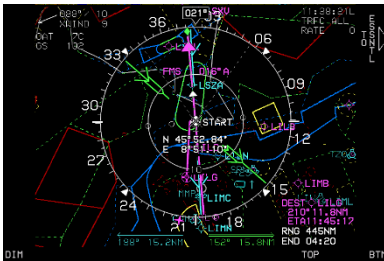


Latitude/longitude display is removed when a traffic alert is present.



- 4) Scroll **1** to **LAT/LON** and either press **EXIT (R1)** or scroll **1** to **DONE** and push to enter.

- 1) To turn off terrain, press **MENU (R1)** and **FORMAT (R8)**. Scroll **1** to **TERRAIN** and push to uncheck.



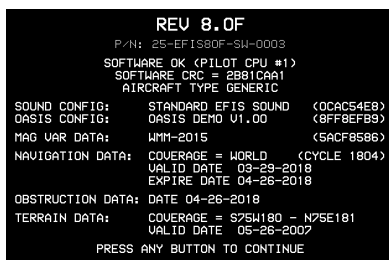
- 2) To exit menu, press **EXIT (R1)** or scroll **1** to **DONE** and push to enter. When the IDU is powered down and reinitialized, terrain remains in the off condition until restored.

Section 6 Quick Start Tutorial

Quick Reference Guide (DOC 64-000096-080F)



Begin by reading the EFIS Rotorcraft Flight Manual (RFM) or Rotorcraft Flight Manual Supplement (RFMS).



Power up the EFIS. The system performs a built-in test routine. If all tests pass, the system displays a screen identifying the database coverage. Press any button or push encoders **3**, **2**, or **1** to acknowledge. The system begins a two-minute count down while awaiting sensor initialization. For the purpose of flight planning, etc., press any button to override this countdown.



Encoders at the bottom of the IDU bezel are numbered 1-3 from the right side as noted. Scroll **3** to adjust the heading bug setting.

PFD


Press **BARO (R2)**.



Scroll **1** to proper setting and push to enter value or press **EXIT (R1)**.



Press **B>** (**R4**) to enter a destination active waypoint.



Scroll **1** 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 or viewed.



Magenta star bearing to the waypoint and green diamond ground track symbols 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.

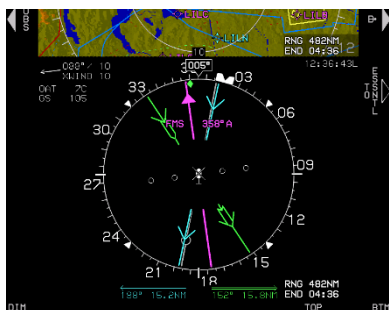


Active waypoint information, including type and identifier; elevation or crossing altitude; and bearing/distance are displayed below the analog AGL indicator or mini map as configured.



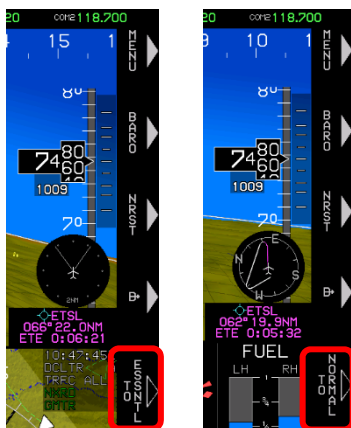
Indicated airspeed is on the left, altitude is on the right, and heading is across the top. FMS/VLOC CDI is located on the bottom. VSI appears on the right side of the altitude tape. Time-critical caution is displayed in the primary field of view.


MFD



Analog navigation symbology on MFD HSI shown in bottom area.

PFD Essential Mode



Press  (R5) to change the PFD to a display with primary flight information on top and EICAS on the bottom display.

Press  (R5) to restore IDU to the previous display configuration.



On MFD, press **(R5)** to display PFD on top and EICAS on bottom.



On MFD, press **(R5)** to display ENGINE page on top and MFD on bottom.



When EICAS is not enabled,



press **(R5)** to restore MFD on top and bottom.

Manual Leg



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



To resume normal waypoint sequencing press **RESUME (L6)**.

Flight Plans (Stored Routes)

Activate Flight Plan on PFD or MFD

- 1) Press **FPL (L1)**.
- 2) Scroll **1** to **SELECT..** and push to enter.
- 3) Scroll **1** to select desired flight plan and push to activate.

Create Flight Plan on PFD or MFD

- 1) Press **FPL (L1)**.
- 2) Scroll **1** to **CREATE-EDIT..** and push to enter.
- 3) Scroll **1** to **CREATE FLIGHT PLAN** and push to enter.
- 4) Press **ADD (R6)** to create first waypoint using **1** 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)** select next waypoint, and push to enter.
- 5) Press **SAVE (R8)** to save flight plan.
- 6) Press **EXIT (R1)** to exit flight planner.

Waypoints

Create a User Waypoint on PFD or MFD

- 1) Press **MENU (R1)**.
- 2) Press **DESIG (L3)**.

Edit a User Waypoint PFD or MFD

- 1) Press **FPL (L1)**.
- 2) Scroll **1** to **CREATE-EDIT..** and push to enter.
- 3) Scroll **1** to **EDIT USER WPT** and push to enter.
- 4) Scroll **1** to highlight waypoint to edit and push to enter.
- 5) Edit waypoint. Press **SAVE (R8)** and press **EXIT (R1)** to exit flight planner.

Insert Waypoint to an Active Route on PFD or MFD

- 1) Press **ACTV (L2)**.
- 2) Scroll **1** to location on waypoint list where added waypoint is to be inserted above.
- 3) Press **INSERT (R2)**.
- 4) Press **NRST APT (L2)**, **NRST VOR (L3)**, **NRST NDB (L4)**, **NRST FIX (R2)**, or **NRST USR (R3)**, or **AIRWAY (R4)** and then
 - a) Scroll **1** to make selection and push to enter, or
 - b) Use **1** to enter waypoint identifier and push to enter.
- 5) Press **SAVE (L1)** to save new active flight plan as another stored flight plan.

Delete Waypoint from an Active Route on PFD or MFD

- 1) Press **ACTV (L2)**.
- 2) Scroll **1** to highlight the waypoint to delete and press **DELETE (R3)** to prompt **CONFIRM DEL WPT**. If part of a published procedure, press **DELETE (R3)** to prompt **CONFIRM DEL PROC**.
- 3) Push **1** to **CONFIRM DEL WPT** or **CONFIRM DEL PROC** and push to enter.

Omnibearing Selector Function

Automatic OBS (FMS OBS Only)

- 1) Press **OBS (L4)**.
- 2) Push **1 OBS:AUTO** to enter.

Manual OBS

- 1) Press **OBS (L4)**.
- 2) To select desired HSI source, press **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)**.

- 3) If HSI source is **NAV FMS**, press **OBS MANUAL (R4)** then scroll **1** to desired OBS value and push to enter; or press **OBS SYNC (R3)** and push to **1** enter.
- 4) If HSI source is **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)**, scroll **1** to desired course (OBS:XXX° (XXX°)) and push to enter.

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.)

- 1) Press **ACTV (L2)**.
- 2) Scroll **1** to desired airport or user waypoint and push to enter.
- 3) Scroll **1** to **VFR APPR..** and push to enter.
- 4) Scroll **1** to desired runway and push to enter.

Change Runway during VFR Approach on PFD or MFD

- 1) Press **ACTV (L2)**.
- 2) Scroll **1** to highlight the following and push to enter:
 - a) Destination airport
 - b) **VFR APPR..**
 - c) Desired runway

(This will delete the previous VFR approach and create a new VFR approach to the selected runway.)

Select an IFR Approach on PFD or MFD

- 1) Press **ACTV (L2)**.
- 2) Scroll **1** to desired eligible airport and push to enter.
- 3) Scroll **1** to **IFR APPR..** and push to enter.
- 4) Scroll **1** to desired approach and push to enter.
- 5) Scroll **1** to desired transition and push to enter.

- 6) Scroll **1** to desired runway and push to enter.

Change Runway on IFR Approach on PFD or MFD

- 1) Press **ACTV (L2)**.
- 2) Scroll **1** to destination airport and push to enter.
- 3) Select **APPR**: Scroll **1** to desired approach. Push to enter.
- 4) Select **TRANS**: Scroll **1** to desired transition. Push to enter.
- 5) Select **RW**: Scroll **1** to desired runway. Push to enter.

(This will delete the previous IFR approach and create a new IFR approach to the selected runway.)

XFILL SYNC Operation

XFILL SYNC Operation

(Crossfill is the normal default mode of operation.)

- 1) During crossfill inhibited operation, **XFILL INHBT** appears on the PFD in the lower left corner.
- 2) When the pilot and co-pilot systems are not synchronized, **XFILL ARM** appears in lower left corner of the PFD.
- 3) When the pilot and co-pilot systems are not synchronized, press **MENU (R1)** then **XFILL SYNC (L1)** to synchronize the pilot and co-pilot active flight plan parameters from the system where the button press occurred.



Section 7 IFR Procedures

7.1. Active Flight Plan

Upon activation of the active flight plan menu, the application checks for an active waypoint. If there is no active waypoint, **NO ACTIVE WPT** is issued. Otherwise, a nav log of waypoints in the active flight plan is presented with the following:

- 1) Waypoint identifier and characterization (default, overfly **[OF]**, or no radius **[OR]**)
- 2) Symbol designating waypoint type and what type of procedure (if any) the waypoint is associated
- 3) VNAV altitudes and offsets associated with each waypoint
- 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 glidepath intercept point. When courses are presented as part of the path information, they are displayed referenced to magnetic north with the degree (°) symbol.

VNAV altitudes and offsets from the navigation database or have been manually entered are white, and those computed automatically are gray. The active waypoint is designated by an asterisk and is magenta but turns amber (yellow) in the event of a GPS LON caution.

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. Since only one approach may be active at any given time, only one waypoint may be suppressed at any given time.

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.

To add a waypoint to the end of the active flight plan, scroll through each waypoint of the flight plan to one position past the end. If not, the application makes the selected waypoint active. Otherwise, a list is presented.

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, 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 the selected waypoint is neither suppressed, skipped, nor a manual termination, make the selected waypoint the active waypoint.
- 2) **VNAV:** If the selected waypoint is neither suppressed, skipped, a manual termination, part of an IFR approach, nor part of a VFR approach, enter a manual VNAV altitude and offset for the selected waypoint. This level includes tiles to synchronize the VNAV altitude to current altitude and to remove the manual VNAV altitude and offset entry. VNAV altitudes are settable in increments of 100 feet, and offsets are settable in increments of 1NM.
- 3) **HOLD:** If the selected waypoint is neither suppressed, skipped, a manual termination, part of an IFR approach after the FAF/FAWP, part of a VFR approach, a holding waypoint, nor a DP anchor waypoint, enter a manual holding pattern at the selected waypoint. Define the course, turn direction (left or right), and leg length (expressed as either distance or time) for the manual holding pattern. Holding pattern course is settable in increments of 1° and leg length is settable in increments of 1NM (1-25NM) or in tenths of a minute. (0.5-5.0MIN).
- 4) **OFLY/AUTO:** If the selected waypoint is neither suppressed, skipped nor a manual termination, change the waypoint's overfly characterization. The choices are:
 - a) **AUTO:** Reset automatic overfly characterization by FMS.

- b) **OVERFLY:** Force the overfly 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:** 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.

- 5) **VFR APP:** If selected waypoint is a user waypoint with an approach bearing, a VFR approach to the user waypoint based upon the approach bearing is created, and the user waypoint is suppressed. If the selected waypoint is a VFR airport or an IFR airport with surveyed runways, the pilot is presented with a list of runways. After selecting a runway, a VFR approach to the runway is created, and the airport waypoint is suppressed. Activating a VFR approach deletes 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.
- 6) **IFR APP:** 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.

- 7) **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.
- 8) **DP:** If selected waypoint is an airport with a DP, the pilot is presented with a list of DPs, followed by a list of available transitions (if there are more than one) and a list of runways (if there are surveyed runways and more than one runway authorized for the DP). After selection, the appropriate DP is created, and upon activation, deletes any pre-existing DPs.

7.2. 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. Use of both types of departure procedures; Obstacle Departure Procedures (ODP), which are printed either textually or graphically, and Standard Instrument Departure procedures (SIDs), 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 the navigation database, and 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 enroute 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.

7.3. Overview of Procedures and Instrument Approaches

This Genesys Aerosystems EFIS provides 3-D 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) 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.

Approach with vertical guidance (APV) procedures are defined in ICAO Annex 6 and include approaches such as the LNAV/VNAV procedures presently being flown with barometric vertical navigation (BARO-VNAV). These approaches provide vertical guidance but do not meet the more stringent standards of a precision approach. With the WAAS BETA 3 GPS receiver and updatable navigation database in this system, these approaches may be flown using an electronic glidepath, which eliminates errors introduced by using barometric altimetry.

In addition to LNAV/VNAV procedures, APV takes advantage of the high accuracy guidance and increased integrity provided by GBS/SBAS. This SBAS (TEROS/ICAO) generated angular guidance allows use of the same TERPS approach criteria for ILS approaches. The resulting approach procedure minima, localizer performance with vertical guidance (LPV), have a decision altitude as low as 200 feet height above touchdown (EASA OPS LPV 250 ft.) with visibility minimums as low as ½ mile (providing the terrain and airport infrastructure and regulations support the lowest minima criteria.)

Another non-precision GPS/SBAS approach, certified as an localizer performance (LP) approach where terrain or obstructions prohibit the certification of the LPV vertically guided approach, takes advantage of the angular lateral guidance and smaller position errors (provided by GPS/SBAS) to provide a lateral only procedure similar to an ILS localizer. LP procedures may provide lower minima

than a LNAV procedure due to the narrower obstacle clearance surface. In the LP approach, vertical guidance is for information only and is based on SBAS or BARO information.

The Genesys Aerosystems EFIS guides the pilot through every step of the approach procedure with HITS 3-D 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 lateral deviation for display on the GPS/SBAS CDI and VDI. The IDU auto-sequences from one waypoint to the next in accordance with the flight plan along the flight path with the following exceptions:

- 1) Pilot has 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) 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 (**SUSPEND** shown).

The linear vertical scale limits of the VDI for LNAV/VNAV and LPV approaches are shown in Figure 7-1.

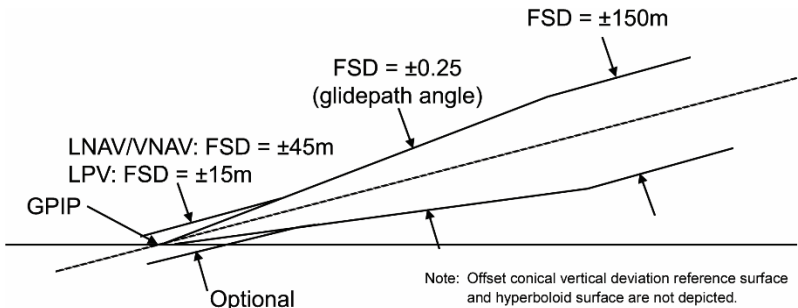


Figure 7-1: Vertical Deviation Indicator Linear Deviation

7.3.1. Highway in the Sky (Skyway)

When not decluttered, the PFD displays the active navigation route or manual OBS course 3-D 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 requirements (TSO-C-146C). 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 groundspeed.

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. Skyway boxes 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 7-1: Highway in the Sky Configuration

Type HITS Lines	Fully Integrated Autopilot	Partially Integrated Analog Autopilot (HDG Mode and/or NAV/APR mode discrete inputs)	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 the FMS, FMS1, or FMS2 as the selected navigation source.	Always Solid

Skyway box altitude is controlled by VNAV altitude, aircraft altitude, aircraft climb performance, and climb/descent angle setting. 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° . VNAV is guided by VNAV waypoints determined by VNAV altitude and VNAV offset from flight plan waypoints. There are two sources for VNAV altitudes; the navigation database and manual input through the ACTV menu. VNAV altitudes for waypoints without a navigation database or manually input VNAV altitudes are computed using look-ahead rules. When look-ahead finds a further VNAV altitude constraint above the previous VNAV altitude constraint (i.e., climb commanded), an automatic VNAV altitude is continuously calculated for the waypoint based upon an immediate climb to the altitude constraint at the higher of actual climb angle or the climb angle setting (dynamic climb angle). When look-ahead finds a further VNAV altitude constraint below the previous VNAV altitude constraint (i.e., descent commanded), an automatic VNAV altitude is calculated for the waypoint based upon a descent to reach the VNAV altitude constraint at the associated waypoint using the descent angle setting. If no further VNAV altitude constraints are found, the automatic VNAV altitude is set to the last valid VNAV altitude constraint.

When a VNAV climb is desired, the boxes are drawn at a vertical position the higher of: (a) the dynamic climb angle emanating from the aircraft's present position (aircraft-referenced); (b) the dynamic climb angle emanating from the next waypoint VNAV altitude (geo-referenced forward); or (c) the climb angle setting emanating from the previous waypoint VNAV altitude (geo-referenced backward). 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 gradient is not being met. Once the boxes intercept the VNAV altitude, further boxes are drawn with a zero angle to show a level off followed by a level flight segment. Because five boxes are shown, the level-off depiction is an anticipatory cue for the pilot. Climb guidance is depicted in Figure 7-2, Figure 7-3, and Figure 7-4.

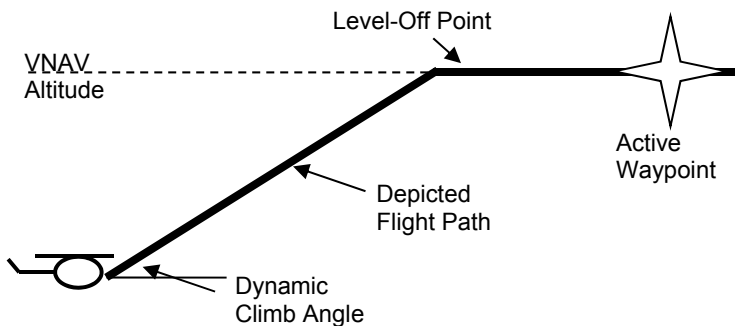


Figure 7-2: Highway in the Sky (Aircraft Referenced)

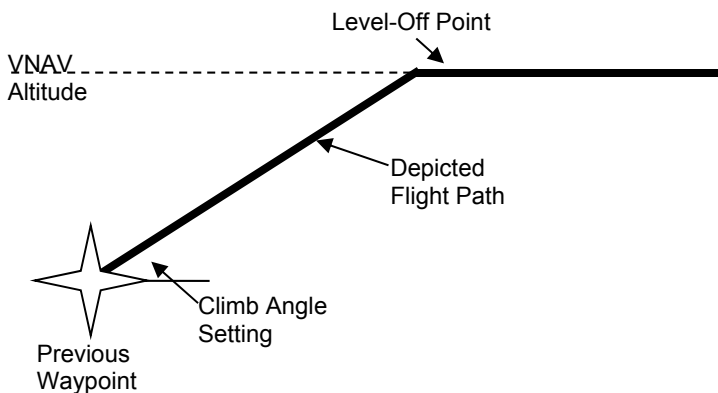


Figure 7-3: Highway in the Sky (Geo-Referenced Backward)

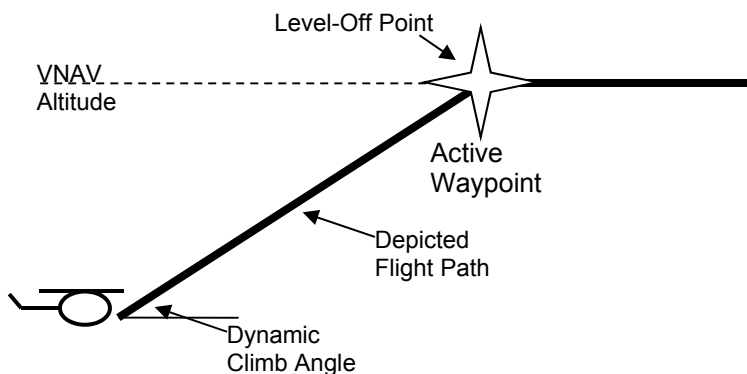


Figure 7-4: Highway in the Sky (Geo-Referenced Forward)

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 as follows.

Table 7-2: Final Segment of IFR Approach, Descent Angle, and VNAV Waypoint

Condition	VNAV Waypoint	Descent Angle
IFR approach with valid final approach segment data block	Glidepath intercept point (GPIP) as defined in final approach segment data block	Descent angle as defined in final approach segment data block
No or invalid final approach segment data block No intermediate waypoints exist between FAF and MAP	Missed approach point location	Straight line from FAF to MAP location and altitudes.
No or invalid final approach segment data block Intermediate waypoints exist between FAF and MAP	Missed approach point location	Steepest descent angle based upon straight lines from FAF and subsequent intermediate waypoints to MAP location and altitudes

On the final approach segment of a VFR approach procedure, the higher of the descent angle setting or 3° is used.

Because five boxes are shown, the descent point depiction is an anticipatory cue. Figure 7-5 depicts descent guidance and creates an easily understood, yet safe, VNAV paradigm meeting the VNAV requirements current guidance. Simplicity is a primary objective.

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.



Figure 7-5: Highway in the Sky Final Approach Segments

7.3.2. Waypoint Sequencing

Where automatic waypoint sequencing is suspended due to reasons 4 or 5 in § 7.3, 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 heading 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. Radii for turning segments (other than DME arc or radius to a fix segment) are calculated with the parameter speed determined as follows:

- 1) If the waypoint is part of a DP and within 30NM of the departure runway, speed is the pre-programmed procedure speed.
- 2) If the waypoint is part of a STAR and within 30NM of the arrival runway, speed is the pre-programmed procedure speed.
- 3) If the waypoint is part of an IAP or VFR approach procedure, speed is the pre-programmed procedure speed.
- 4) If the waypoint is part of a holding pattern, speed is the pre-programmed procedure speed.
- 5) Otherwise, speed is the current true airspeed or pre-programmed procedure speed, whichever is higher.

In all cases, if NavData® derived speed limit is associated with the waypoint, speed is the lower of the NavData® derived speed limit or the speed determined above.

7.3.3. Fly-Over Waypoints

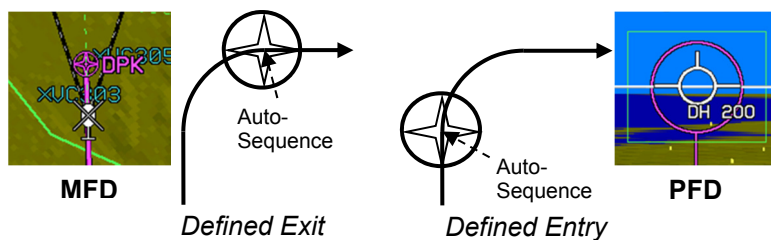


Figure 7-6: Fly-Over Waypoints

To create the desired flight path, each waypoint is designated as a fly-over or a fly-by 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.

These waypoints are type Fly-Over with Defined Entry Heading:

- 1) Exit from holding pattern;

- 2) Exit from procedure turn;
- 3) Entry into holding pattern;
- 4) Missed approach point;
- 5) 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);
- 6) Last waypoint;
- 7) Start waypoint (created by creating a new active flight plan with the Direct-To function – avoids S-turns);
- 8) Reference (takeoff runway end) waypoint of a DP;
- 9) Waypoint leading into discontinuity; and
- 10) Altitude, DME, or radial termination legs (ARINC-424 path types CA, FA, VA, CR, VR, CD, FD, and VD).
- 11) Waypoints marked as overfly in the navigation database.

Table 7-3: 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.			

7.3.4. Fly-By Waypoints

These waypoints are Fly-Over with Defined Exit Heading:

- 1) Entry into procedure turn; and
- 2) Waypoint exiting a discontinuity with the exception of phantom waypoints or DP reference waypoints;

- 3) First waypoint with the exception of start waypoints or DP reference waypoints;
- 4) 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.

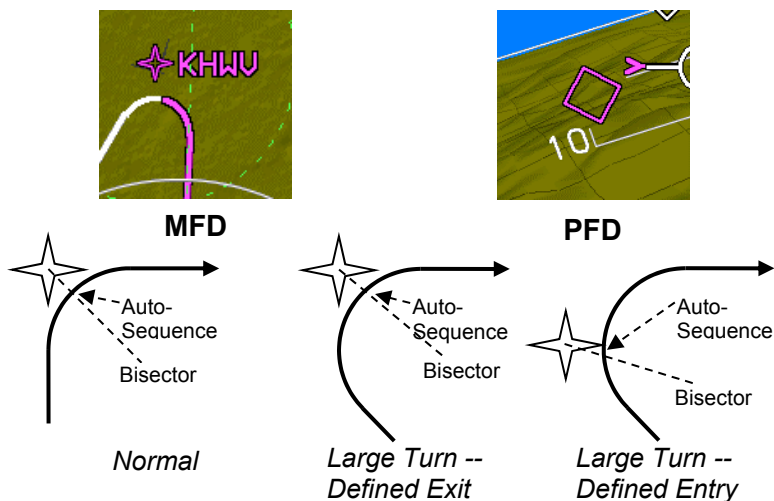


Figure 7-7: Fly-By Waypoints

NOTE:

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

Leg segments for paths are constructed by the IDU as follows.

Table 7-4: Leg Segments for Paths Constructed by EFIS			
Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
Straight Leg, DME Arc or	Fly-By	Fly-By	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry to exit turns.

Table 7-4: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
Radius to a Fix			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.
	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	Fly-Over Defined	Turn from entry heading after entry waypoint.

Table 7-4: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
	Entry Heading	Exit Heading	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°). 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. Degree of turn varies depending upon entry procedure and heading. WGS-84 geodesic path to holding fix for direct and teardrop entries. WGS-84

Table 7-4: Leg Segments for Paths Constructed by EFIS

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
			geodesic path to entry of 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).

7.3.5. 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 as a discontinuity.
- 3) Phantom waypoint is designated a Fly-Over Defined Entry Heading waypoint where entry heading is current aircraft track.

Where the selected “To” fix is not in the active flight plan, the required transition is created as follows:

- 1) A new active flight plan is created from “Start” (current aircraft location) to the “To” fix.

- 2) “Start” waypoint is designated a Fly-Over Defined Entry Heading waypoint where entry heading is current aircraft track.

7.3.5.1. Direct-To Unnamed Waypoints Inside Procedures

The following identifiers are implemented for unnamed waypoints inside a published procedure and are found on the ND or inside the active flight plan.

- 1) **-ALT-** altitude terminations
- 2) **-DIR-** waypoints that begin a Direct-To leg
- 3) **-DME-** distance or DME terminations
- 4) **-INT-** intercept terminations
- 5) **-RAD-** radial terminations
- 6) **-MAN-** manual terminations

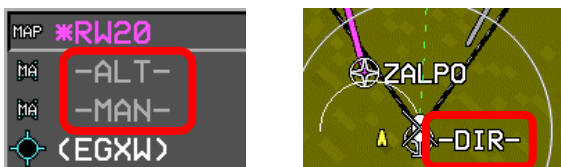


Figure 7-8: Unnamed Waypoints

7.4. 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 pilot cannot activate the waypoint exiting the discontinuity, as it is not possible to provide path guidance to this waypoint. Attempts to activate the waypoint exiting the discontinuity activates the next waypoint or, if there is no next waypoint (i.e., end of active flight plan), activation of the waypoint leading into the discontinuity.

7.4.1. 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 a discontinuity;
- 2) Waypoint sequencing is suspended on the leg prior to the manual termination leg;
- 3) Once the CDI transitions to FROM operation, **RESUME (L6)** appears;
- 4) 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 would be no waypoint to waypoint sequencing to resume.

7.5. 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 has the capability 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 with the NIMA GEOMAG algorithm and World Magnetic Model appropriate to the five-year cycle.

7.5.1. 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/“DG”—EFIS Magnetic North: Use when operating around significant magnetic disturbances in areas where navigation is done relative to magnetic north. Ensure the compass rose is slewed to a magnetic north value.

AHRS Free/“DG”—EFIS True North: Method of operation in high-latitude areas where navigation is accomplished relative to true north. Heading is not drift free and requires periodic correction. This mode may also be used when operating around significant magnetic disturbances in areas where navigation is done relative to true north. Ensure the compass rose is slewed to a true north value.

7.5.2. GPS Altitude

WGS-84 ellipsoid altitude received from the GPS/SBAS is converted to geodetic (MSL) altitude using the EGM 2008 geoidal database, which is revised on a twelve-year cycle.

7.5.3. 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.

7.5.4. 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.

7.5.5. 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. An exception is 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 does not propagate through route discontinuities, unreasonable path geometries as follows:

- 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 Start/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 or exit waypoints are inserted into the flight plan. Discontinuities precede parallel offset entry waypoints and follow parallel offset exit waypoints. This allows the pilot to navigate to and from the parallel offset as required.

The EFIS provides guidance to parallel tracks at a selected offset distance. When executing a parallel offset, 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 1NM, left or right of course, and is capable of offsets of at least 20NM. Offset mode is clearly indicated with an advisory flag, i.e., **PTK = L 20NM**. When in offset mode, the EFIS provides reference parameters (e.g., cross-track deviation, distance-to-go, time-to-go) relative to the offset path and offset reference points.



Figure 7-9: Parallel Offset PTK-/PTK ENDING

Once a parallel offset is activated, the offset remains active for all flight plan route segments until removed automatically (transitioning through a parallel track exit waypoint), until the flight crew enters a “Direct-To” routing or activates a new flight plan route, or until (manual) cancellation.




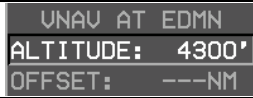
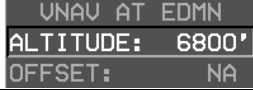
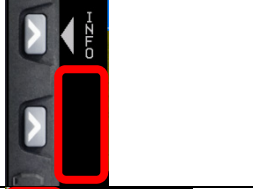

NOTE:

If a parallel offset is entered in the active flight plan and then cancelled, that active flight plan is no longer eligible for configuring another parallel offset without deleting and reopening due to the creation of a discontinuity.

Table 7-5: Parallel Offsets Symbols and Description

Symbol	Description
	Parallel offset has been created and has a designated ending waypoint.
	Designated ending waypoint of parallel offset

Table 7-5: Parallel Offsets Symbols and Description

Symbol	Description
	Parallel track advisory indicating offset track 3 NM to the right of host route.
	PTK (L4) appears when active route is eligible for a parallel offset.
	Approaching end of parallel offset waypoint
	VNAV altitude is possible with offset of distance before or after waypoint.
	VNAV altitude input is possible but not an offset of a distance before or after waypoint.
	The absence of PTK (L4) indicates a parallel offset is not allowed for reasons stated above.
	Indicates each waypoint is a part of the parallel offset.

7.6. Default GPS/SBAS Navigation Modes

In the default GPS/SBAS mode, the EFIS has enroute, 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 7-6: Default GPS/SBAS Navigation Modes	
Navigation Mode	Annunciation
Enroute	None
Terminal	TERMINAL
LNAV Approach	LNAV APPR
LNAV/VNAV Approach	LNAV/VNAV APPR
LP Approach	LP APPR
LPV Approach	LPV APPR
VFR Approach	VFR APPR
Departure	TERMINAL

The system switches to default navigation modes based upon region of operation as follows.

Table 7-7: Default Navigation Modes Based Upon Region of Operation	
Default Navigation Mode	Definition of Region
Departure	Selected when active waypoint is first waypoint of a departure or missed approach procedure <u>and</u> active leg heading is aligned ($\pm 3^\circ$) with active runway heading. Also set when active waypoint is MAWP but a missed approach has been manually activated*.
VTF Approach (LNAV, LNAV/VNAV, LP or LPV)	VTF IFR approach has been selected; <u>and</u> within 30NM of the active runway*; <u>and</u> FAWP is active waypoint*; <u>and</u> bearing to FAWP is within 45° of final approach segment track (treated as a mode entry criteria)*; <u>and</u> desired track to FAWP is within 45° of final approach segment track (treated as a mode entry criteria).
Approach (LNAV, LNAV/VNAV, LP or LPV)	IFR approach has been selected; <u>and</u> within 30NM of the active runway*; <u>and</u> MAWP or FAWP is active waypoint; <u>and</u> if FAWP is active waypoint:

Table 7-7: Default Navigation Modes Based Upon Region of Operation

Default Navigation Mode	Definition of Region
	bearing to FAWP is within 45° of final approach segment track (treated as a mode entry criteria)*; <u>and</u> desired track to FAWP is within 45° of final approach segment track (treated as a mode entry criteria)*; <u>and</u> either segment leading into FAWP is not a holding pattern, or pilot has elected to continue out of holding.
VFR Approach	VFR Approach has been selected*; <u>and</u> within 30NM of the active runway*; <u>and</u> active runway is the active waypoint.
Terminal	Not in departure mode; <u>and</u> not in approach mode; <u>and</u> active waypoint is part of a departure <u>or</u> active waypoint and previous waypoint are parts of an arrival or approach <u>or</u> within 30NM of the departure airport, arrival airport, or runway.
Enroute	Not in departure, approach, nor terminal modes.

7.7. GPS/SBAS CDI Scale

Table 7-8: Summary of Changes In Cross-Track FSD

	To Enroute	To Terminal	To Approach
From Enroute		Change from ± 2 NM FSD to ± 1 NM FSD over distance of 1 NM; start transition when entering terminal mode.	
From Terminal	Change from ± 1 NM FSD to ± 2 NM FSD over distance of 1		If VTF, switch immediately. Otherwise, change from ± 1

Table 7-8: Summary of Changes In Cross-Track FSD

	To Enroute	To Terminal	To Approach
	NM; start transition when entering enroute mode.		NM FSD to approach FSD over distance of 2 NM; start transition at 2 NM from FAWP.
From Approach		Change to ± 1 NM.	
From Departure		If initial leg is aligned with runway, change from ± 0.3 NM FSD to ± 1 NM FSD at turn initiation point of first fix in departure procedure.	

7.8. Approach Type Selection

The IDU 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) LPV Enable is enabled;
- b) ARINC-424 "Level of Service" indicates LPV minimums are published;
- c) Valid long-term, fast and ionospheric SBAS corrections are available and being applied to at least 4 GPS satellites;
- d) Final approach segment data block exists and passes CRC check; and
- e) Horizontal and vertical alert limits from final approach segment data block are predicted to be supported.

2) LP:

- a) LPV Enable is enabled;
- b) ARINC-424 “Level of Service” indicates LP minimums are published;
- c) Valid long-term, fast, and ionospheric SBAS corrections are available and being applied to at least 4 GPS satellites;
- d) Final approach segment data block exists and passes CRC check; and
- e) Horizontal alert limit from final approach segment data block is predicted to be supported.

3) LNAV/VNAV:

- a) ARINC-424 “Level of Service” indicates LNAV/VNAV minimums are published;
- b) If a final approach segment data block exists, LPV Enable is enabled;
- c) If a final approach segment data block exists, it passes CRC check; and
- d) Horizontal alert limit of 556m (.3NM) is predicted to be supported.

NOTE:

Because the IDU inherently supports barometric VNAV, it is not a prerequisite that the vertical alert limit be supportable, nor is it a prerequisite that 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, and there are no prerequisites for selecting LNAV.

The IDU continuously displays the approach type (mode indication) after selection. The IDU does not degrade the approach type after selection unless the approach procedure is reselected or changed.

NOTE:

These are GPS/SBAS modes and still appear during a ground-based approach such as an ILS approach.

7.8.1. Approach Path Definition

Normal IAP path definitions are as specified in the procedure contained in the navigation database. Deviations are provided with respect to the active leg of the approach procedure.

7.8.2. VTF IFR Approach

In addition, the pilot may select a VTF IFR approach, indicating the pilot does not intend to fly the entire procedure. When a VTF IFR approach is selected, the IDU 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 prior to the IP is designated a discontinuity. Until the FAWP is sequenced, the IDU indicates a VTF IFR approach has been selected (**VECTORS**) to indicate guidance is not relative to a published approach path, and TERPS clearances are not assured.

7.8.3. VTF VFR Approach

The pilot may select a VFR approach to a runway or user waypoint with a defined approach bearing. When a VFR approach is selected, the IDU creates an IP waypoint approximately 12 NM on the extended final approach course to provide deviations relative to the extended final approach course. The IP is designated as a fly-over defined exit heading waypoint, and the leg prior to the IP is designated as a discontinuity.

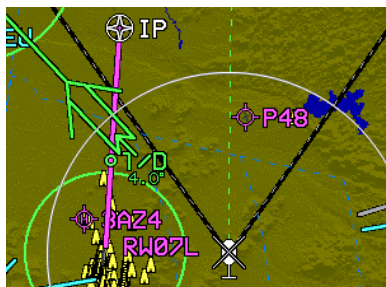


Figure 7-10: VTF VFR Approach

As depicted in Figure 7-10, during the VTF VFR approach, the aircraft proceeds 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 RW07L is activated.

7.9. Missed Approach and Departure Path Definition

Once on the final approach segment, the pilot may initiate an immediate missed approach or arm the system to execute the missed approach at the MAWP. If armed before crossing the MAWP, the equipment arms the missed approach for automatic initiation at the MAWP. If a missed approach is not initiated prior to crossing the MAWP, the IDU switches to FROM mode at the MAWP and continues on the same course.

If the pilot initiates the missed approach, the EFIS provides guidance relative to the procedure. If a missed approach is armed prior to crossing the MAWP, the desired path to and after the MAWP is defined by the procedure. 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.

The pilot may select DP guidance and, if the first leg in the DP is not a straight path aligned within 3° of the runway heading, terminal mode FSD (± 1 NM) is used. Otherwise, the FSD is ± 0.3 NM (departure mode) and changes to terminal mode FSD (± 1 NM) at the turn initiation point of the first waypoint in the DP.



Figure 7-11: Missed Approach and Departure Path

7.10. Loss of Navigation Monitoring

The EFIS continuously monitors for loss of navigation capability. In manual or automatic RNP mode prior to sequencing the FAWP, the LON caution is displayed with a 10-second time to alert the RNP value is less than 2NM and a 30-second time to alert otherwise. RNP is also a statement of navigation performance necessary for operation within a defined airspace. Use the Faults menu to distinguish the cause of the LON caution. The caution returns to its normal state upon termination of the responsible condition.

NOTE:

This aircraft is equipped for the following individual 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) 0.01NM increments between RNP 0.10 and RNP 0.3
- 2) 0.1NM increments between RNP 0.3 and RNP 2
- 3) 1NM increments between RNP 2 and RNP 15

7.11. 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 includes examples of step-by-step procedures:

- 1) Standard Terminal Arrival Route (STAR)
- 2) ILS Instrument Approach
- 3) ILS Instrument Approach with Manual Termination leg
- 4) LOC Back Course Instrument Approach
- 5) RNAV (GPS) Instrument Approach to LPV Minima

- 6) NRST ILS Instrument Approach with Standard Instrument Departure (SID)
- 7) VOR/DME Instrument Approach
- 8) Instrument approach with primary and alternate missed approach procedures.

7.11.1. Standard Terminal Arrival Route (STAR) (Step-By-Step)



If the selected waypoint is an airport with a published STAR, this option is available for selection from a 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 it 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.

The following example includes the execution of a Standard Terminal Arrival Route procedure into Friedrichshafen Germany (EDNY) followed by an ILS RWY 06.

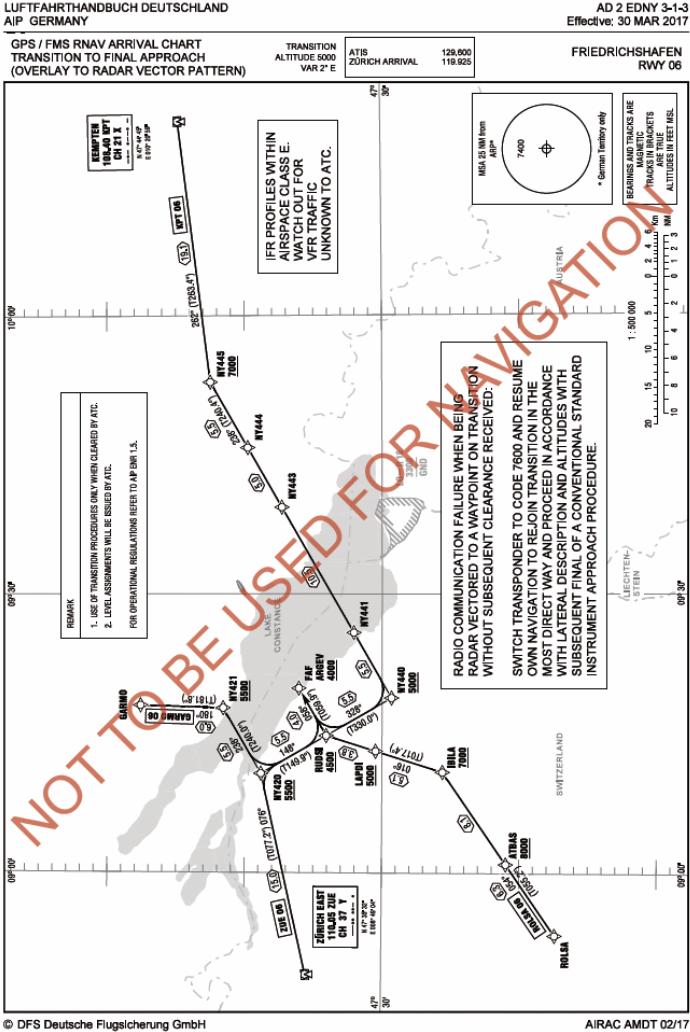


Figure 7-12: Standard Terminal Arrival Route (STAR)



- 1) Arrival airport must be entered as a waypoint.
- 2) Push **1** with desired airport (EDNY) highlighted.



3) Scroll **1** to **STAR..** and push to enter.



4) Scroll **1** to desired STAR (KPT6P). Push to enter.



5) If no transition is offered, scroll **1** to desired runway (RW06). Push to enter.



6) ATC clears direct MOKOP and ILS RWY 26. Press **ACTV (L2)** scroll **1** to MOKOP, press **DP (R4)** and push **1** to enter. (See § 7.11.2 for loading an ILS)



7) Push **1** and scroll to NAV LOG and push to enter to view first portion and then scroll **1** to view remainder of NAV LOG.



8) The NAV LOG, which is static in nature and can be viewed at any time, is the only page with clock time, groundspeed, fuel quantity, and fuel flow displayed. The active flight plan can be opened as an overlay to make changes.

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



All approach operations begin with the same basic steps. This example selects ILS or LOC RWY 24 at Memmingen Germany (EDJA).

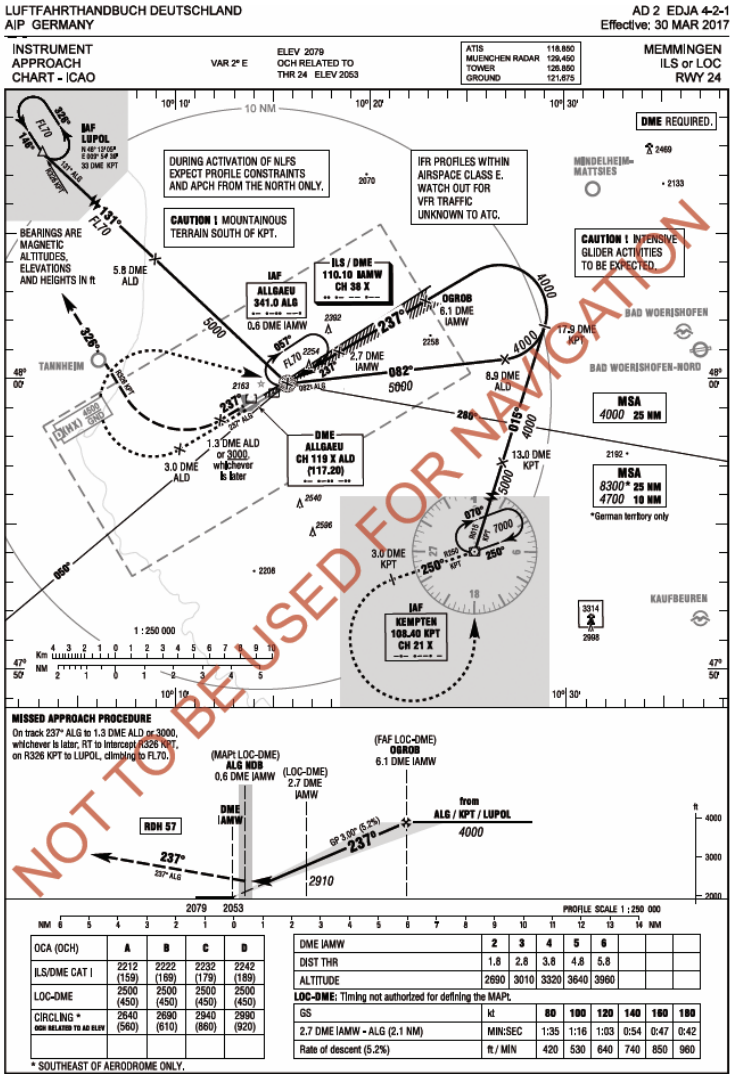
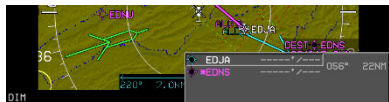


Figure 7-13: ILS Instrument Approach (EDJA)



1) Press **ACTV (L2)**. Select intended landing airport as active waypoint.



2) Scroll **1** to desired airport and push to enter.



3) Scroll **1** and select **IFR APPR...** Push to enter.



4) Scroll **1** to desired approach. Push to enter.



5) Scroll **1** to transition (*indicates most logical from current position). Push to enter.

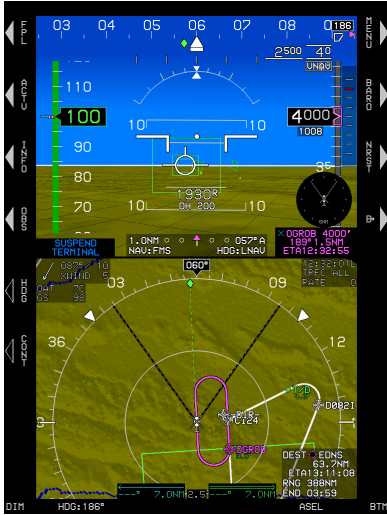


6) Scroll **1** to landing runway. Push to enter.



7) If instructed to hold at OGROB as published, scroll **1** to **OGROB** and push to enter. Scroll **1** to **HOLD** and push to enter and enter holding direction and leg length or time. Push to enter.

8) The holding pattern is created and is the next leg to be sequenced. ATC issues clearance for the ILS 24 Memmingen and to maintain 4000'.



- 9) Established in the HOLD as directed at 4000'. When ATC issues clearance for the approach, press **CONT (L6)** to continue waypoint sequencing to the FAF.



- 10) Passing the FAF, press **ARM (L6)** to arm the missed approach procedure and continue waypoint sequencing.

- 11) After **ARM** is pressed, **SUSPEND** disappears, and auto waypoint sequencing continues through the full missed approach procedure after passing the MAWP.



- 12) Push **1** and scroll to **HSI** and push to enter. Inside the FAF with the ND displaying the HSI page.
- 13) Over the middle marker and with zoom mode active, press **MENU (R1)** then **ZOOM (R3)** to emulate the outside view in the PFI area.
- 14) During the missed approach, press **MENU (R1)** then **ZOOM OFF (R3)** to restore normal wide field of view in the PFI area.



- 15) Missed approach segment appears as magenta and white dashed lines. The next leg (-ALT-) has an altitude termination leg of 3000'.

06ROB	4000'	/---	237°	6NM
RW24	2110'	/---	235°	2NM
*D237C	3000'	/---	237°	3000'
-ALT-	3000'	/---	237°	3000'

7.11.3. ILS Approach with Manual Termination Leg in MAP (Step-By-Step)

This example selects RAF Cranwell United Kingdom (EGYD) with -ALT- termination leg followed by an immediate manual termination leg requiring pilot action to resume automatic waypoint sequencing.

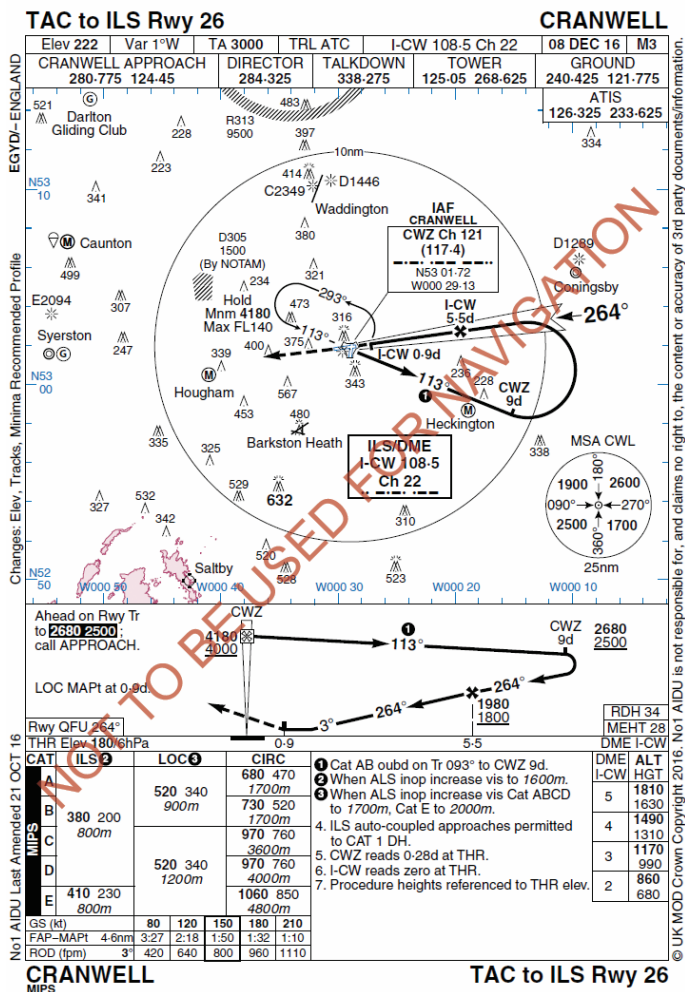


Figure 7-14: ILS Approach (EGYD)



1) Press **ACTV (L2)**. Scroll **1** to the destination airport and push to enter.



2) Scroll **1** to **IFR APPR..** and push to enter.



3) Scroll **1** to desired approach and push to enter.



4) Scroll **1** to desired Transition and push to enter. (* = most logical from present position.)



5) Scroll **1** to desired runway (colors the active runway light gray).



6) Passing the FAF, press **ARM (L6)** to arm the missed approach procedure and resume automatic waypoint sequencing.



- 7) DH set at 200' and localizer minimums set as MDA 520'
- 8) Over the middle marker on glideslope and on the localizer.



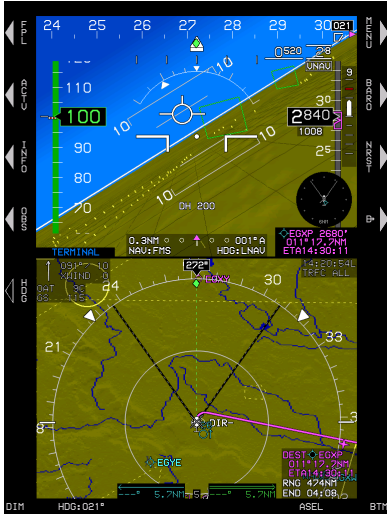
- 9) Past the MAWP, auto nav source switches to FMS-1 and auto waypoint sequencing is suspended due to -ALT- leg climbing to 2680' with green altitude predictor arc indicating climb performance achieves leg requirement.



10) Automatic waypoint sequencing still suspended and ready for pilot action to press **RESUME (L6)**.



11) After **RESUME (L6)** is pressed, normal waypoint sequencing resumes.



- 12) Course to next active waypoint appears as a magenta line, and active waypoint information is updated.

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



This example includes a LOC/DME Back Course approach at Santa Maria, California, USA (KSMX) with attention drawn to OBS settings and includes blue numbers to associate places of reference on the chart and the EFIS.

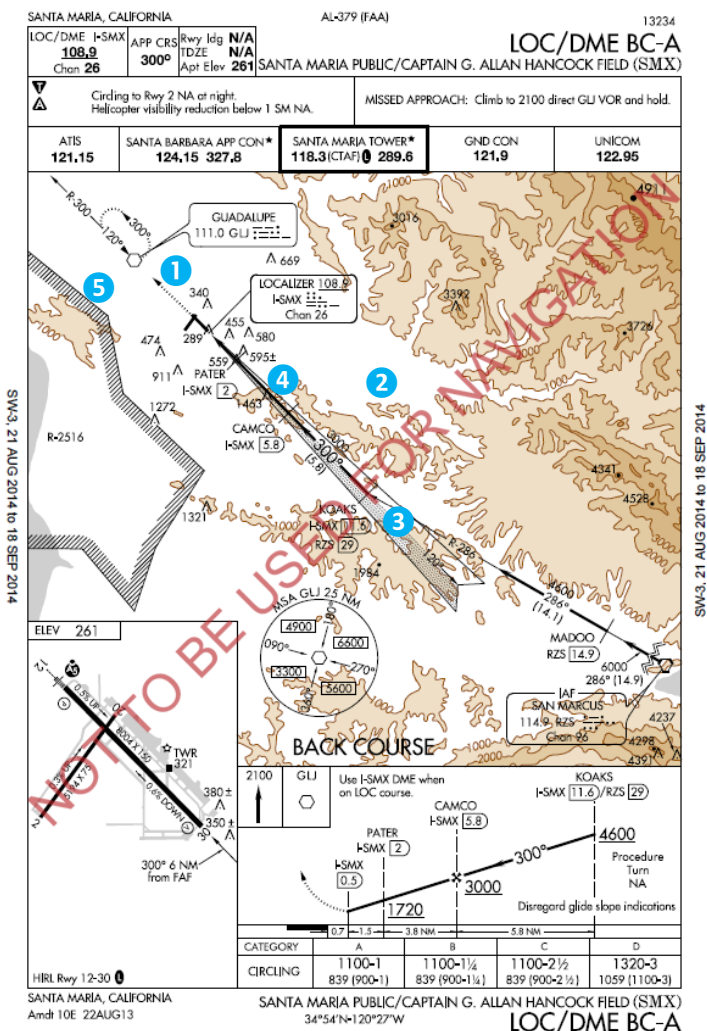


Figure 7-15: LOC Back Course Approach



- 1) **1** Press **ACTV (L2)**.
Scroll **1** to airport active waypoint. Push to enter.



- 2) Scroll **1** to **IFR APPR..** and push to enter.



- 3) Scroll **1** to **LBCA** and push to enter.



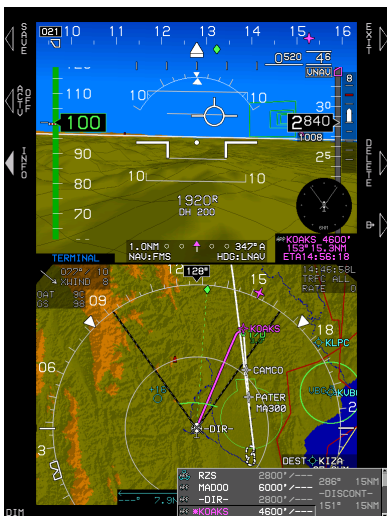
- 4) Scroll **1** to transition (*indicates most logical from current position). Push to enter.



- 5) Scroll **1** to desired runway. Push to enter.

WAYPOINT	UNAV/OFFSET	PATH	DIST	ETE	ETA	FUEL
DIR	6000'	R-126	41.1km	01:24	141:30	73
WRZS	6000'	R-286	14.1km	01:05	151:13	65
KDAKS	4600'	R-286	14.1km	01:05	151:22	62
CAGCC	9000'	R-30	2.4km	01:03	151:26	61
PATER	1720'	R-30	2.4km	01:03	151:20	60
MA300	1320'	R-30	2.4km	01:03	151:20	60
GLJ	2100'	R-126	5.1km	01:05	151:32	58
GLJ	2100'	R-126	5.1km	01:05	151:36	58
KSMX	2100'	R-117	30.2km	01:18	151:54	52
K12A	2100'	R-117	30.2km	01:18	151:54	52

- 6) Follow ATC clearance and determine where to proceed. To view NAV LOG, push **1** and scroll to **NAV LOG** and push to enter.



- 7) **2** Assume ATC issued clearance to proceed direct to KOAKS, **ACTV (L2)** and **DR (R4)** were pressed when KDAKS was highlighted.



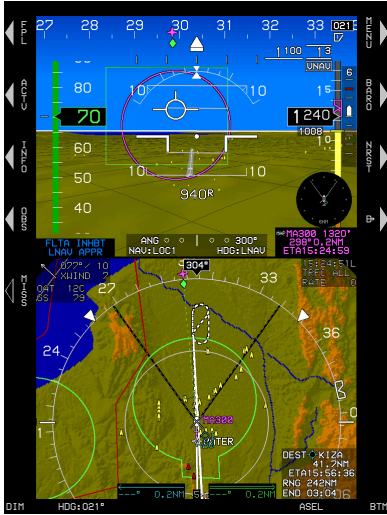
- 8) To set minimums, press **MENU (R1)**, **BUGS (R2)**, **MINS (R3)**, scroll **1** to **MIN ALT..**, and push to enter. Scroll **1** to set minimum altitude and push to enter.



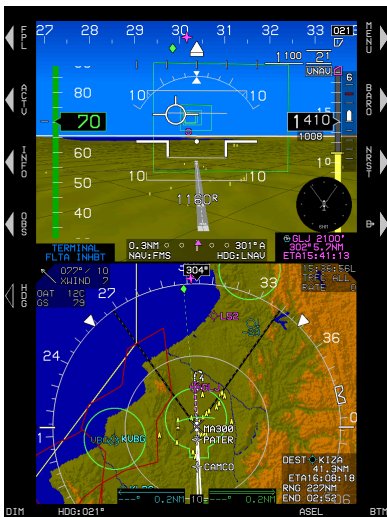
- 9) **3** Press **OBS (L4)**. Press **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)** as applicable. Scroll **1** to set back course bearing of 300° and push to enter. This results in proper sensing of back course CDI indications. The map is configured for ARC mode.



- 10) **4** After passing the FAF (CAMCO), **MISS (L5)** and **ARM (L6)** appear. In this case, there is no SUSPEND advisory due to the stepdown fix of PATER 0.2NM ahead. Approaching PATER (fly-by waypoint symbol) stepdown fix with the missed approach procedure armed and speed transitioned to 70 KIAS. The green arc altitude predictor indicates arrival at minima over the runway.



11) Approaching MAP MA300 with runway insight. IAS stabilized at 70 KIAS.



12) Passing the MAWP, nav source automatically switches to FMS.



- 13) **5** Entering HOLD at GLG and navigating on FMS.
- 14) **CONT (L6)** appears as a reminder to press when ready to leave the HOLD and continue to the destination KIZA.

7.11.5. RNAV (GPS) Instrument Approach to LPV Minima (Step-By-Step)



This example includes an RNAV (GPS) RWY 32 approach to Wichita, Kansas, USA (KICT) and includes blue numbers to associate places of reference on the chart and the EFIS.

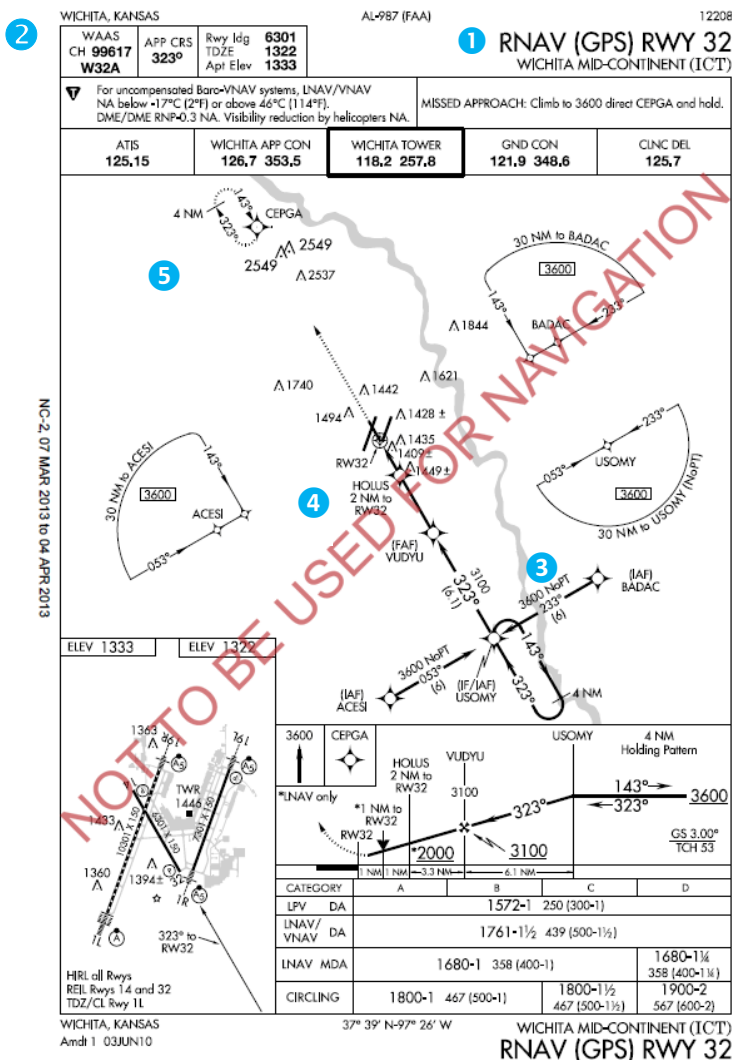


Figure 7-16: RNAV (GPS) Instrument Approach to LPV Minima



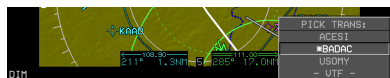
- 1) To select airport from active flight plan, press **ACTV (L2)**, scroll **1** to desired airport **1**, and push to enter.



- 2) Scroll **1** to **IFR APPR..** and push to enter.



- 3) Scroll **1** to desired approach, for example, **RNAV32 (99617)**. Verify WAAS channel number **2** matches instrument approach chart and push to enter. Push to enter.



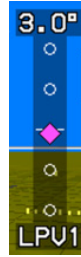
- 4) Scroll **1** to the desired transition and push to enter. (* = transition following likely avenue of actual arrival direction.)



- 5) Scroll **1** to assigned landing runway. (Active runway colored light gray for identification purposes.)



- 6) **3** On final approach course and approaching the FAF, **LPU APPR** appears along with the VDI.




- 7) **4** Upon passing **HOLUS**, press **ARM (L6)** to continue auto waypoint sequencing. (This is the latest point on the approach to press **ARM (L6)**.)
- 8) VDI displays vertical guidance for the LPV vertical profile based on GPS/SBAS.
- 9) Obstructions appear on PFI and ND areas.



- 10) Press **MENU (R1)** then **ZOOM (R3)** for wide-angle view of PFI area.
- 11) FPM lined up on the active runway on glidepath approaching minimums with CDI centered and on glidepath approaching minimums of 1580' MSL.



- 12) Below minimums with FPM aligned with touchdown zone on runway. Minimums are amber (yellow) and flashing as the audible alert, "Minimums, Minimums," sounds. 



- 13) Past the MAWP, NAV source remains FMS1 and scale automatically changes to 0.3NM FSD.

Satisfying the altitude termination leg of 1572' during the missed approach leg.

M-ALT- 1572'
320° 0.1NM
ETE 0:00:02



- 14) **5** Established in hold at CEPGA. Press **CONT (L6)** to continue waypoint sequencing to next leg in active flight plan.

7.11.6. NRST ILS Instrument Approach (Step-By-Step)



This method does not require the airport to be in the active flight plan. This example selects ILS RWY 24 at Memmingen Germany (EDJA) with the NRST ILS method of creation followed by the Kempten Three Alpha (KPT 3A) SID.

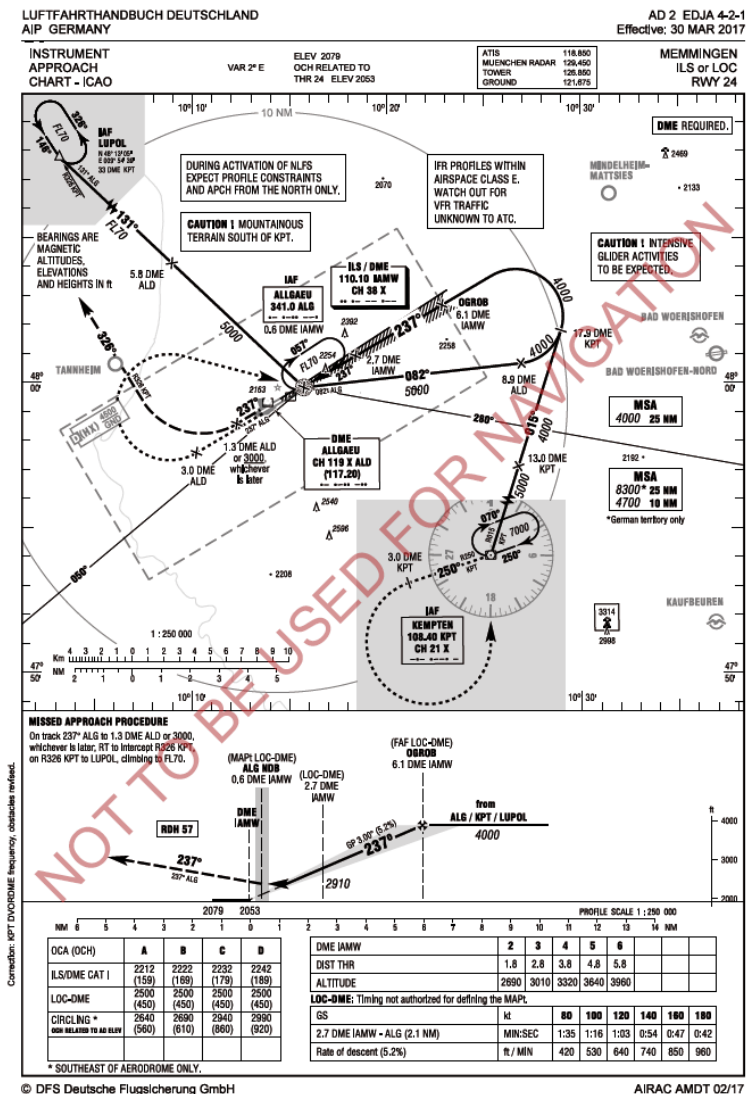


Figure 7-17: NRST ILS Instrument Approach

LUFTFAHRHANDBUCH DEUTSCHLAND
AIP GERMANY

AD 2 EDJA 5-7-11
Effective: 02 FEB 2017

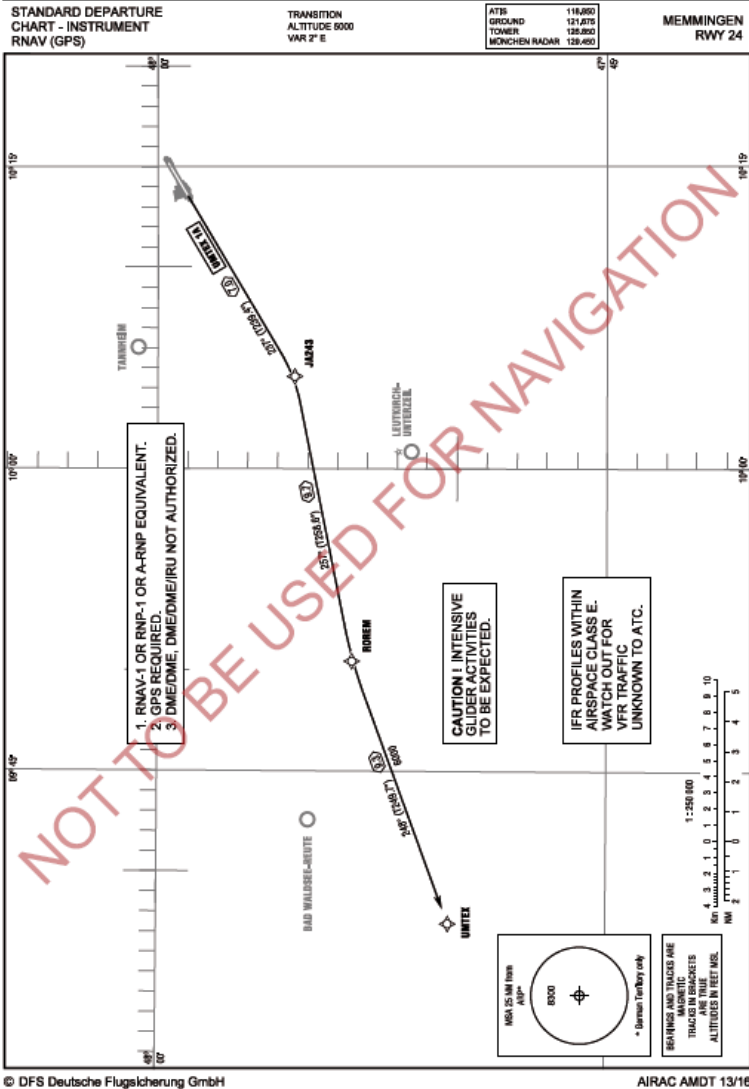


Figure 7-18: Standard Instrument Departure Procedure

<p>KPT 3A</p>	<p>KEMPTEN THREE ALPHA On track 237° ALG to 5.3 DME ALD. LT, on track 165° to intercept R259 KPT to KPT (Δ). GPS/FMS RNAV: JAC2500+J - JA242(L) - JA244(L) - KPT.</p>	<p>FL 70</p>	<p>München Radar 129.450</p>	<p>Not to be used during activation of NLF5. Expect Re-routing by ATC. Flights continuing via M738: PDG 4.9% (300 ft/NM) until reaching KPT.</p>
---------------	--	--------------	----------------------------------	--

Figure 7-19: Kempton Three Alpha (KPT 3A) SID



- 1) Press **NRST (R3)** then scroll **1** to **ILS...** Push to enter. This action clears any prior active flight plan.

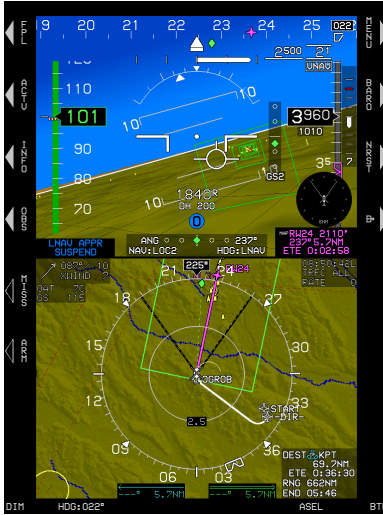


- 2) Once confirmed, push **1** to activate the ILS.

Following actions occur:



- a) Direct flight plan to the ILS airport is created.
- b) A vectors-to-final ILS approach is activated.
- c) Heading bug is activated to the current heading.
- d) VLOC 1 and VLOC 2 OBS are set to the associated localizer course.
- e) ILS frequency is automatically transmitted to NAV#1 in standby position.
- f) EFIS changes to LOC1, and VDI indicates source of glideslope GS2.



3) Passing the FAF (OGROB), **MISS (L5)** and **ARM (L6)** appear. Press **ARM (L6)** to arm the missed approach procedure and continue automatic waypoint sequencing.

4) HITS indicates guidance to follow GPS overlay of the localizer and glideslope. However, the localizer source for CDI and glideslope receiver VDI are the primary sources for guidance on this ILS approach.



5) Inside 2.0 NM final with **FLTA INHBT** and **LNAV APPR** indicating no TAWS alerts are triggered and the default GPS mode of LNAV APPR is active.

6) Push **1** and scroll to **HSI** and push to enter for the HSI page to appear.



- 7) Below DH over the inner marker with zoom mode on and stabilized at 70 KIAS on the localizer centerline.



- 8) During the missed approach, the navigation source automatically switches to FMS1 with 0.3NM FSD. FLTA is still inhibited and terminal mode is active while within the terminal area.



- 9) Kempton Three Alpha SID was loaded to the (EDJA) suppressed waypoint and JA242 and JA244 displayed on the white track line. This requires management of the active flight plan to follow the SID in lieu of the missed approach path.



- 10) Press **ACTV (L2)** and scroll **1** to JA242 press **[R4]** and push to enter.



- 11) Now the active waypoint is JA242 with a magenta line going straight out instead of turning right for the published missed approach procedure. With route of flight as follows:

On track 237° ALG to 5.3 DME ALD. LT, on track 166° to intercept R299 KPT to KPT climb to FL 70.

7.11.7. VOR/DME Instrument Approach (Step-By-Step)



This example loads the Lamar Municipal, Colorado, USA VOR/DME RWY 36 approach and is flown via the east arc followed by a missed approach. Blue numbers associate locations on chart and EFIS.

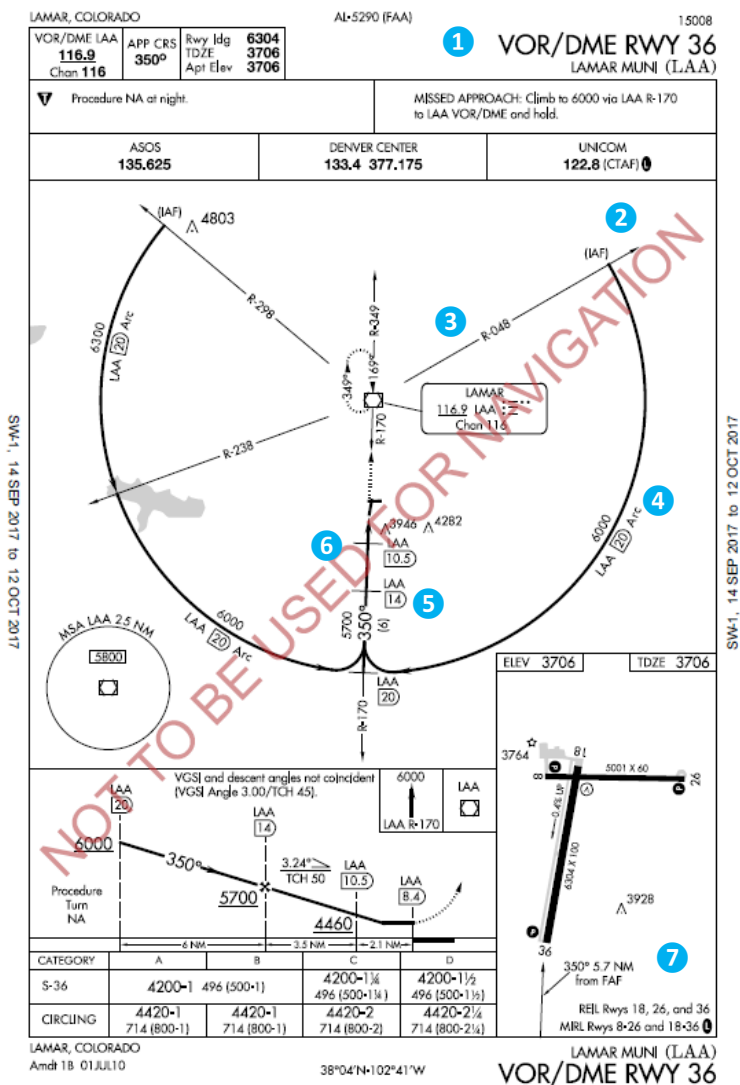
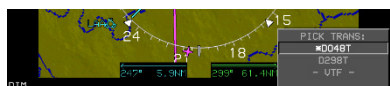
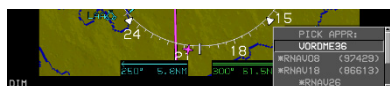
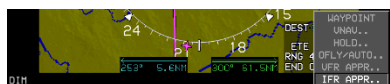


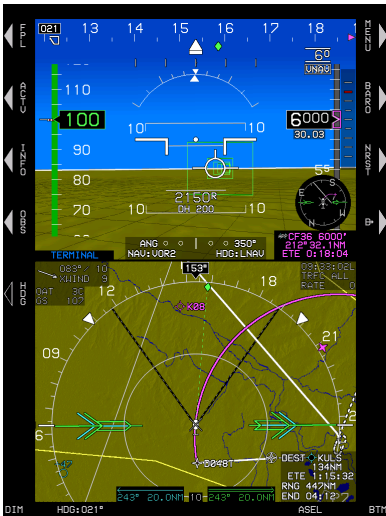
Figure 7-20: VOR/DME Instrument Approach



- 1) With destination airport entered as the waypoint, scroll **1** to select **IFR APPR..** and type of approach. Push to enter.
- 2) **1** Scroll **1** to select desired approach (VORDME36) and push to enter.
- 3) Scroll **1** to desired transition of DO48T (* = most likely transition from this avenue of arrival). Push to enter.
- 4) Scroll **1** to desired runway. Push to enter.
- 5) Press **ACTV (L2)** scroll **1** to view procedure and select fix for compliance with ATC clearance **2** (DO48T). Press **B (R4)** and push **1** to enter.



- 6) A magenta line leads from the -DIR- current position to **3** D048T, which is now the active waypoint. 6000' is the VNAV altitude, and aircraft is descending to the HITS boxes with green arc altitude predictor showing where this altitude is reached along the route.



- 7) Established on the 20 DME ARC **4** with NAV1 and NAV2 set on 116.9 MHz for LAA VOR and inbound FAC set at 350° on both VORs with DME indicating on both nav sources.

ANLG AGL	
BANK SCL	✓
BASIC	
MINI MAP	✓
MINI TRFC	
SKYWAY	
SUS TAWS	✓
SUS BASIC	
TRAFFIC	
TURN IND	✓
FD1	
FD2	
METERS	
DONE	

- 8) To declutter the mini map for best situational awareness in the PFI area, press **MENU (R1)**, and then **DCLTR (R4)**. Scroll **1** to **MINI MAP** and then press **EXIT (R1)** or scroll **1** to **DONE** and push to enter.





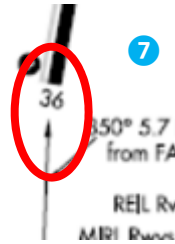
- 11) Approaching the **6** stepdown fix 11VOR at the proper altitude of 4460' as shown in the waypoint information box.

APP 11VOR **4460'**
355° 0.4NM
ETE 0:00:14

Below minimums with audible alert, "MINIMUMS, MINIMUMS."



- 12) Established at 100 KIAS on short final with the runway in sight .6 NM ahead at the same angle as shown on the instrument approach chart.





- 13) After passing the MAWPT and the missed approach procedure was automatically sequenced, aircraft begins following the dashed magenta missed approach course lines on the MAP. NAV source automatically switched to FMS1 and 0.3NM FSD.

**TERMINAL
FLTA INHBT**

reference to still being in the terminal area and TAWS terrain alerts are still inhibited.

7.11.8. ILS or LOC RWY 1 Instrument Approach with Missed Approach Flown to Alternate fix (Step-By-Step)

This example loads the Akron-Canton, Ohio, USA, ILS or LOC RWY 1 approach with the missed approach flown to the alternate missed approach fix (KEATN)

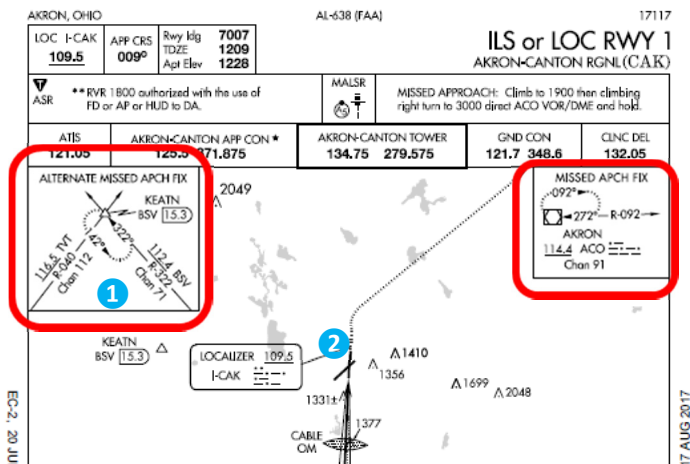


Figure 7-21: ILS or LOC RWY 1 Instrument Approach with Missed Approach Flown to Alternate fix (Step-By-Step)

During the instrument approach clearance, ATC advised that in the event of a missed approach, plan on flying the alternate missed approach instructions to **1** KEATN intersection and hold as published. The ILS RWY 1 instrument approach is loaded and the active flight plan is opened and **1** is scrolled to one position past (KCAK) and **INSERT (R2)** is pressed and KEATN entered with **1** and pushed to enter.



- 1) **1** Create KEATN waypoint in active flight plan and push **1** to enter.



- 2) Scroll **1** to HOLD and push to enter.

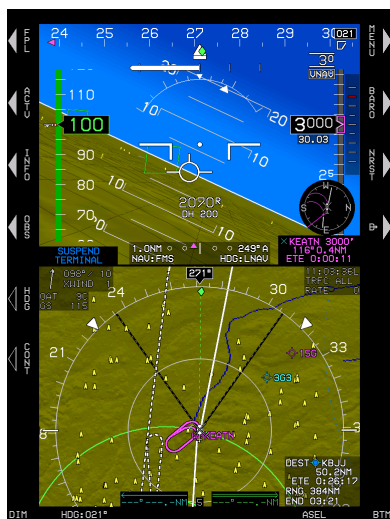


3) Create published holding pattern at KEATN and scroll/push **1** through the process then push to enter. Observe KEATN is in correct position in active flight plan after (KCAK.)

4) **2** Upon executing the missed approach, scroll **1** to KEATN then press **D** (R4) and push **1** to enter a direct routing to KEATN.



5) Verify the active flight plan has the holding pattern entered as published and is depicted on the ND correctly.



6) Established in the holding pattern at KEATN. When cleared to continue to next waypoint on Active flight plan, press **CONT** (L6). Waypoint sequencing resumes.

7) If an instrument approach is necessary at the destination, KBJJ, the approach can be loaded without losing the holding pattern at KEATN since it was not part of the KCAK ILS 01 Instrument approach procedure.

WAYPOINT	UNAV/OFFSET	PATH	DIST	ETE	ETA	FUEL
KCAK	3000'	E- 033*	15.7M	01:12	---	---
KPOU	3000'	E- 033*	10.0M	01:11	11:18	64
DIR	3000'	E- 033*	10.0M	01:11	10:54	72
KEATN	3000'	E- 070*	10.1M	01:00	11:00	71
KEATN	3000'	E- 070*	10.1M	01:19	11:07	65
PONCC	3000'	E- 084*	22.1M	01:19	11:22	64
JUNIC	3000'	E- 188*	4.3M	01:00	11:22	63
TONSR	2800'	E- 098*	5.3M	01:00	11:22	62
COIPK	1980'	E- 098*	2.3M	01:0	11:25	65
RW10	1150'	E- 098*	2.3M	01:0	11:30	61
DEHYH	3000'	E- 098*	11.3M	01:07	11:37	59
DEHYH	3000'	E- 098*	11.3M	01:08	11:44	58
(KBJJ)					---	---

- 8) Push **1** and scroll to **NAV LOG** and push to enter. The preceding ILS procedure is deleted automatically when the instrument approach is loaded for KBJJ.

NOTE:

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 **LPU ULON** 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. Enhanced HTAWS and HTAWS (Terrain Awareness and Warning System) Functions

The IDU provides TSO-C194 HTAWS functionality. Depending on aircraft configuration and external sensors/switches, the system is configurable as an Enhanced HTAWS or HTAWS. Warning functions provided by HTAWS are:

- 1) **Terrain Display:** Terrain and obstacles on PFD and ND.
- 2) **Forward Looking Terrain Awareness (FLTA):** Alerts to hazardous terrain or obstructions in front of the aircraft.
- 3) **Excessive Rate of Descent (GPWS Mode 1):** Alerts when high rate of descent above terrain (i.e., descending into terrain).
- 4) **Excessive Closure Rate to Terrain (GPWS Mode 2):** Alerts when hazardously high rate of change over rising terrain.
- 5) **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.
- 6) **Flight into Terrain when not in Landing Configuration (GPWS Mode 4):** Alerts when descending into terrain without properly configuring the aircraft for landing.
- 7) **Excessive Downward Deviation from an ILS Glideslope (GPWS Mode 5):** Alerts when deviating below glideslope on the ILS final approach segment.

Table 8-1: TAWS Functions Provided by the EFIS

Aircraft Type	TAWS Class	Terrain Display	FLTA	GPWS Mode				
				1	2	3	4	5
Rotorcraft RG	Enhanced	✓	✓	✓	✓	✓	✓	✓
Rotorcraft FG	Enhanced	✓	✓	✓	✓	✓		✓
Rotorcraft	Norm	✓	✓			✓		

Notes: RG = Retractable Gear; FG = Fixed Gear

8.2. Terrain Display

The display of terrain on the PFD and ND are described in Sections 3 Display Symbology and 5 Menu Functions and Step-By-Step Procedures of this pilot guide where applicable.



Figure 8-1: Terrain Display

8.3. Forward Looking Terrain Alert 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 | 5) Aircraft track |
| 2) Obstruction database | 6) Aircraft groundspeed |
| 3) Airport and runway database | 7) Aircraft bank angle |
| 4) Aircraft position | 8) Aircraft altitude |
| | 9) Aircraft vertical speed |

8.3.1. FLTA Modes

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

8.3.2. GPS/SBAS Navigation Mode Slaving

The EFIS performs TSO-C146c GPS/SBAS system functions in addition to the TAWS functions. As a result, GPS/SBAS navigation mode is available as an input to the TAWS. The pilot may select an IFR procedure (approach, DP, or STAR), which automatically changes the GPS/SBAS navigation mode to enroute, terminal, departure, or IFR approach as appropriate. In addition, the pilot may select a VFR approach to any runway or user waypoint with a defined approach path. Selection of a VFR approach causes automatic GPS/SBAS navigation mode changes to enroute, terminal, or VFR approach as appropriate.

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.

8.3.3. Default FLTA Mode

If the default FLTA navigation mode is higher in precedence than the GPS/SBAS navigation mode, FLTA mode is slaved to the default FLTA navigation mode. These modes and order of precedence are:

- 1) **Departure Mode:** Enabled when in Ground Mode. Reference point for automatic FLTA inhibiting and mode envelope definition is the last point at which the ground definition was satisfied (near the liftoff point). Departure Mode ends upon climbing through 1500 feet above or traveling more than 6NM from the reference point.

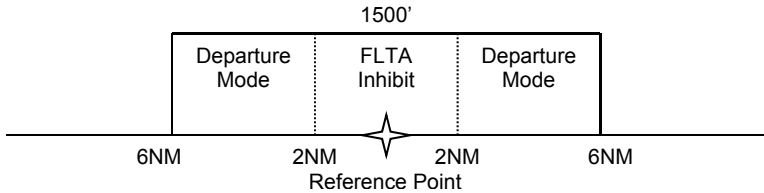


Figure 8-3: Default FLTA INHBT

- 2) **Other Modes:** For other default FLTA modes, reference point for automatic FLTA inhibiting and mode envelope is the nearest runway threshold or the nearest user waypoint with a defined approach bearing. TAWS continuously searches all runway thresholds at the nearest three airports to determine the nearest runway threshold. 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:
- Approach Mode:** When within 1900 feet and 5NM of the reference point.
 - 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.
 - Enroute Mode:** When not in any other mode.

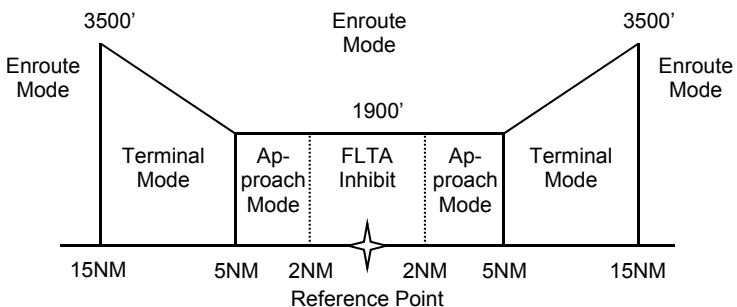


Figure 8-4: FLTA INHBT Mode Areas

8.3.4. 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, a caution or warning is given. Dimensions of the search envelope depend upon TAWS type, FLTA mode, and aircraft track, groundspeed, bank angle, and vertical speed. Basic envelope parameters are as follows:

- 1) **TAWS Type:** Determines value of several parameters used to calculate the search envelope.

Table 8-2: FLTA Search Envelope for HTAWS

Envelope	Parameter
Level-Off Rule	10% of vertical speed Used for level off leading
Range	36 seconds of forward range search envelope Reduced to 24 seconds when Low Altitude Mode is engaged. After calculations, GPS/SBAS HFOM is added to range.
Enroute Mode Level/Climbing Flight RTC	150 feet Reduced to 100 feet when Low Altitude Mode is engaged.
Terminal Mode Level/Climbing Flight RTC	
Approach Mode Level/Climbing Flight RTC	
Departure Mode Level/Climbing Flight RTC	100 feet
Enroute Mode Descending RTC	
Terminal Mode Descending RTC	
Approach Mode Descending RTC	
Departure Mode Descending RTC	

- 2) **Aircraft Track:** Terrain search envelope is aligned with aircraft track.
- 3) **Aircraft Groundspeed:** Used in conjunction with range parameter to determine the look-ahead distance and used with FLTA mode to determine search volume width as follows:

- a) **Enroute Mode:** Based on a 30° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.5NM either side of track.
- b) **Terminal Mode:** Based on a 15° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.5NM either side of track.
- c) **Approach Mode:** Based on a 10° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.3NM either side of track.
- d) **Departure Mode:** Based on a 10° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.3NM either side of track.

After calculating search volume width as described above, the GPS/SBAS HFOM is added to search volume width.

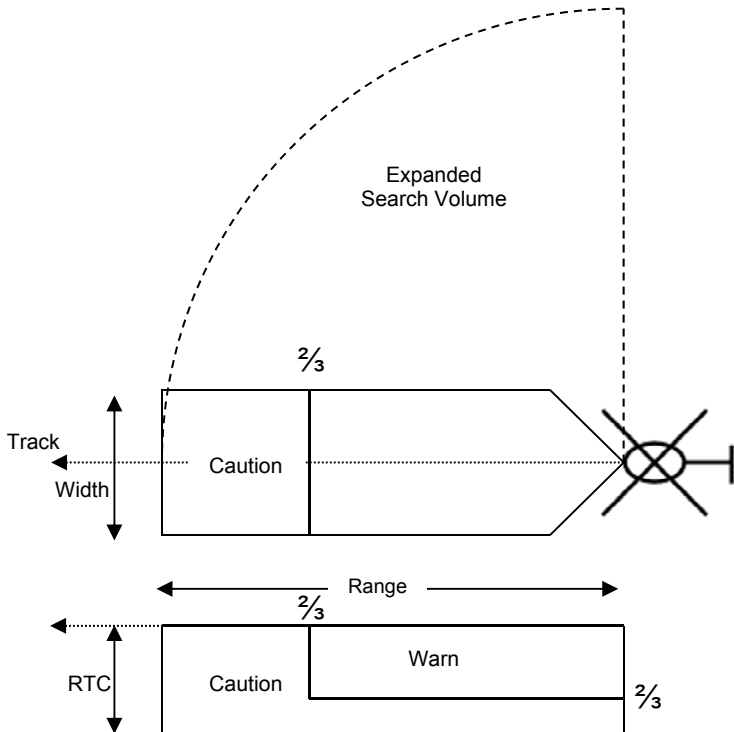


Figure 8-5: FLTA Search Volume

- 4) **Aircraft Bank Angle:** Used to expand the search volume in the direction of a turn and require 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.

8.3.5. FLTA Alerts and Automatic Popup



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 navigation display screen, terrain rendering is only enabled 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 navigation display.
- 2) Switches to aircraft centered and heading up.
- 3) Panning disabled.
- 4) Scale set to:
 - a) 10NM (groundspeed > 200 knots);
 - b) 5 NM (groundspeed \leq 200 knots and groundspeed > 100 knots); or
 - c) 2NM (groundspeed \leq 100 knots).



Figure 8-6: PFD in Popup Mode

After the popup mode is engaged, the pilot may change any setting automatically changed by the popup mode. In addition, **RESET** appears for 20 seconds to reset the previous screen configuration with one button press. Popups only occur on IDU #0 or IDU #1 with either HTAWS classes enabled and do not occur:

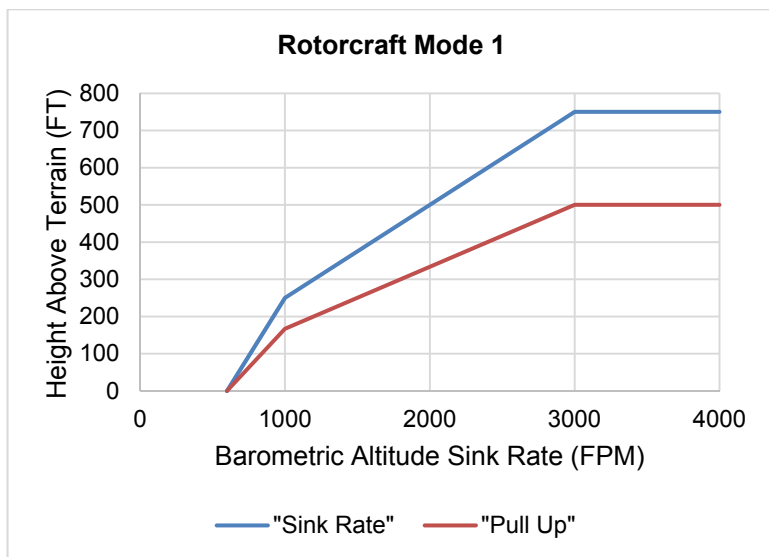
- 1) If TAWS Inhibit is enabled;
- 2) In Essential Mode, if Essential EICAS page is shown.

8.4. Excessive Rate of Descent (GPWS Mode 1)

GPWS Mode 1 function uses aircraft vertical speed information and AGL altitude to alert when high rate of descent above terrain. GPWS Mode 1 has a caution and a warning threshold. When below thresholds, a GPWS Mode 1 warning is generated.

Table 8-3: HTAWS GPWS Mode 1 Envelope

Sink Rate (fpm)	AGL Altitude (ft.)	
	“Sink Rate” Caution Threshold	“Pull Up” Warning Threshold
< 1000	$62.5\% \times (\text{Sink Rate} - 600)$	$66\% \times (\text{Caution Threshold})$
1000 to 3000	Lesser of: 750, or, $25\% \times (\text{Sink Rate})$	

**Figure 8-7: Rotorcraft GPWS Mode 1**

8.5. Excessive Closure Rate to Terrain (GPWS Mode 2)

GPWS Mode 2 function is present in Enhanced HTAWS and uses filtered AGL rate and AGL altitude to alert when hazardously high rate of change 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 follows.

Table 8-4: HTAWS GPWS Mode 2 Envelopes

Landing Gear	Mode 2A	Mode 2B
Retractable	Landing Gear Up	Landing Gear Down
Fixed	AGL Altitude > 200 ft or Airspeed > 80 KIAS	AGL Altitude ≤ 200 ft and Airspeed ≤ 80 KIAS

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

Table 8-5: HTAWS GPWS Mode 2A Envelopes (NOT in Landing Configuration)

AGL Rate (fpm)	AGL Altitude (ft.)	
	“Caution, Terrain” Caution Threshold	“Pull Up” Warning Threshold
< 1905	$125\% \times (\text{AGL Rate} - 1600)$	
> 1905	20% of the lesser of:	
	Airspeed (KIAS)	AGL Rate (fpm)
	< 90	3120
	90 to 130	$3120 + 72 \times (\text{Airspeed} - 90)$
> 130	6000	$66\% \times (\text{Caution Threshold})$
or AGL Rate		

Table 8-6: HTAWS GPWS Mode 2B Envelopes

AGL Altitude (ft.)	
“Caution, Terrain” Caution Threshold	“Pull Up” Warning Threshold
Lesser of: 300, or, $20\% \times (\text{AGL Rate} - 2000)$	$66\% \times (\text{Caution Threshold})$

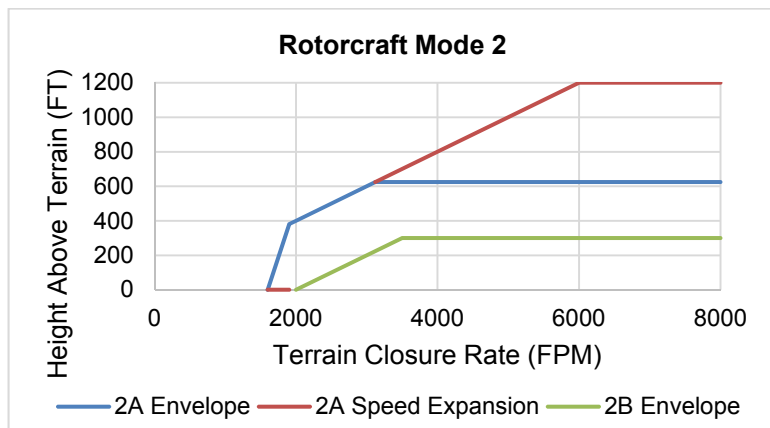


Figure 8-8: Rotorcraft GPWS Mode 2

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 by either being in ground mode or by being 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 400 feet AGL, traveling more than 3NM 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 = $1.4 \times$ sink rate), a GPWS Mode 3 caution is generated.

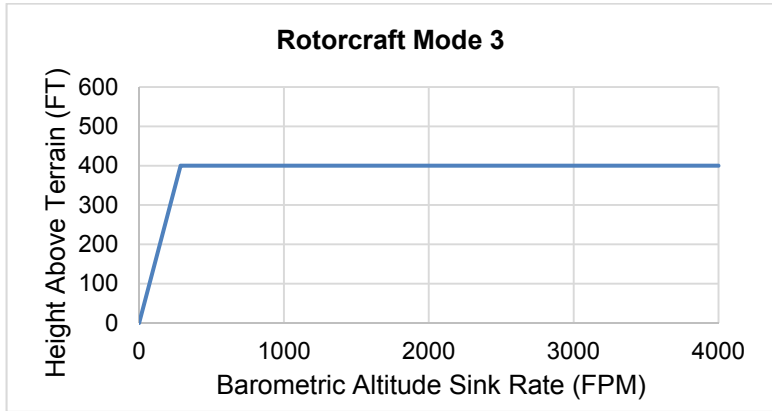


Figure 8-9: Rotorcraft GPWS Mode 3

8.7. Flight into Terrain when not in Landing Configuration (GPWS Mode 4)

GPWS Mode 4 function is present in Enhanced HTAWS 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 gives cautions when landing gear is in other than landing configuration, and Mode 4B gives cautions when landing gear are in other than landing configuration. Applicability of Mode 4 envelopes to aircraft types are as follows.

Table 8-7: HTAWS GPWS Mode 4 Envelopes

Landing Gear	Mode 4A	Mode 4B
Retractable	Landing Gear Up	Not Applicable
Fixed	Not Applicable	Not Applicable

Mode 4 envelope consists of low-speed and high-speed regions.

Region	Caution Flag	Single Voice Alert
Low-Speed		"Too Low Gear"
High-Speed		"Too Low Terrain"
Autorotation expansion, when engaged, regardless of speed		"Too Low Gear"

Mode 4 alerting criteria require the Mode 4 envelope to be entered from above, so changing aircraft configuration while within a Mode 4 envelope does not generate an alert.

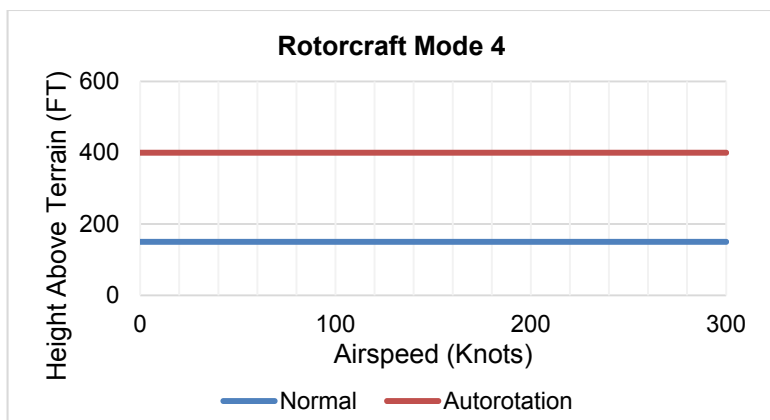


Figure 8-10: Rotorcraft GPWS Mode 4

Segment	Speed (KIAS)	AGL Altitude (ft.)
4A Low-Speed	< 100	150
4A High-Speed	≥ 100	(400 in autorotation)

8.8. Excessive Downward Deviation from an ILS Glideslope (GPWS Mode 5)

GPWS Mode 5 function uses ILS glideslope deviation information and AGL altitude to alert when excessive downward glideslope

deviation is detected on the final approach segment of an ILS approach. GPWS Mode 5 is armed when a valid glideslope 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

(**GLIDESLOPE**, **GLIDESLOPE** or **GLIDESLOPE**). The curve compares glideslope deviation to AGL altitude as follows. (Reference: RTCA/DO-161A Mode 5 for TAWS)

Table 8-10: HTAWS GPWS Mode 5 Envelopes	
Caution Threshold	Warning Threshold
Greater of: $\left[1.3 + 1.4\% \times (150 - \text{AGL Altitude}) \right] \text{ Dots}$ or 1.3 Dots	Greater of: $\left[2 + 1\% \times (150 - \text{AGL Altitude}) \right] \text{ Dots}$ or 2 Dots

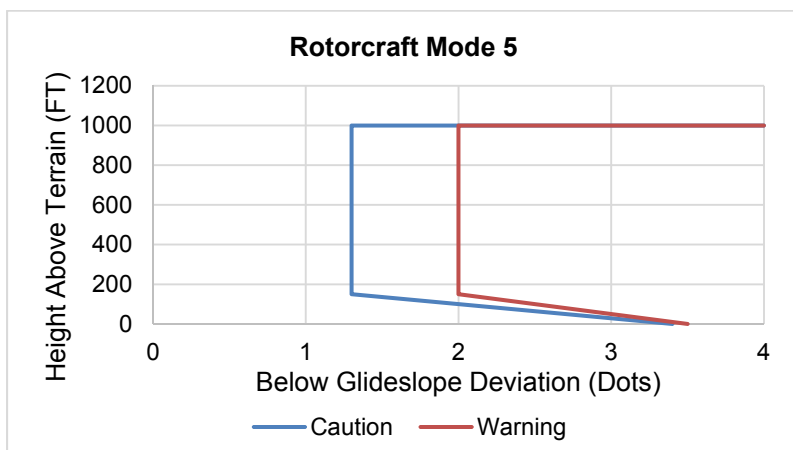


Figure 8-11: Rotorcraft GPWS Mode 5

8.9. 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.** Glideslope receiver is the source of glideslope deviation.
- 4) **Radar Altimeter (RA).** Source for radar altitude.
- 5) **Gear Position Sensors.** As configured in the system limits, source of landing gear position.
- 6) **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 on PFD).
- 7) **Low Altitude Mode Switch.** As configured in the system limits, used for inhibiting and modifying HTAWS alerting functions to allow normal operation at low altitudes. Low Altitude Mode Switch is of the latching type and gives an obvious indication of actuation (e.g., toggle/rocker or pushbutton with indicator light and **TAWS LOW ALT** in the lower left corner of PFI area on PFD).
- 8) **Audio Mute Switch.** Momentarily activated to silence active audible alerts. It is connected directly to the IDU.
- 9) **Glideslope Deactivate Switch.** As configured in the system limits, momentarily activated to inhibit GPWS Mode 5 function.
- 10) **Low Torque Sensor:** A low torque discrete, as configured in the system limits and used for inhibiting and modifying HTAWS alerting functions during an autorotation.

Table 8-11: External Sensors and Switches (Applicable TAWS)

Aircraft Type	Rotorcraft RG	Rotorcraft FG	Rotorcraft
HTAWS Class	Enhanced	Enhanced	Norm

Table 8-11: External Sensors and Switches (Applicable TAWS)

Aircraft Type	Rotorcraft RG	Rotorcraft FG	Rotorcraft
GPS/SBAS	✓	✓	✓
ADC	✓	✓	✓
Gear Position Sensor	✓		
TAWS Inhibit Switch	✓	✓	✓
Audio Cancel Switch	✓	✓	✓
Low Altitude Mode Switch	✓	✓	✓
Low Torque Sensor	✓	✓	
ILS	✓	✓	
Radar Altimeter	✓	✓	
Glideslope Deactivate Switch	✓	✓	

Notes: RG = Retractable Gear; FG = Fixed Gear

8.10. TAWS Basic Parameter Determination

Fundamental parameters used for TAWS functions are as follows.

Table 8-12: HTAWS Basic Parameters Determination

Parameter	Source	Notes
Aircraft position, groundspeed, 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 mode of flight
MSL Altitude Secondary source of MSL altitude is barometric altitude from an air data computer. Barometric	GPS/SBAS	Geodetic height converted to MSL with current EGM database. To be considered valid to use as MSL altitude, VFOM must be less than or equal to 106 feet. 1) If either the pilot or co-pilot system is operating

Table 8-12: HTAWS Basic Parameters Determination

Parameter	Source	Notes
<p>altitude is based upon a barometric setting in the following order of preference:</p>		<p>in QNH mode, the QNH barometric setting is used (i.e. on-side barometric setting preferred); or</p> <p>2) If GPS/SBAS geodetic height has been valid within the last 30 minutes, a barometric setting derived from the GPS/SBAS geodetic height is used.</p> <p>If neither of the above conditions is met, MSL altitude is marked as invalid.</p> <p>When a reporting station elevation is determined and outside air temperature is valid, a temperature correction is applied.</p> <p>TAWS uses the lower of the barometric altitude or the temperature-corrected altitude. In the case of QNH-mode barometric setting, reporting station elevation is derived from waypoint or active runway elevations in the active flight plan using the following logic:</p> <p>1) If the aircraft is in TERMINAL, DEPARTURE, IFR APPROACH, or VFR APPROACH mode and an active runway exists, reporting station elevation</p>

Table 8-12: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		<p>is the elevation of the active runway threshold.</p> <p>2) Otherwise, if the aircraft is in TERMINAL mode, reporting station elevation is the elevation of the airport causing TERMINAL mode.</p> <p>3) In ENROUTE mode, no reporting station elevation is determined.</p> <p>In the case of GPS/SBAS geodetic height-based barometric setting, reporting station elevation is the GPS MSL altitude reported at the time the barometric setting was determined (see Section 3 Display Symbology).</p>
Terrain Data	Terrain Database	<p>To be considered valid, the following must apply:</p> <ol style="list-style-type: none"> 1) Aircraft position is valid; 2) Aircraft position is within the boundaries of the terrain database; and 3) Terrain database is not corrupt as determined by built-in test at system initialization and during runtime.
Obstacle Data	Obstacle Database	<p>To be considered valid, the following must apply:</p> <ol style="list-style-type: none"> 1) Aircraft position is valid; 2) Aircraft position is within the boundaries of the obstacle database; and

Table 8-12: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		3) Obstacle database is not corrupt as determined by built-in test at system initialization.
AGL Altitude	Radar Altitude	Secondary source f is MSL altitude less terrain altitude.
Vertical Speed	Instantaneous Vertical Speed	IVSI values come from barometric vertical speed from an ADC “quickenened” with vertical acceleration from an AHRS. Secondary source for vertical speed is barometric vertical speed from an ADC. 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 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: <ol style="list-style-type: none"> 1) Aircraft position is valid; 2) Aircraft position is within boundaries of the navigation database; and 3) Navigation database is not corrupt as determined by a built-in test at system initialization.

8.11. 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 the Terminal, Departure, IFR Approach, or VFR Approach Modes and within 2NM and 1900' of the reference point.
- 2) PDA function is automatically inhibited when within 2NM and 1900' of the approach runway threshold.
- 3) GPWS Modes 1 through 4 are automatically inhibited when below 50 feet AGL (radar altimeter AGL altitude) or below 100 feet AGL (terrain database AGL altitude).
- 4) 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 glideslope receiver detects glideslope sidelobes.
- 5) FLTA function is automatically inhibited when airspeed or groundspeed is below the HTAWS FLTA Inhibit Speed.

8.11.1. TAWS Automatic Inhibit Functions (Abnormal Operation)

The following automatic inhibit functions occur during the specified abnormal operations:

- 1) **Autorotation detection:** When low torque sensor is active, Enhanced HTAWS enters Autorotation Mode. In this mode:
 - a) FLTA is inhibited;
 - b) GPWS Mode 1 is inhibited;
 - c) GPWS Mode 2 is inhibited; and
 - d) GPWS Mode 4 uses a modified envelope (see § 8.7).
- 2) **System Sensor/Database Failures:** System sensor failures, non-installation of optional sensors, database failures, and combinations thereof affect the TAWS as follows.

Table 8-13: TAWS Automatic Inhibit Functions								
Sensor	Parameters Lost	Terrain Displaced	FLTA	GPWS Mode				
				1	2	3	4	5
GPS/SBAS (H)	AC Position	Inhibit	Inhibit					
TD	Terrain Elev.	Inhibit	Inhibit					
ILS	Glide-slope Dev.							Inhibit
MSL	MSL Altitude	Inhibit	Inhibit					
GPS/SBAS (H) + RADLT	AC Position, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC	MSL Altitude, VSI	Inhibit	Inhibit	Inhibit		Inhibit		
TD + RADLT	Terrain Elev. AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Sensor	Parameters Lost	Terrain Displaced	FLTA	GPWS Mode				
				1	2	3	4	5
				MSL + RADLT	MSL Altitude, AGL Altitude	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC + RADLT	MSL Altitude, VSI, AGL ALT	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Notes:

- Combinations listed give the minimum combinations with the worst consequences. Many other combinations are possible, but their effects are subsumed within the combinations listed.
- GPS/SBAS (H) = HFOM > max (0.3NM, HAL). Indication is loss of terrain display on PFD and ND.
- GPS/SBAS (V) = VFOM > 106'.
- GPS/SBAS = GPS/SBAS (H) + GPS/SBAS (V). Indication is loss of terrain display on PFD and ND.
- TD = Terrain Data invalid. This would be due to being beyond the database boundaries or database corruption.
- ADC = Air Data Computer. Indication is **ADC1 FAIL**, **ADC2 FAIL**, or **ADC1/2 FAIL**, or red Xs indicating a single ADC failure.
- RADALT = Radar Altimeter. Indication is **RALT FAIL**, **RALT1 FAIL**, **RALT2 FAIL**, or **RALT1/2 FAIL**.
- ILS = ILS Glideslope Deviation. Indication is lack of glideslope needles.

- 9) MSL = MSL Altitude Invalid. Indication is

PLT1 TAWS
PLT2 TAWS
PLT3 TAWS
PLT4 TAWS

 or

CPLT1 TAWS
CPLT2 TAWS
CPLT3 TAWS
CPLT4 TAWS

 in the absence of other failures.

8.11.2. TAWS Manual Inhibit Functions

The pilot may select the following manual inhibit functions:

- 1) Terrain display function may be inhibited using an 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 display of FLTA warnings (red) and cautions (amber [yellow]) flags on the ND.
- 3) GPWS Mode 5 is manually inhibited with the glideslope cancel switch when below 1000' AGL. GPWS Mode 5 manual inhibit automatically resets by ascending above 1000'AGL.

8.12. TAWS Selections on PFD

PFD Declutter menu includes three option possibilities for TAWS:

- 1) SVS TAWS
- 2) SVS BASIC
- 3) None

The following figures show all 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.

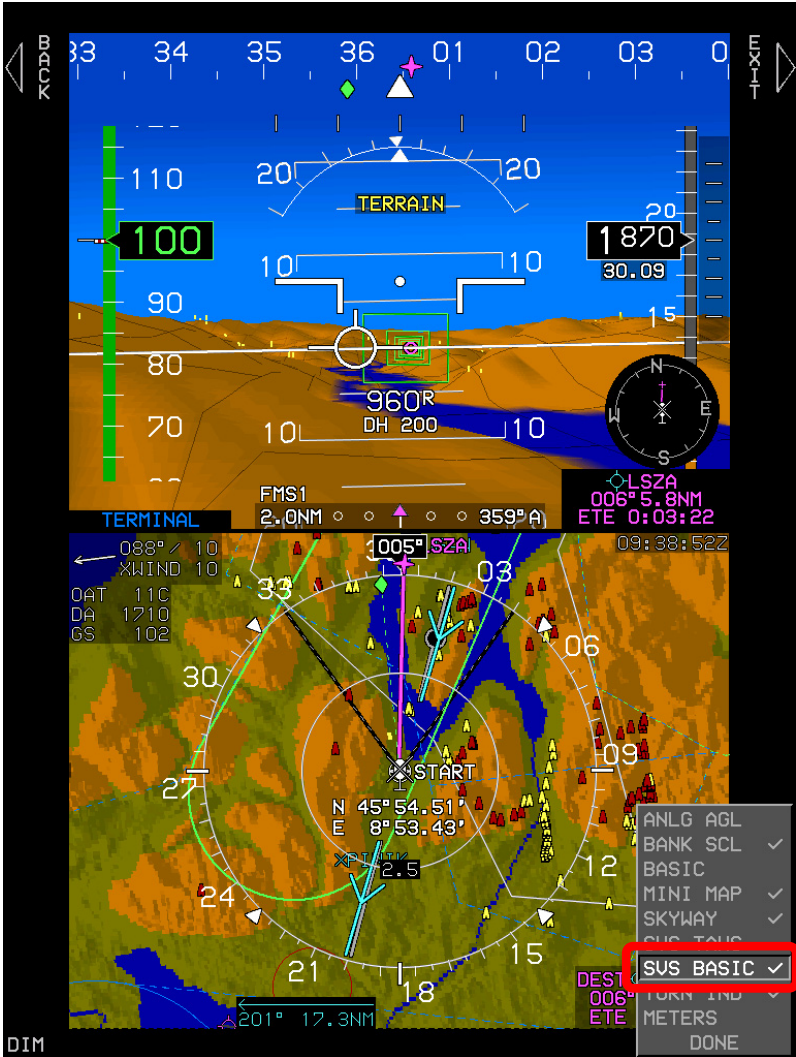
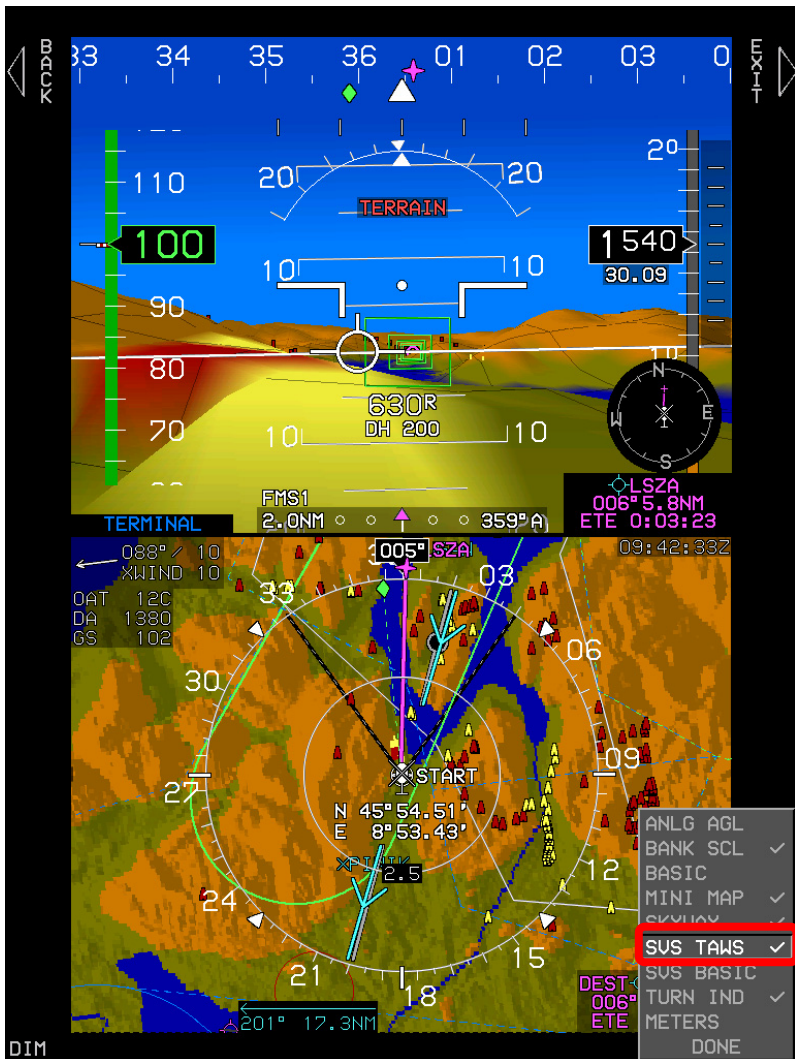
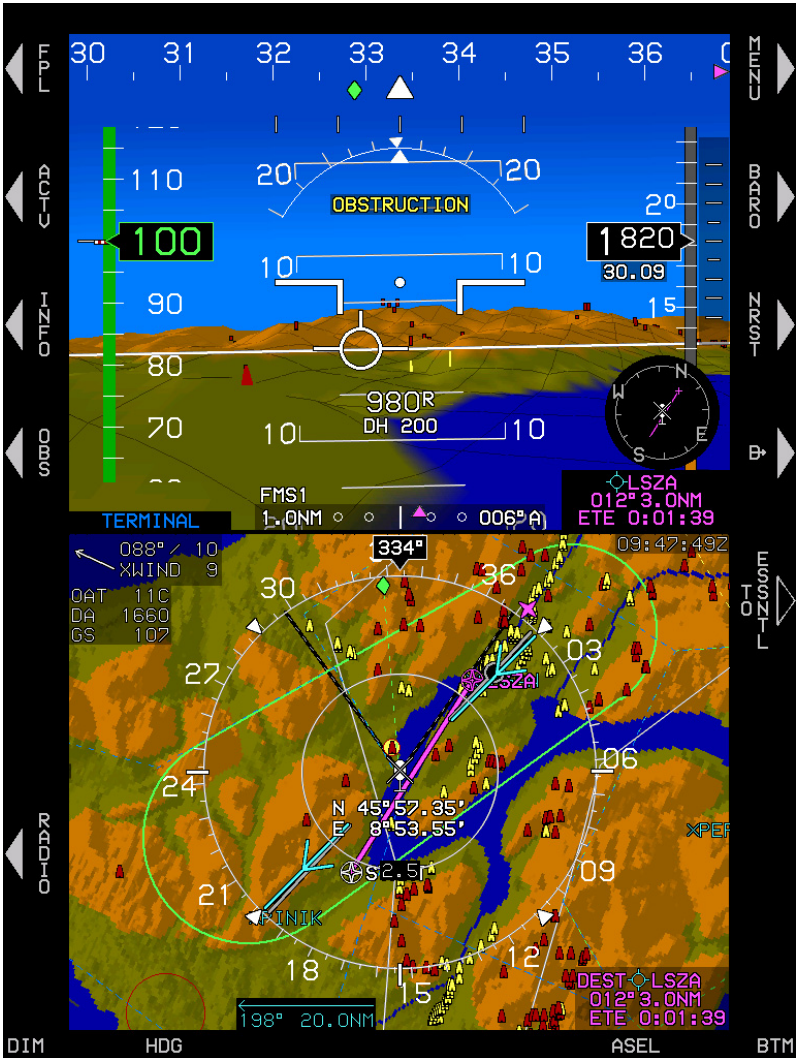


Figure 8-12: PFD SVS BASIC Option



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

Figure 8-13: PFD SVS TAWS Option




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

Figure 8-14: PFD SVS TAWS Option and Obstruction Caution




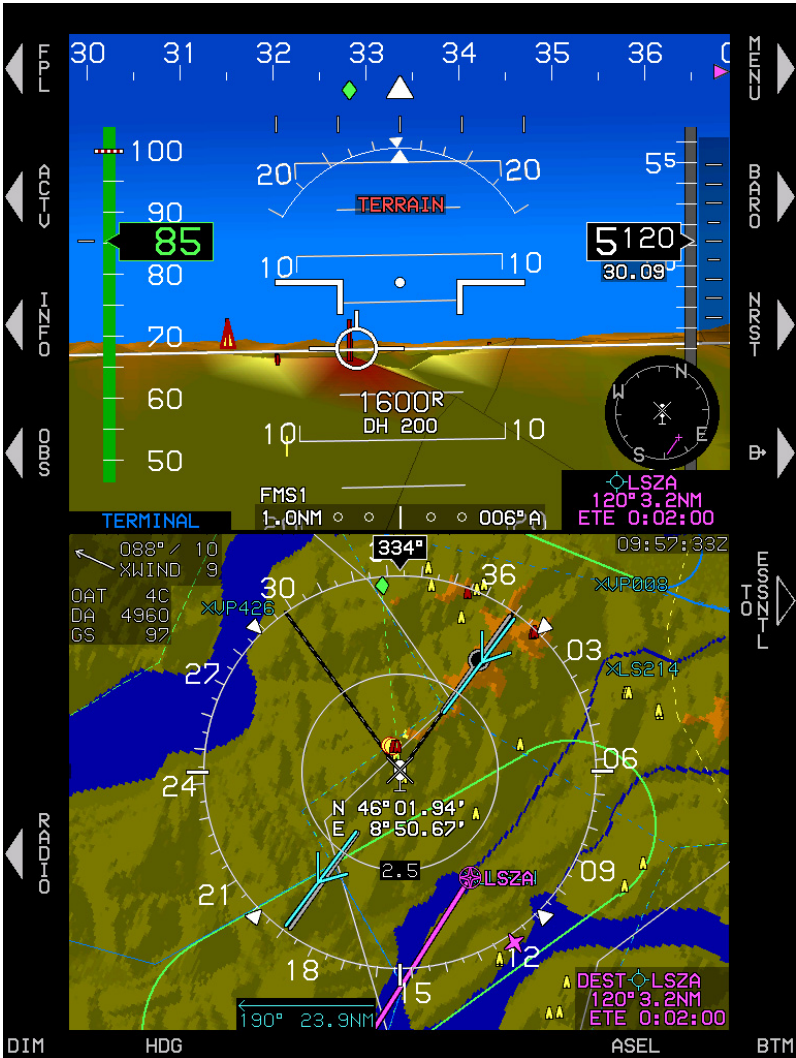
Obstruction within TAWS FLTA warning envelope with audible alert “Warning Obstruction, Warning Obstruction.” 
 Obstruction symbols flash.

Figure 8-15: 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 8-16: Automatic PFD Terrain Warning

Section 9 Appendix

9.1. Appendix

This section contains a variety of useful information not found elsewhere in the document and includes operating tips, system specifications, feedback forms, and environmental requirements.

9.2. Operating Tips

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. Additional operating tips are available with future releases of this publication.

9.3. Domestic or International Flight Planning

Due to the differences in every aircraft avionics suite installation for the pilot to 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.

9.4. Descent Planning

Instead of performing conventional time/speed/distance/descent-rate calculations, use the waypoint symbol for descent planning. Simply maintain the cruise altitude until the "X" at the bottom of the waypoint symbol is 2-3 degrees below the horizon (as indicated by the pitch scale) then begin a 2-3 degree descent. Maintain the correct descent angle by keeping the flight path marker positioned on the waypoint "X" symbol. Following the skyway boxes assures the VNAV descent angle is maintained.

9.5. Terrain Clearance

Use the flight path marker to evaluate climb performance for terrain clearance. If climbing at the best climb speed to clear terrain and the flight path marker is overlaying the terrain, which must be cleared, the climb rate is insufficient. Either the course or climb rate must be

altered to adequately clear the terrain. If the flight path marker is well clear of the terrain (overlying blue sky), the climb is sufficient for the present time, and no further action is necessary until level off.

9.6. Departure Airport Information

On startup, all the information for the departure airport is readily available. The altimeter is automatically set to the nearest IFR runway touchdown zone elevation (if Baro Autosetting on Startup is enabled in EFIS limits). Press **NRST (R3)** to reveal the nearest airports when highlighted where all important data such as elevation, frequencies, and runway lengths are displayed.

9.7. Unique Names for Flight Plans

Multiple routes between the same airport pairs are numbered automatically (KCEW-KDHN) [0], (KCEW-KDHN) [1], etc.). The work-around is to apply this easily remembered differentiation. If a route is routinely flown from one airport to another but different routing is necessary due to weather, hot MOA areas, etc., up to 10 different flight plans may be created for the same destination.

As an example for departing Sikes on a northern routing (KCEWN) or a southern routing (KCEWS), create two different user waypoints at the departure airport named KCEWN and KCEWS followed by different routing to clear whatever creates the necessity for specific routing, e.g. a MOA.

9.8. Altimeter Settings

Use caution when setting the altimeter and inadvertently changing the transition level. If this is reset to a lower than normal altitude, **CHK BARO** may appear due to the altimeter setting not on 29.92 inHg or 1013 mbar.

9.9. Warnings, Cautions, and Advisories

Review Section 2 System Overview for the conditions precisely defining scenarios for various time-critical warning alerts, warning alerts, master visual and audio alerts, time-critical caution alerts and advisory alerts, as they appear including the conditions and time delay when applicable.

9.10. Magnetic vs. True North Modes of Operation

There are two modes for the AHRS:

- 1) Slaved mode (i.e., compass rose stabilized by Earth's magnetic flux horizontal field) is the normal mode. It works well over most of the surface of the earth (i.e., areas with a horizontal field of 5000nT or above, which includes about 2/3^{ds} of Canadian NDA). ADAHRS senses magnetic flux with a 3D magnetometer. Performance in small horizontal fields is installation dependent as variable magnetic disturbances from the aircraft may begin to predominate.
- 2) Free or "DG" mode (i.e., compass rose not stabilized by the Earth's magnetic flux horizontal field and subject to drift) is used in areas of magnetic disturbances (oilrigs, MRI machines, etc.) or in areas where the horizontal field is too weak. In Free/"DG" mode, heading no longer corrects towards Earth's magnetic flux horizontal field, and the pilot may "slew" the heading solution.

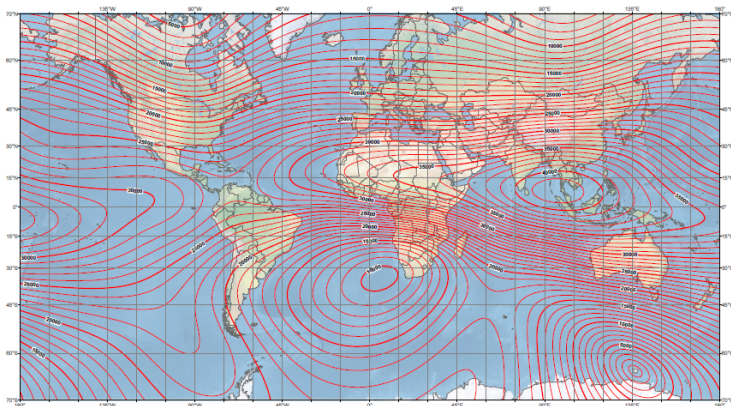


Figure 9-1: US/UK World Magnetic Model

There are two modes for the EFIS:

- 1) Magnetic North mode: Heading from AHRS (whether slaved or Free/"DG") is used as-is and is expected to reflect Magnetic North. GPS Track is converted from true north-referenced to magnetic north-referenced using a magnetic variation database. PFD scenes and compass rose symbols are aligned with magnetic north. Wind is displayed referenced to magnetic north.

- 2) True North mode: GPS track is used as-is and reflects true north. When AHRS is in slaved mode, heading from AHRS is converted from magnetic north-referenced to true north-referenced using a magnetic variation database. When AHRS is in Free/"DG" mode, heading from the AHRS is used as-is and is expected to reflect true north. PFD scenes and compass rose symbols are aligned with true north. Wind is displayed referenced to true north.

NOTE:

Designating magnetic north vs. true north mode is critical since it determines how inputs are used – i.e., the relationship between GPS track and ADAHRS heading. Mixing things up in Free/"DG" mode (i.e., slewing the compass rose to match magnetic north when in true north mode and vice-versa) may result in large errors in wind calculations and GPS track/flight path marker displays.

9.11. 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. Allowable instrument error is based upon the values of SAE AS8002A Table 1 as follows.

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'

Allowable installed system error is added on top of instrument error and these values are derived from the regulations as follows.

Table 9-2: Regulatory Reference

Regulation	Allowed Error
14 CFR § 27.1325	At sea level, the greater of 30' or 30% of the calibrated airspeed in knots. This increases proportionally to SAE AS8002A Table 1 at higher altitudes.
14 CFR § 29.1325	

An allowable altitude error is computed for each compared value and added together to create the altitude miscompare threshold. This accommodates for the values deviating in different directions.

Worked example for a calibrated airspeed of 100 knots and comparing a first altitude of 3,490' with a second altitude of 3,510':

- Calculate allowable instrument error based upon altitudes:
 Allowable Instrument Error #1 = 50'
 Allowable Instrument Error #2 = 50'
- Calculate allowable installed system error based upon altitudes and calibrated airspeed:
 Allowable Installed System Error #1 = 30'
 Allowable Installed System Error #2 = 30'
- Calculate altitude miscompare threshold based upon sum of above allowable errors:
 Altitude Miscompare Threshold = 160'

9.12. Airspeed Miscompare Threshold

Airspeed miscompare threshold is based upon allowable airspeed error. There are two components to allowable airspeed error, instrument error and installed system error. Allowable instrument error is based upon the values of SAE AS8002A Table 3 as follows.

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
200 knots	2 knots
250 knots	2.4 knots

Allowable installed system error is added on top of instrument. Error and these values are derived from the regulations as follows.

Table 9-4: Airspeed Regulatory Reference

Regulation	Allowed Error
14 CFR § 27.1323	Starting from $(0.8 \times V_{CLIMB})$: Greater of 5 knots or 3%. Do not perform a comparison if either value is below $(0.8 \times V_{CLIMB})$.
14 CFR § 29.1323	For climbing flight ($VSI > 250$ feet per minute): Starting from $(V_{TOS} - 10)$: 10 knots Do not perform a comparison if either value is below $(V_{TOS} - 10)$ For other flight regimes: Starting from $(0.8 \times V_{TOS})$: Greater of 5 knots or 3%. Do not perform a comparison if either value is below $(0.8 \times V_{TOS})$. System uses V_{CLIMB} as a substitute for V_{TOS} .

An allowable airspeed error is computed for each compared value and added together to create the airspeed miscompare threshold and accommodates for the values deviating in different directions.

9.13. Jeppesen Sanderson NavData® Chart Compatibility

As GPS navigation, flight management systems, computer flight maps, and computer flight planning systems have gained acceptance, avionics companies and software developers have added more features. Even with the many systems available today, paper enroute, departure, arrival, and approach charts are still required and necessary for flight. Avionics systems, flight planning, computer mapping systems, and associated databases *do not* provide all of the navigation information needed to conduct a legal and safe flight. They are not a substitute for current aeronautical charts.

See www.Jeppesen.com for the latest information on coding instrument procedures, naming conventions, altitudes within the database, and aeronautical information compatibility.

9.14. ARINC-424 Path-Terminator Leg Types

For information, definitions, and examples, visit the FAA website, www.faa.gov, to view the Instrument Procedures Handbook (FAA-H-8083-16A).

9.15. 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 flights 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 prior to activating any GMF to avoid erroneous failure indications or corruption of the IDU.

9.15.1. 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.

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 flight has started.

- 2) Press any button on the IDU or push **1** to return to the Ground Maintenance menu.

9.15.2. 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. 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 follows.

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

9.16. Routes and Waypoints

9.16.1. VFR Flight Planning

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.

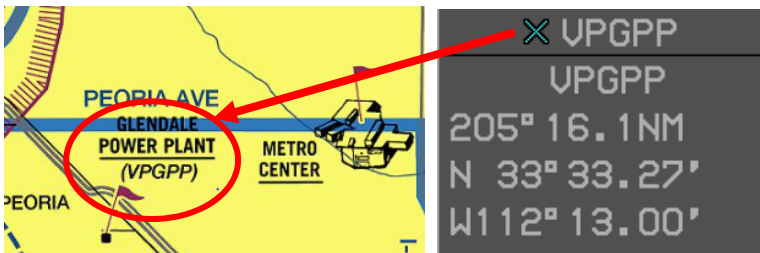


Figure 9-2: VFR Waypoint

9.16.2. 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."

9.16.3. Upload Routes and User Waypoints

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

9.16.4. 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.

9.16.5. EFIS Training Tool (ETT)

See the Installation and User Guide distributed with the ETT install files for directions to install and use the EFIS Training Tool.

Use the ETT to create routes and user waypoints to save and upload into the aircraft mounted IDUs. When uploading a saved flight plan (route) into an aircraft mounted IDU, the following rules apply:

- 1) Either upload flight plan (route) into each IDU to ensure flight plan (route) is saved in the route directory (all other displays);
Or
- 2) Upload flight plan (route) into one display while in the ground mode. When in flight mode, activate that flight plan and on any other display, view active flight plan and press **SAVE (L1)** to save flight plan in the route directory. This action will save the new uploaded flight plan (route) in all other displays.

NOTE:

In a two-sided system, crossfill must be enabled to save flight plan to all other displays on each side of the system.

The ETT has a bezel with simulated buttons and encoders responsive to mouse and keyboard messages. Bezel graphics are derived from actual bezel design data, and the ETT presents an active display with 1:1 pixel correspondence to an actual IDU display. The audio output capability for the ETT matches the audio functionality in the actual IDU. This training tool simulates the functionalities of the IDU, which begins flight in Reno, Nevada at approximately 8000' MSL. If different ETT startup conditions are required, they may be edited.

Flight plans may be created (on the PFD or MFD), stored, and activated in the same manner as on the EFIS displays installed in the aircraft. This allows for moving the start point to anywhere in the world where loaded NavData is present for practicing published procedures. As with the demonstrator program, the aircraft begins flying at approximately 8000' MSL (unless the simulate.ini program is loaded) intercepting the first leg at a 45° angle.

9.17. USB Flash Drive Limitations

When powering up the IDU with a USB flash drive inserted and “Error: No updater files found on USB drive” displays, the USB 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.

9.18. Certification Basis

The following TSOs are considered applicable to the IDU-680 (depending upon the features of the installed software).

Document Number	Document Title	
ARINC 429-16	Mark 33 Digital Information Transfer System (DITS)	
ARINC 735A-1	Traffic Alert and Collision Avoidance System	
EIA-232D	Interface between Data Terminal Equipment and Data	
EIA-422A	Electrical Characteristics of Balanced Voltage Digital Interface Circuits	
FAA AC 23.1311-1B	Installation of Electronic Display in Part 23 Airplanes	
RTCA/DO-155	Minimum Performance Standards - Airborne Low-Range Radio Altimeters	
RTCA/DO-229D	Minimum Operational Performance Standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment	
RTCA/DO-283A	Minimum Operational Performance Standards for Required Navigation Performance for Area Navigation	
SAE AS396B	Bank and Pitch Instruments (Indicating Stabilized Type)	
SAE AS8002A	Air Data Computer - Minimum Performance Standard	
TSO-C4c	Bank and Pitch Instruments	
TSO-C87	Airborne Low-Range Radio Altimeter	
TSO-C106	Air Data Computer	
TSO-C194	Terrain Awareness and Warning System	
TSO-C113	Airborne Multipurpose Electronic Displays	SAE AS8034
TSO-C52b	Flight Director Equipment	SAE AS8008
TSO-C146a	Stand-Alone airborne navigation equipment using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)	
N/A	Airplane Aerodynamics and Performance, Lan and Roskam, 1981.	

9.19. Environmental Requirements

While the IDU-680 meets the following RTCA/DO-160F requirements, Genesys Aerosystems claims the following:

- 1) The coldest storage temperature is -55°C.
- 2) Coldest condition in which the units can be powered up is -40°C and will take at least 4 minutes to warm up with the internal heater circuit operating.

Sec.	Condition	Cat.	Test Category Description	Notes
4.0	Temperature and Altitude	F2	Equipment intended for installation in non-pressurized and non-controlled temperature location in an aircraft that is operated at altitudes up to 55,000 ft. (16,800 m) MSL. Operating Low Temp: -55 °C Operating High temp: +70 °C Ground Survival Low Temp: -55 °C Ground Survival High Temp: +85 °C Altitude: +55,000 feet	+75°C for Short-Time Operating High Temp. Cat. V (30 minutes) for loss of cooling.
5.0	Temperature Variation	B	Equipment in a non-temperature-controlled or partially temperature controlled internal section of the aircraft.	
6.0	Humidity	B	Equipment intended for installation in civil aircraft, non-civil transport aircraft and other classes, installed under conditions in which a more severe humidity environment than standard conditions may be encountered.	

Sec.	Condition	Cat.	Test Category Description	Notes
7.0	Operational Shocks & Crash Safety	B	Equipment generally installed in fixed-wing aircraft or helicopters and tested for standard operational shock and crash safety.	Aircraft Type 5, Test Type R for Crash Safety Sustained Test
8.0	Vibration	H + R + U	<p>H – Demonstrates performance at high-level, short duration transient vibration levels</p> <p>R - (Fixed-Wing) Demonstrates performance at higher, robust vibration levels and after long term vibration exposure.</p> <p>U - (Helicopter w/Unknown Frequencies) Demonstrates performance at higher vibration levels and after long term vibration exposure for fuselage and instrument panel equipment when the specific rotor frequencies are unknown.</p>	<p>Cat. H, curve R</p> <p>Cat. R, curves B, B1</p> <p>Cat. U, curve G</p>
9.0	Explosive Atmosphere	X	Not Applicable	
10.0	Waterproofness	W	Equipment is installed in locations where it may be subjected to falling water, such as condensation.	Drip proof test
11.0	Fluids Susceptibility	X	Not Applicable	
12.0	Sand and Dust	S	Equipment is installed in locations subject to blowing sand and dust.	

Sec.	Condition	Cat.	Test Category Description	Notes
13.0	Fungus Resistance	F	Demonstrate whether equipment material is adversely affected by fungi growth.	By Analysis
14.0	Salt Fog	S	Equipment is subjected to a corrosive atmosphere	
15.0	Magnetic Effect	Z	Magnetic deflection distance less than 0.3m.	
16.0	Power Input	Z	Equipment intended for use on aircraft DC electrical systems where the DC supply has a battery whose capacity is small compared with the capacity of the DC generators.	200 ms power interruption capacity
17.0	Voltage Spike	A	Equipment intended primarily for installation where a high degree of protection against damage by voltage spikes is required.	
18.0	Audio Frequency Conducted Susceptibility-Power Inputs	Z	Equipment intended for use on aircraft DC electrical systems where the DC supply may not have a battery of significant capacity floating on the dc bus at all times.	
19.0	Induced Signal Susceptibility	ZC	Equipment intended primarily for operation in systems where interference-free operation is required on aircraft whose primary power is constant frequency or DC.	
20.0	Radio Frequency Susceptibility	Y	Equipment and interconnecting wiring installed in severe	Radiated: K

Sec.	Condition	Cat.	Test Category Description	Notes
	(Radiated and Conducted)		electromagnetic environments and to show compliance with the interim HIRF rules.	Minimum level at all frequencies to be 100V/m
21.0	Emission of Radio Frequency Energy	M	Equipment in areas where apertures are EM significant but not in direct view of aircraft antennas, such as passenger cabin or cockpit.	
22.0	Lightning Induced Transient Susceptibility	A3J 33	Equipment interconnected with wiring installed within any airframe or airframe section when structural resistance is also a significant source of induced transients, (i.e., carbon fiber composite structures). Level 3 designates equipment and interconnecting wiring installed in a moderately exposed environment.	Level 4 for MSU and OAT Probe pins.
23.0	Lightning Direct Effects	X	Not Applicable	
24.0	Icing	X	Not Applicable	
25.0	Electrostatic Discharge (ESD)	A	Electronic equipment that is installed, repaired, or operated in an aerospace environment.	
26.0	Fire, Flammability	C	Non-metallic equipment, component parts, sub-assemblies installed in pressurized or non-pressurized zones and non-fire zones with largest dimension greater than 50 mm.	By Analysis

Traffic

T 1. Traffic Symbolology



Figure T-1: Traffic Symbolology

T 1.1. Traffic Display Definitions

- 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 6 NM and ± 1200 feet from ownship that is not a RA or TA.
- 4) Other Traffic (**OT**): Traffic beyond 6 NM or ± 1200 feet from ownship that is not a RA or TA.

T 1.2. Traffic Rendering Rules

Table T-1: Traffic Rendering Rules		
Type Traffic	Distance	Results
OT and PA Traffic	Beyond 6 NM	Not displayed
TAS	Within 200' of ground	Not displayed
OT and PA Traffic with no bearing	Not displayed	





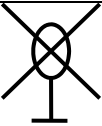
Table T-2: Traffic Symbology	
Type Traffic	Symbology
TCAS-I, TCAS-II, and TIS-A	   
	Other Traffic Proximate Advisory Traffic Advisory (Flashing) Resolution Advisory (Flashing)
Ownship Symbol	

Table T-3: 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 +500FPM, 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.

T 1.3. Traffic Thumbnail



When selected from declutter options, the traffic thumbnail 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 scale.

Figure T-2: Traffic Thumbnail

The traffic thumbnail is automatically enabled while there is an active traffic warning (TA or RA) and the aircraft is above 500' AGL. During a traffic warning, the traffic thumbnail scale automatically adjusts in multiple multiples of 2 NM (2 NM, 4NM, or 6NM), to optimally display the traffic. While the traffic thumbnail is mutually exclusive with the MINI MAP, and ANLG AGL, so it too disappears in the unusual attitude mode.

T 2. TCAS-II Traffic RA 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.



Figure T-3: TCAS-II RA Indication

T 3. Dedicated Traffic Screen

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

T 3.1. Traffic Display Format

The traffic display uses a centered display format with the ownship symbol (Table T-2) centered in the traffic screen with data displayed out to an equal distance in all directions. When the AHRS is in DG Mode, "DG" appears to the right of the ownship symbol.



Figure T-4: Traffic Display Format

T 3.2. Traffic Screen Range

Traffic screen ranges are available (all distances represent the distance from the ownship symbol to the compass rose): 5NM, 10NM, and 20NM. A TCAS range ring is centered upon the ownship symbol to help judge range to displayed symbols with a 3NM radius in 5NM and 10NM ranges, has a radius of half the range in 20NM, 50NM, and 100NM ranges, and is presented on the TCAS range ring (e.g., 3NM, 10NM, 25NM, or 50NM).

T 3.3. Compass Rose Symbols

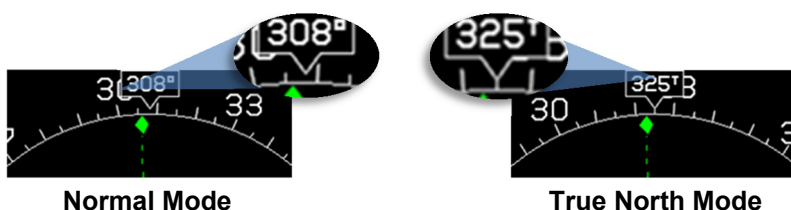


Figure T-5: Traffic Screen Range Compass Rose Symbols

The compass rose is aligned with either magnetic north or true north depending upon the status of the true north discrete input. A digital heading readout and pointer aligned with the longitudinal axis of the ownship symbol appears on the compass rose boundary circle. Compass rose symbols are as specified in Section 3 Display Symbolology. A green dashed lubber line connects the center of the aircraft symbol and the track pointer.

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 upon current VSI). A top of descent symbol is shown at the point where a VNAV descent is predicted to commence. The track pointer, lubber line, altitude capture predictor arc, and top of descent symbol are not displayed when groundspeed is less than 30 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the compass rose. 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.

T 3.4. Clock and Options

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

13:38:50Z
TRFC ALL

Zulu Time

15:40:29L
TRFC ALL

Local Offset Time

Figure T-6: Clock and Options

Table T-4: Clock and Options		
Feature	Options	Notes
Zulu Time or Local Offset	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-3). AUTO = TRFC AUTO ABOVE = TRFC ABV BELOW = TRFC BLW NORMAL = TRFC NORM ALL = TRFC ALL
ADS-B Traffic Vector Length		Length of traffic vector announced as VECT## (traffic vector length in minutes)

T 3.5. Fuel Totalizer/Waypoint Bearing and Distance Functions

As defined in Section 3 Display Symbology.

DEST  NY22
 37.7NM
 ETE 0:18:52
 RNG 462NM
 END 03:52

Figure T-7: Fuel Totalizer/Waypoint Bearing and Distance Functions

T 3.6. OASIS Traffic Screen Overlays

Up to 8 symbology OASIS traffic overlays are possible to appear on top of all other traffic symbology but below CAS warnings.

T 3.7. Active Flight Plan Path/Manual Course/Runways






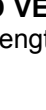

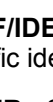



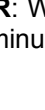
When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path, when selected, is shown on the traffic screen in correct relationship to the ownship symbol. The active flight plan path depiction meets all the requirements of GPS/SBAS path definition and matches the lateral navigation guidance given on the PFD (GPS/SBAS CDI in automatic OBS mode, skyway boxes, and mini-map). Active flight plan path waypoint symbols for fly-over waypoints are distinct from fly-by waypoints and consist of the waypoint symbol within a circle. When there is a parallel offset, the active flight plan path depicts the parallel offset path, and the original flight plan path is shown with haloed gray dashed lines.

When there is an active waypoint and the GPS/SBAS OBS setting is manual, the manual course through the waypoint is shown as a pointer centered on the waypoint and matches the lateral navigation guidance given on the PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini-map).

The active flight plan path's active leg/manual course and active waypoint are magenta and turn amber (yellow) in the event of a GPS LON caution. The traffic screen displays airport runways in correct relationship and scale to the ownship symbol.

When traffic source is ADS-B, traffic vectors and aircraft identification data are shown. The traffic vector is a line connecting the traffic's current position with the traffic's predicted position based on its current track and groundspeed. The prediction time, in minutes, is pilot-selectable. Aircraft identification (e.g. aircraft registration number or scheduled airline flight number) is text located near the traffic symbol in the same color as the traffic symbol.

Table T-5: ADS-B and TIS-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			

T 4. MFD Traffic Format (FORMAT) Menu

Upon selecting the MFD format menu, **FORMAT (R8)**, a list appears with the following options:

- 1) **ROUTE ON/ROUTE OFF:** Toggles active flight plan route.
- 2) **IDENT OFF/IDENT ON:** When EFIS is configured for TIS-B, toggles traffic identifier/squawk information.
- 3) **ALT FILTER:** Sets traffic altitude filter to **AUTO**, **ABOVE**, **BELOW**, **NORMAL**, or **ALL**.
- 4) **TCAD TEST:** Activates test function when Ryan/Avidyne TCAD.
- 5) **TREND VECTOR:** When TCAS flag is TIS-B, sets traffic trend vector length in minutes. **OFF (R4)** turns off traffic trend vector.

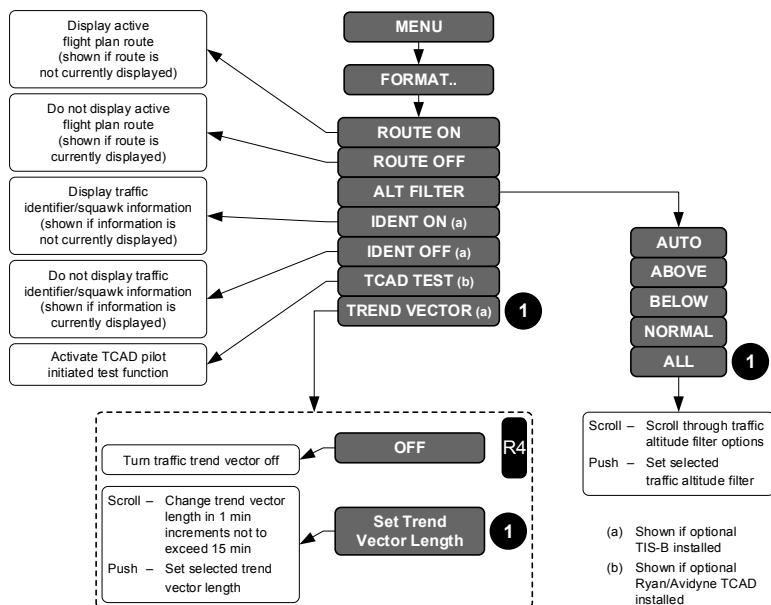


Figure T-8: MFD Traffic Format (FORMAT) Menu

T 5. PFD Declutter (DCLTR) Menu

Upon activating the PFD declutter menu, an option list of declutter items is shown.

Table T-6: PFD Declutter Options and Features		
Declutter Options	Configuration	
	Tapes	Basic
PFD Traffic Thumbnail	✓	✓
Perspective Traffic Depiction	✓	

T 6. MFD Page (PAGE) Menu

TRAFFIC: Shows the Traffic page.

T 7. MFD Fault Display (FAULTS) Menu

If traffic enabled, loss of communications with traffic sensor (TRFC).

T 8. Menu Synchronization
Table T-7: Menu Synchronization

Menu Parameter	Notes
<i>The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.</i>	
Traffic Filter Setting	
<i>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.</i>	
PFD Traffic Thumbnail Show Flag	
PFD Traffic Show Flag	
<i>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.</i>	
MFD Traffic Page Settings	Independent between top and bottom 680 MFD areas

Remote Bugs Panel (RBP)

RBP 1. Remote BUGs Panel

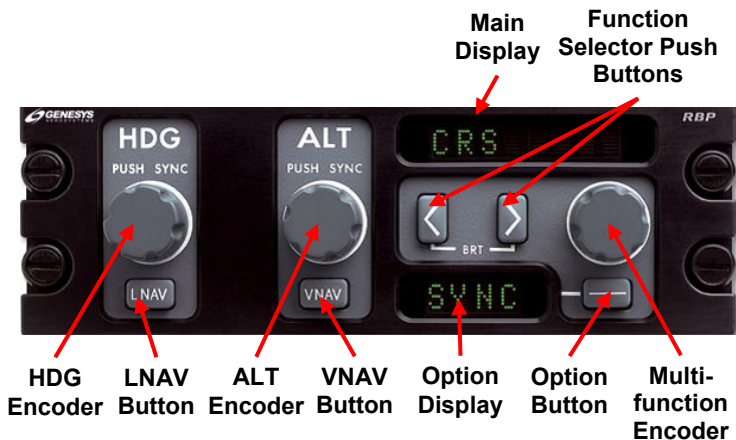


Figure RBP-1: Remote Bugs Panel

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) encoders behave similarly as the encoders on the IDU. (See Section 5 Menu Functions and Step-By-Step Procedures for HDG and ALT encoder 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 encoder to make adjustments. 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/Encoder	Function	Scroll	Push
HDG Encoder	Heading Bug	Increment or decrement	Synchronize to current heading

Table RBP-1: Remote Bugs Panel (RBP)

Button/Encoder	Function	Scroll	Push
ALT Encoder	Altitude Bug	Increment or decrement target altitude	Synchronize to current altitude
Multifunction Encoder	GPS Course	Increment or decrement	Synchronize to current bearing to active waypoint
Multifunction Encoder	VOR 1 Course	Increment or decrement	Synchronize to current bearing to the station
Multifunction Encoder	VOR 2 Course		
Multifunction Encoder	Airspeed Bug	Increment or decrement	Synchronize to current airspeed
Multifunction Encoder	Vertical Speed Bug	Increment or decrement	Synchronize to current VSI
Multifunction Encoder	Climb Angle Set	Increment or decrement	Set to 3°
Multifunction Encoder	Descent Angle Set		
Multifunction Encoder	Decision Height Bug	Increment or decrement	Set to 200' AGL
Multifunction Encoder	Minimum Altitude Bug	Increment or decrement	Synchronize to current altitude
Option “---“ Button	GPS Course	N/A	Change OBS mode (manual or automatic)
Option “---“ Button	VOR 1 Course	N/A	No function
Option “---“ Button	VOR 2 Course		
Option “---“ Button	Airspeed Bug	N/A	Toggle on or off
Option “---“ Button	Vertical Speed Bug	N/A	Toggle on or off

Table RBP-1: Remote Bugs Panel (RBP)

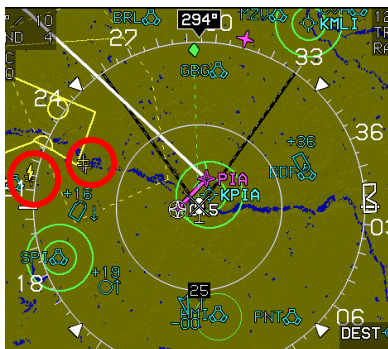
Button/Encoder	Function	Scroll	Push
Option “---“ Button	Climb Angle Setting	N/A	No function
Option “---“ Button	Descent Angle Setting	N/A	No function
Option “---“ Button	Decision Height Bug	N/A	Toggle on or off
Option “---“ Button	Minimum Altitude Bug	N/A	Toggle on or off
Arrow Buttons	Function Scroll	N/A	Move through “Set” options. Press both arrow buttons simultaneously to place into dimming mode.
VNAV Button (With autopilot enabled)	VNAV	N/A	Switch autopilot pitch steering and commanded VSI between VNAV sub-mode and target altitude sub- mode
LNAV Button (With autopilot enabled)	LNAV	N/A	Switch autopilot roll steering between LNAV sub-mode and heading sub- mode

WX-500 Lightning Strikes

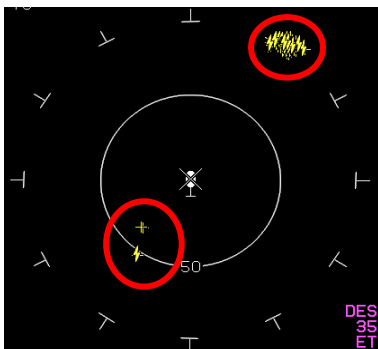
S 1. WX-500 Data

When selected, the ND displays cell mode or strike mode lightning strikes in correct relationship to the ownship symbol with the following limits.

Table S-1: Lightning Strikes	
Time or Distance Limit	View
Display scale less than 25 NM	Strikes not shown
More than 3 minutes old	
Strikes less than 20 seconds old	Lightning symbol
Strikes between 20 seconds and 2 minutes old	Large cross symbol
Strikes between 2 and 3 minutes old	Small cross symbol



ND Lightning Display



Strike Screen Display

Figure S-1: Lightning Symbols

The pilot may select either an arced or centered display format.

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 ND with navigation data is displayed out to an equal distance in all directions.

The strike screen has Strikefinder markings aligned with either magnetic north or true north depending upon the status of the true north discrete input. When the AHRS is in DG mode, “DG” appears to the right of the ownship symbol.

S 1.1. Strike Screen Range

The following strike screen ranges may be selected with all distances representing the distance from the ownship symbol to the Strikefinder markings: 12.5 NM, 25 NM, 50 NM, 100 NM, and 200 NM. The range ring is centered upon the ownship symbol to help judge range to displayed symbols. The range ring has half the radius of the Strikefinder markings displayed indicating the range corresponding to the radius of the range ring such as (1.5 NM, 25 NM, 50 NM, and 10 NM.) The range ring is completely visible in arced display format for the pilot to ascertain the current strike screen setting.

S 1.2. Air Data and Groundspeed

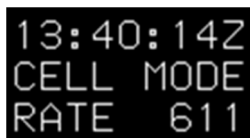


Figure S-2: Air Data and Groundspeed in Upper Left Corner

S 1.3. Clock and Options



Clock with Local Offset Time



Clock with Zulu Time

Figure S-3: Clock and Options

The following are displayed in the upper right corner of traffic screen:

- 1) **Zulu Time or LCL 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-2.

Table S-2: WX-500 Status

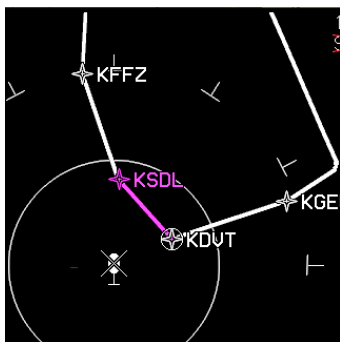
Strike Page	
Condition	Annunciation
System Normal, Cell Mode	CELL MODE annunciates mode RATE ### depicts strike rate
System Normal, Strike Mode	STRK MODE annunciates mode RATE ### depicts strike rate
System Failed with “Show Full Sensor Status Flag” enabled in EFIS Limits.	STRIKES overlaid with red “X” Strike symbols removed
System in Test Mode	STRK TST shown Strike symbols removed
Traffic Page	
System Normal, Strikes Selected	RATE ### depicts strike rate Strike symbols shown
System Normal, Strikes De-selected with “Show Full Sensor Status Flag” enabled in EFIS Limits.	STRIKES overlaid with green “X” Strike symbols removed
System Failed with “Show Full Sensor Status Flag” enabled in EFIS Limits.	STRIKES overlaid with red “X” Strike symbols removed
System in Test Mode	STRK TST shown Strike symbols removed

A new strike rate value is calculated every five seconds during normal operation, based upon strikes within the selected display range. The number of fresh strikes (less than 20 seconds old) is used to generate a strike rate representing strikes per minute. Strike rate increases are displayed immediately upon calculation, while decreases in strike rate are damped. Activating the strike clear function resets the strike rate to zero.

S 1.4. 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 strike screen in correct relationship to the ownship symbol.

When there is an active waypoint and the GPS/SBAS OBS setting is manual, the course through the waypoint is shown as a pointer centered on the waypoint. The pointer matches the lateral navigation guidance on the PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini-map).



The active flight plan path's active leg/manual course and active waypoint are magenta but turn amber (yellow) in the event of a GPS LON caution. The strike screen displays airport runways in correct relationship and scale to the ownship symbol.

Figure S-4: Active Flight Plan Path/Manual Course/Runways

S 1.5. Fuel Totalizer/Waypoint Bearing and Distance Functions



As defined in Section 3 Display Symbology.

Figure S-5: Fuel Totalizer/Waypoint Bearing and Distance Functions

S 2. MFD Page First-Level Option Descriptions

CLR STRKS (L2) or **WX LGND (L2)**: On ND or Strike page with WX-500 enabled, **CLR STRKS** activates the strike clear option.

S 3. MFD Strike Format (FORMAT) Menu

Upon selecting the MFD format menu, **FORMAT (R8)** when in the Strike page, the following option list appears:

- 1) **CENTER/ARC**: Toggles centered and arced display format.
- 2) **ROUTE ON/ROUTE OFF**: Toggles the active flight plan route.

- 3) **STRK MODE/CELL MODE:** Toggles strike and cell mode.
- 4) **STRK TEST:** Activates the WX-500 test function.

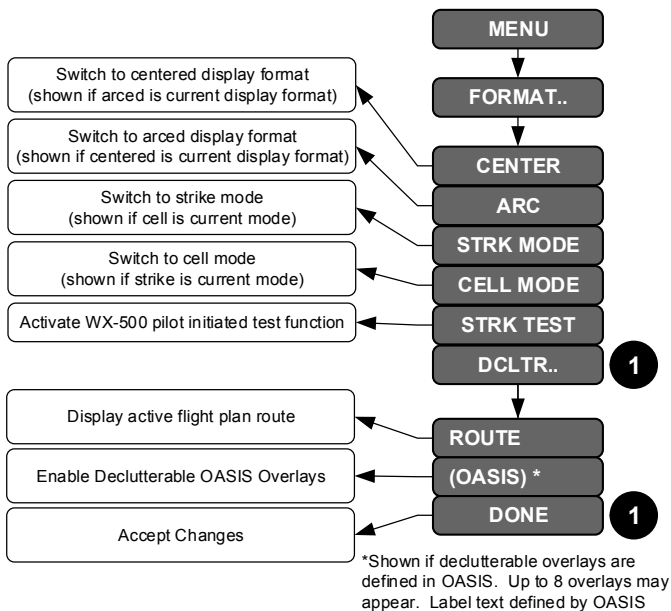


Figure S-6: MFD Strike Format (FORMAT) Menu

S 3.1. MFD STRIKES Page (Step-By-Step)



- 1) Push **1** or **2** and scroll to **STRIKES** and push to enter.



- 2) Example shows MFD with **STRIKES** in bottom area.

S 4. MFD Page (PAGE) Menu

PAGE menu allows the pilot to select which MFD page to display:

STRIKES: Shows the Strike page.

MFD Fault Display (FAULTS) Menu: If WX-500 is enabled, loss of communications with the WX-500.

S 4.1. Fuel Totalizer/Waypoint Bearing and Distance Functions



Figure S-7: ND Fuel Totalizer

S 5. OASIS Strikes Screen Overlays

Up to 8 symbology OASIS Strikes overlays are possible to appear on top of all other Strikes symbology but below CAS warnings.

S 6. Menu Synchronization

Table S-3: Menu Synchronization

Menu Parameter	Notes
<i>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.</i>	
MFD Strike (WX-500) Page Settings	

Datalink

D 1. Datalink Symbology

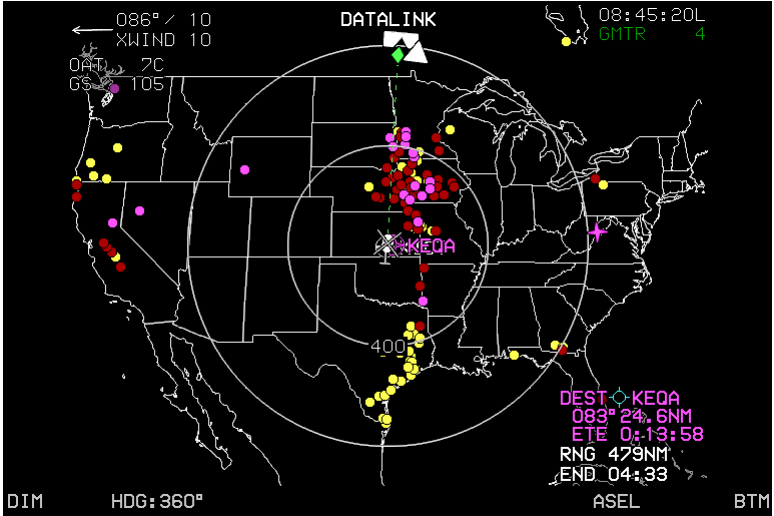


Figure D-1: Datalink Symbology with G METAR On

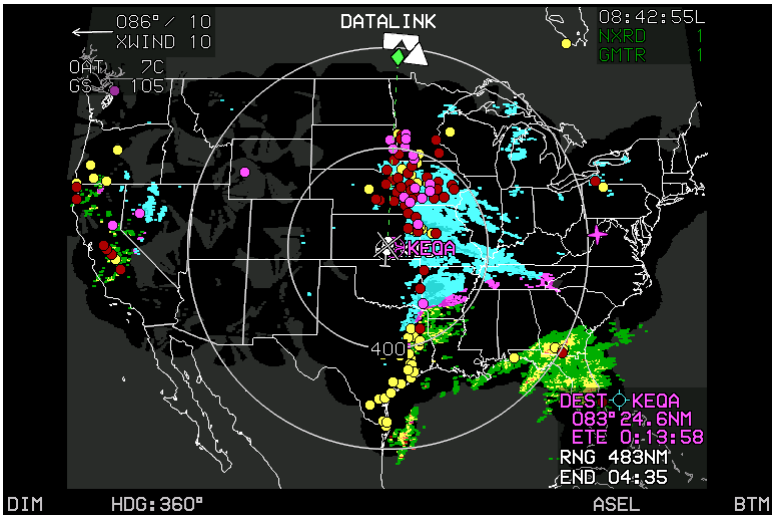


Figure D-2: Datalink Symbology with NEXRAD On

Table D-1: ADS-B Data

NEXRAD Data	Available if included in user subscription.
Graphical METAR Data	Available if Textual METAR data is included in user subscription. Derived from Textual METAR data using EFIS algorithm.

NEXRAD data is displayed on the ND in correct relationship as colored regions of precipitation using the convention.

Table D-2: Datalink NEXRAD Data

Color	Meaning
Gray Shading	Areas beyond the limits of radar coverage or areas with missing data
Magenta	Rain \geq 50dBZ
Red	Rain \geq 45dBZ and $<$ 50dBZ
Light Red	Rain \geq 40dBZ and $<$ 45dBZ
Amber (Yellow)	Rain \geq 30dBZ and $<$ 40dBZ
Green	Rain \geq 20dBZ and $<$ 30dBZ
Cyan	Snow \geq 20dBZ
Light Cyan	Snow \geq 5dBZ and $<$ 20dBZ
Magenta	Mixed Precipitation \geq 20dBZ (Area is distinguishable from rain \geq 50dBZ by graphical context)
Light Magenta	Mixed Precipitation \geq 5dBZ and $<$ 20dBZ

Graphical METARs are displayed in correct relationship to the ownship symbol as a large color-filled circle as follows.

If the airport has an available datalinked METAR, the circular part of the airport symbol is colored-fill with the following coloring convention.

Table D-3: Graphical METAR Symbols



Color		Meaning
Sky Blue		Visual Flight Rules (VFR)
Green		Marginal Visual Flight Rules (MVFR)





Table D-3: Graphical METAR Symbols	
Color	Meaning
Amber (Yellow)	 Instrument Flight Rules (IFR)
Red	 Low Instrument Flight Rules (LIFR)
Magenta	 Less than Category 1 Approach Minimums
Black	 No Data

Table D-4: Graphical METARS (GMETARS) Screen Range	
Screen Range	Display
50 NM	All GMETARS with Airport Symbol and ID
100 NM	All GMETARS with Airport Symbol only
200 NM	All GMETARS
400 NM	VFR GMETARS are decluttered
800NM and 1,600 NM	VFR and MVFR GMETARS are decluttered

Graphical METARs are also displayed in the menu system “nearest airport,” “nearest weather,” and “info” functions.



Figure D-3: NRST Airport INFO

Graphical weather conditions data are displayed in the menu system “info” function as large colored squares per the following convention.

Table D-5: Datalink Graphical METAR Precipitation	
Color	Meaning
Sky blue	No significant precipitation
Green	Rain
White	Snow
Red	Hazardous weather
Right half gray	Obscuration to visibility

Table D-5: Datalink Graphical METAR Precipitation

Color	Meaning
Small black square centered in large square	High wind
Black	No data

The following may be displayed on the datalink screen:

- 1) **Convective SIGMET**: Magenta line segments showing the area boundary in correct relationship to the ownship symbol. Pilot may view the text of individual convective SIGMETs. When viewing text, the associated symbol flashes.
- 2) **Icing AIRMET and SIGMET**: Cyan line segments showing the area boundary in correct relationship to the ownship symbol. Pilot may view the text of individual icing AIRMETs and SIGMETs. When viewing text, the associated symbol flashes.
- 3) **IFR AIRMET and SIGMET**: Red line segments showing the area boundary in correct relationship to the ownship symbol. Pilot may view the text of individual IFR AIRMETs and SIGMETs. When viewing text, the associated symbol flashes.
- 4) **Turbulence AIRMET and SIGMET**: Amber (yellow) line segments showing the area boundary in correct relationship to the ownship symbol. Pilot may view the text of individual turbulence AIRMETs and SIGMETs. When viewing text, the associated turbulence AIRMET or SIGMET symbol flashes.

Winds and temperature aloft data are displayed in correct relationship to the ownship symbol as a grid of black squares with textual readouts of wind speed and temperature (units determined by the Temp Units in the EFIS Limits) and a graphical arrow indicating wind direction. When winds and temperature aloft data are displayed, soft tiles are present to change the data altitude.

Textual METAR and TAF data are displayed when appropriate in the menu system “info” function. Time of observation and forecast are contained within the text.

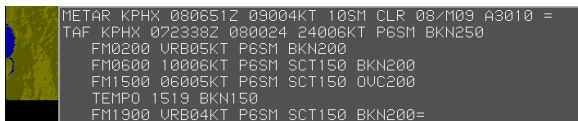


Figure D-4: METAR and TAF Report for KPHX

D 1.1. Ownship Symbol



When not panning with AHRS in the DG mode, “DG” appears right of the ownship symbol. The datalink screen 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-5: Datalink Symbology Rotorcraft Ownship Symbol

D 1.2. Datalink Screen Legend

G METAR	NEXRAD
● UFR	■ NO COVERAGE
● MVFR	■ ABOVE 50DB
● IFR	■ 45-50DB
● LIFR	■ 40-45DB
● BLW CAT I	■ 30-40DB
● NO DATA	■ 20-30DB

Figure D-6: ADS-B Datalink Screen Legend

D 1.3. Air Data and Groundspeed

Air data and groundspeed are displayed in the upper left corner of the datalink screen as specified in Section 3 Display Symbology.

D 1.4. Clock/ Options

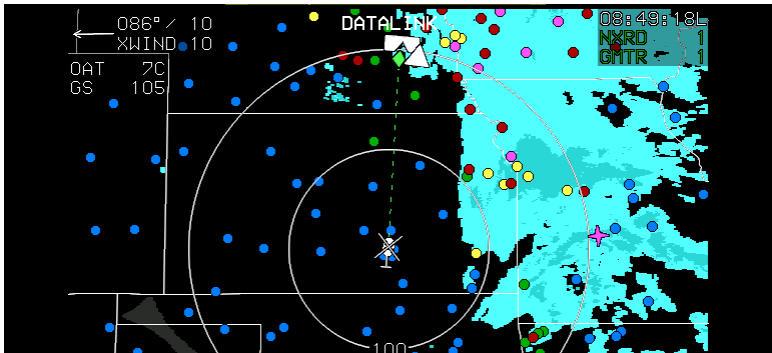


Figure D-7: Clock/Timers/Options

The following are displayed in the upper right corner of the ND:

- 1) **Zulu Time or LCL Time:** As in Section 3 Display Symbology.
- 2) **Datalink Weather Status:** When status of NEXRAD, graphical METARs, and lightning ground strike data are displayed as follows.

Table D-6: Datalink NEXRAD Status

Condition	Status Annunciation	
	*NEXRAD	Graphical METAR
Never completely downlinked	No Annunciation	
Downlinked within last 5 minutes and selected for display (*if installed, weather radar deselected from display). "Show Full Sensor Status Flag" enabled.	"NXRD ##" in green. ## is age in minutes. NEXRAD shown.	"GMTR ##" in green. ## is age in minutes. GMETARS shown.
Downlinked within last 5 minutes and deselected from display (*if installed, weather radar selected for display).	"NXRD ##" in green. ## is age in minutes.	"GMTR ##" in green. ## is age in minutes.

Table D-6: Datalink NEXRAD Status

Condition	Status Annunciation	
	*NEXRAD	Graphical METAR
“Show Full Sensor Status Flag” enabled.	“NXRD ##” overlaid with green “X” NEXRAD not shown.	“GMTR ##” overlaid with green “X” GMETARS 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 Flag” enabled.	“NXRD ##” in amber (yellow). ## is age in minutes. NEXRAD shown.	“GMTR ##” in amber (yellow). ## is age in minutes. GMETARS 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 Flag” 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” GMETARS not shown.
Not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display (*if installed, weather radar deselected from display).	“NXRD ##” in red. ## is age in minutes. NEXRAD shown.	“GMTR ##” in red. ## is age in minutes. GMETARS shown.
Not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display	“NXRD ##” in red. ## is age in minutes.	“GMTR ##” in red. ## is age in minutes.

Table D-6: Datalink NEXRAD Status		
Condition	Status Annunciation	
	*NEXRAD	Graphical METAR
(*if installed, weather radar selected for display). “Show Full Sensor Status Flag” enabled.	“NXRD ##” overlaid with green “X” NEXRAD not shown.	“GMTR ##” overlaid with green “X” GMETARS not shown.
Not downlinked within last 75 minutes (timed-out). “Show Full Sensor Status Flag” enabled.	“NXRD XX” in red “NXRD XX” overlaid with red “X” NEXRAD not shown.	“GMTR XX” in red “GMTR XX” overlaid with red “X” GMETARS not shown.

D 1.5. Datalink Screen Orientation

When selected, the following screen ranges (all distances represent distance from the ownship symbol to the boundary circle) are available. Radius of the range ring is presented on the range ring.

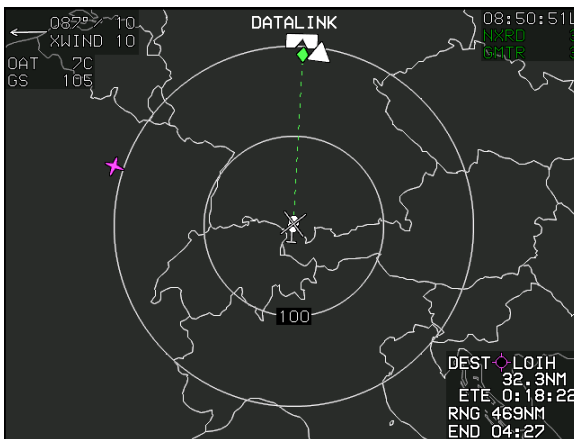


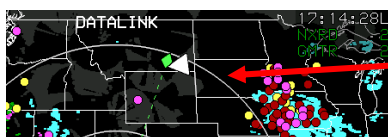
Figure D-8: Datalink Screen Range

Table D-7: Datalink Screen Ranges

Owncip to Boundary Circle	Radius Range Values
50 NM	25 NM
100 NM	50 NM
200 NM	100 NM
400 NM	200 NM
800 NM	400 NM
1,600 NM	800 NM

D 1.6. 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.



**Boundary
Circle**

Figure D-9: 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 groundspeed is less than 60 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the boundary circle. A magenta, star-shaped waypoint pointer displayed on the boundary circle at a point 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 1.7. Active Flight Plan Path/Manual Course/Runways

When there is an active flight plan and automatic GPS/SBAS OBS setting, the flight plan path, when selected, is shown in correct relationship to the ownship symbol. The active flight plan path depiction meets all GPS/SBAS path definition requirements and

matches the lateral navigation guidance on the PFD (GPS/SBAS CDI in automatic OBS mode, skyway boxes, and mini-map). Active flight plan path fly-over waypoints symbols are distinct from fly-by waypoints and consist of the waypoint symbol within a circle. When there is a parallel offset, the active flight plan path depicts the parallel offset path, and the original flight plan path is shown with haloed gray dashed lines.

When there is an active waypoint and manual GPS/SBAS OBS setting, the course through the waypoint is shown as a pointer centered on the waypoint and matches the lateral navigation guidance on the PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini-map).

The active flight plan path's active leg/manual course and active waypoint are magenta but turn amber (yellow) in the event of a GPS LON caution. The traffic screen displays airport runways in correct relationship and scale to the ownship symbol.

D 1.8. Borders

National and United States state borders are drawn in white in correct relationship to the ownship symbol.

D 1.9. Pan Mode

Use the pan mode to change the location of the center of the screen away from current location and view weather conditions along the route of flight and at the intended destination or alternate destination. When pan mode is active, scroll **1** (or **2** as applicable) to pan north, south, east, and west. When pan mode is active, a line is drawn from the map center to the aircraft's current position, and bearing and distance to the map center is always displayed above the ownship symbol when the aircraft is more than 0.5 NM away. If referenced to magnetic north, (as specified in Section 3 Display Symbology) when panning, the nearest displayed graphical METAR symbol within the inner range ring is highlighted with a flashing circle. When such a point is highlighted, dedicated buttons are present to allow the pilot to view and hide the waypoint information (including datalink weather information) associated with that point.

D 2. MFD Page First-Level Option Descriptions

WX LGND (ACTV) (L2): Activates datalink weather legend.

D 3. MFD Datalink Format (FORMAT) Menu

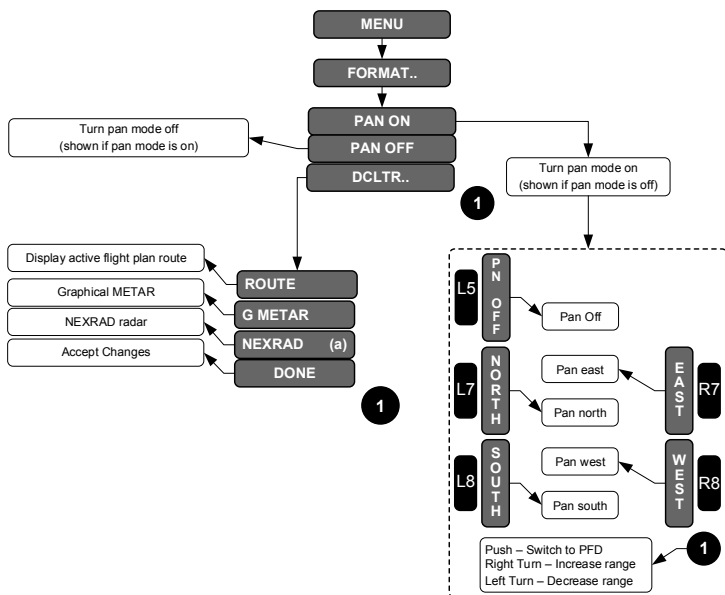
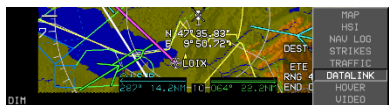


Figure D-10: MFD Datalink Format (FORMAT) Menu

Upon selecting the MFD format menu **FORMAT (R8)** on Datalink page, a list appears with the following options:

- 1) **ROUTE ON/ROUTE OFF:** Toggles active flight plan route.
- 2) **PAN ON/PAN OFF:** Toggles pan mode.
- 3) **DCLTR:** Only available when Datalink weather products are available for display. Allows the pilot to select individual Datalink weather products for display.

D 3.1. MFD DATALINK Page (Step-By-Step)



- 1) Push **1** or **2** and scroll to **DATALINK** and push to enter.

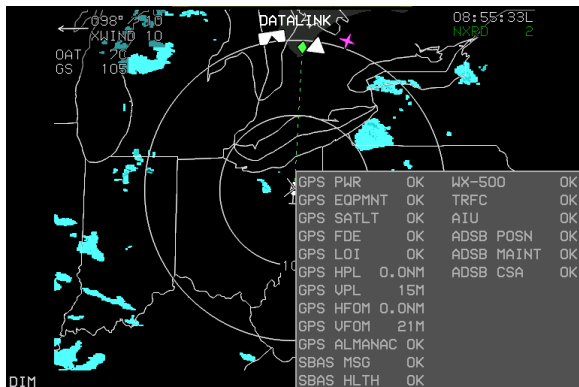


Figure D-11: FAULTS Menu with ADS-B Status

D 7. MFD Page (PAGE) Menu

DATALINK: Shows the Datalink page.

D 8. Menu Synchronization

Table D-8: Menu Synchronization

Menu Parameter	Notes
<i>The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.</i>	
AHRS 1 and 2 mode and slewing values	
UTC Offset	
Crosslink Synchronization Status	
<i>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.</i>	
Active Flight Plan Parameters	
<i>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 680 MFD areas as specified in the notes.</i>	

Table D-8: Menu Synchronization

Menu Parameter	Notes
MFD Datalink Page Settings	Independent between top and bottom MFD areas
680 Essential Mode Status	Support for reversion
MFD Selected Page	Independent between top and bottom MFD areas. Parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom MFD areas. Map scale is transmitted outside to support weather radar range selection.
680 Forced OASIS Minimize	Supports reversion and certain menus. Independent between top and bottom 680 MFD areas.
MFD Map Function Declutter Settings	Independent between top and bottom MFD areas
MFD OASIS Overlay Show Flags	
MFD Show ETA Flag	

Weather Radar

WX 1. Weather Radar



Figure WX-1: Weather Radar Image on ND

Weather radar automatically declutters when weather radar returns are selected for display on the ND map screen in correct relationship to the ownship symbol unless inhibited during active FLTA alerts. When weather radar is selected, Datalink NEXRAD is automatically deselected. Table WX-1 defines all inhibited factors with display.

Table WX-1: Weather Radar Inhibited Conditions
During Active FLTA alerts
ND Moving Map Pan Mode
When North Up orientation is selected
When RDR-2100 is in vertical profile mode
When screen range is too small to effectively show the weather returns (defined as when the length of the weather radar scan line is longer than 512 pixels given current weather radar scale setting, screen range, and screen mode)

WX 2. MFD Page (PAGE) Menu

WX-RDR: Shows the Weather Radar page.

WX 2.1. Ownship Symbol

The ownship symbol appears in horizontal and profile depictions on the weather radar page as follows.

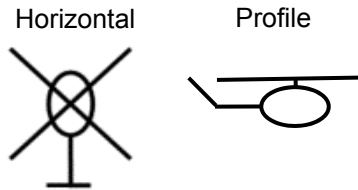


Figure WX-2: Ownship Symbol

WX 2.2. Weather Screen Format

In a horizontal depiction, the weather screen 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.

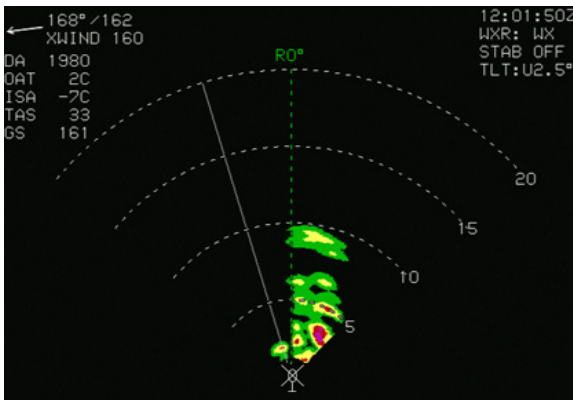


Figure WX-3: Radar Image in Arced Format

In a profile depiction, the weather screen 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.

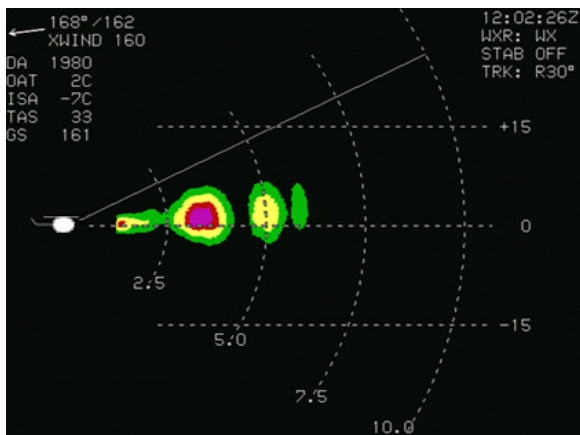


Figure WX-4: Radar Image in Profile Depiction

To select profile depiction, use the weather radar control panel connected to the IDU. The IDU ensures at least one weather radar-enabled screen is showing the weather radar page prior to entering into profile depiction and disables profile depiction if the pilot sets the screens for no weather radar page on any weather radar-enabled screen. The purpose is to maximize the availability of weather radar information on the ND screen. The ND screen only shows a horizontal depiction and disables profile depiction if the weather radar mode is set to off or standby via radar control panel.

WX 2.3. Weather Screen Range

Weather screen range is pilot-selectable with either ❶ (RDR-2000 and RDR-2100 weather radar types) or a control panel directly attached to the weather radar receiver-transmitter. Weather screen range is displayed as a series of equidistant dashed arcs centered upon the ownship symbol to help judge range to the displayed weather radar returns. All distances represent the distance from the ownship symbol to the outer dashed arc: 5NM, 10NM, 20NM, 40NM, 80NM, 160NM, 240NM, and 320NM.

For most screen ranges, there are four equidistant dashed arcs. When in 2.5NM range, there are five equidistant dashed arcs. Each arc is labeled with distance in nautical miles at its right-most point (horizontal depiction) or bottom-most point (profile depiction). In profile depiction, there are also three horizontal altitude lines drawn relative to the aircraft's altitude to help 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 above and below the aircraft varies with the selected range to compensate for the radar scan width at the different ranges.

WX 2.4. Track Line

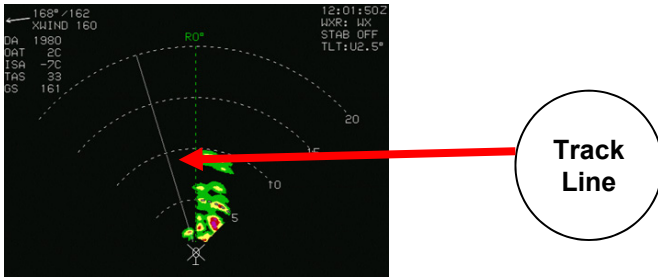


Figure WX-5: Radar Track Line

When the weather radar type is RDR-2000 or RDR-2100 and the horizontal depiction is shown, a dashed track line emanates from the ownship symbol to the outer dashed arc. The value of the track line in whole degrees left or right of aircraft heading is displayed adjacent to the outer end of the track line.

WX 2.5. Active Flight Plan Path/ Manual Course/ Runways

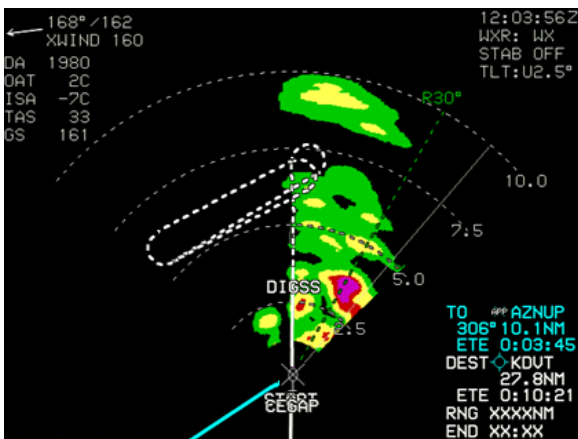


Figure WX-6: Radar Active Flight Plan

The active flight plan path (when selected), waypoints, and manual course appear, when the weather radar screen is showing horizontal depiction. The weather radar screen displays airport runways, when the weather radar screen is showing horizontal depiction.

WX 2.6. Weather Radar Return Data

Weather radar return data are displayed in correct relationship to the ownship symbol as colored regions according to the value of the ARINC 453 3-bit range bins.

Table WX-2: Weather Radar Return Data

ARINC 453 3-Bit Range Bin	Color	Meaning
000b	BLACK	No returns
001b	GREEN	Low-level weather or low-level ground returns
010b	YELLOW	Mid-level weather or mid-level ground returns
011b	RED	Third-level weather returns. Color is black when in MAP mode.
100b	MAGENTA	Fourth-level weather or third-level ground returns. With RDR-2000 or RDR-2100 weather radar type, color alternates between magenta and black at 1Hz when internal submode is WXA.
101b	CYAN	Automatic range limit returns. Indicates areas of unreliable returns due to radar power absorption.
110b	LIGHT GRAY	Moderate turbulence returns
111b	WHITE	Severe turbulence returns

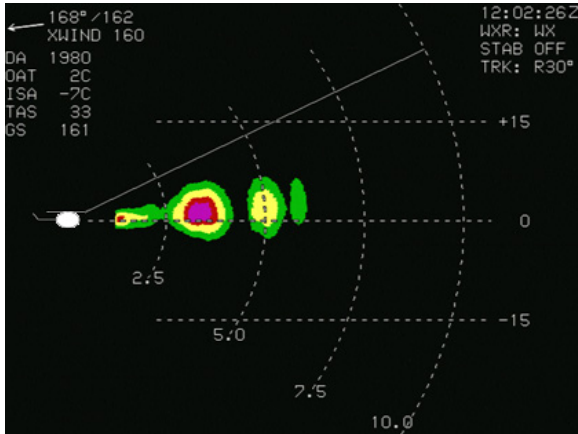


Figure WX-7: Radar Return Data

The following 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.

WX 2.7. Air Data and Groundspeed

Air data and groundspeed are displayed in upper left corner of the weather radar screen as specified in Section 3 Display Symbology.

WX 2.8. Clock/Options

The following are displayed in the upper right corner:

```

12:02:26Z
WXR: WX
STAB OFF
TRK: R30°

```

```

17:23:15L
WXR: WX
TLT:U 0.0

```

Figure WX-8: Radar Clock/Options

- 1) **Zulu Time or LCL Time:** As in Section 3 Display Symbology;
- 2) **Weather Radar Mode Annunciation:** As in Table WX-3 and Table WX-4.

Table WX-3: RDR 2100 Applicability

Mode	Annunciation
Off	WXR:OFF
Standby	WXR:STBY
Weather only	WXR:WX
Weather alert	WXR:WXA
Ground map	WXR:GMAP
Contour	WXR:CONT
Test	WXR:TEST
Not defined	WXR:----

Table WX-4: 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.
STAB OFF (Stabilization)	Mode annunciation not overlaid with a red "X"; Mode not standby or forced standby; and Weather radar indicates stabilization is off.
TGT ALERT (Target Alert)	Mode annunciation not overlaid with a red "X"; Mode not standby or forced standby; Weather radar presenting horizontal depiction.
"TLT:UXX.X" or	U = Up or Down (either U or D, but not both, may appear – use "U" for 0°);

Table WX-4: RDR 2100 Mode Annunciation

Annunciation	Conditions
“TLT:AUTO” (TILT)	XX.X 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: <ol style="list-style-type: none"> 1) Mode annunciation not overlaid with a red “X”; 2) Mode not standby or forced standby; and 3) Radar not in vertical profile depiction.
TRK:LXX (TRACK)	L = Left or Right (either L or R, but not both, may appear – use “R” for 0°); and XX represents absolute value of the track angle in degrees. Weather radar track annunciation only appears when all following conditions are true: <ol style="list-style-type: none"> 1) Mode annunciation not overlaid with a red “X”; 2) Mode not standby or forced standby; and 3) Radar in vertical profile depiction.
“GN:SXXDB,” “GN:CAL,” or “GN:MAX” (GAIN)	S = Sign (either “+” or “-,” but not both, may appear – use “+” for 0°); and XXDB represents the manual gain setting in decibels. “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: <ol style="list-style-type: none"> 1) Mode annunciation not overlaid with a red “X”; 2) Mode not standby or forced standby; and 3) Mode is ground map.

WX 2.9. Fuel Totalizer/Waypoint Bearing and Distance Functions

Displayed as specified in Section 3 Display Symbology.

WX 3. OASIS Weather Radar Screen Overlays

Up to 8 symbology OASIS horizontal weather overlays are possible to appear on top of all other horizontal weather overlays symbology but below CAS warnings.

WX 4. Top-Level Menu Automatic Pop-Up Function Descriptions

Soft menu tiles appear adjacent to buttons under specified conditions.

Table WX-5: Top-Level Auto Pop-Up Function Descriptions

Note 1	Note 2	Tile Legend and Action
L2	L6	When ND Page with: (a) pan mode enabled; (b) information for nearest highlighted waypoint shown; and (c) airport weather information present in the information block; WX allows display of textual METAR and TAF data for the airport.
Note 1: Function tied to page in top area.		
Note 2: Function tied to page in bottom area or transmit enabled.		

WX 5. MFD WX RDR Format (FORMAT) Menu

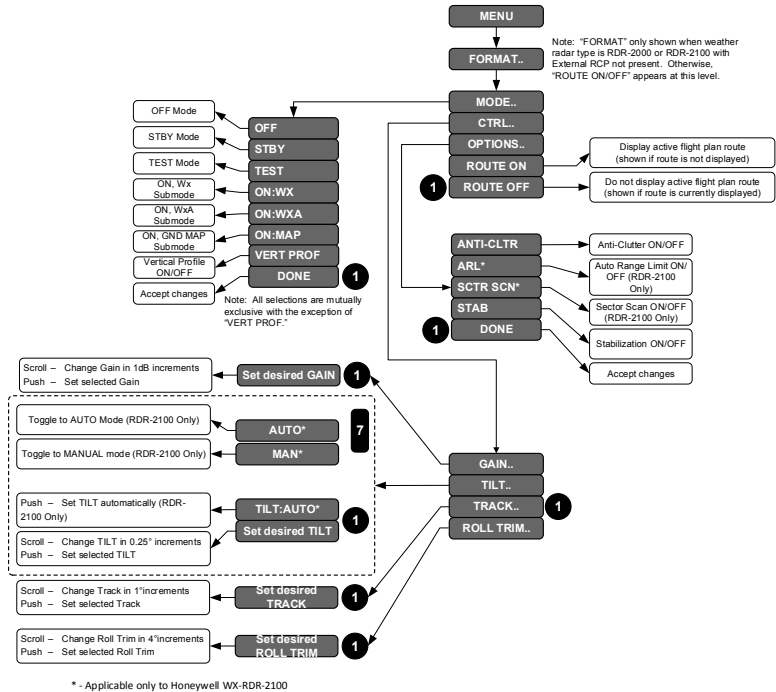


Figure WX-9: MFD WX RDR Format (FORMAT) Menu

Upon selecting MFD format menu, **FORMAT (R8)** in the WX RDR page when weather radar type is RDR-2000 or RDR-2100 without external RCP installed, the following list appears.

- 1) **MODE:** Set the weather radar mode to either **OFF**, **STBY**, **TEST**, **ON: WX**, **ON: WXA**, **ON: MAP**, or **VERT PROF**.

NOTE:

The 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.

- 2) **CTRL:** Activates a list to control live parameters as follows:
 - a) **GAIN:** Changes the gain in increments of 1dB.

- b) **TILT**: Changes tilt in units of 0.25 degrees if tilt mode is manual for both weather radar type RDR-2000 and RDR-2100. **TILT:AUTO** is set when tilt is automatic (only RDR-2100 only). When weather radar type is RDR-2100, toggles **AUTO/MAN** tilt mode.
- c) **TRACK**: Changes track in increments of 1 degree.
- d) **ROLL TRIM**: Changes roll trim in increments of 4 degree.
- 3) **OPTIONS**: Select or deselect available options to **ANTI-CLTR**, **ARL** (RDR-2100 only), **SCTR SCN** (RDR-2100 only), or **STAB**.
- 4) **ROUTE ON/ROUTE OFF**: Toggles active flight plan route.

WX 6. MFD Fault Display (FAULTS) 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) 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.
 - e) A control fault condition exists.
 - f) 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 or a failure status using same test as invalid data SSM for output labels 270, 271, 273, or 275.

WX 7. Menu Synchronization

Table WX-6: Menu Synchronization

Menu Parameter	Notes
<i>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.</i>	
Weather Radar Scale	Onside because range is controlled by the weather radar.
WX RDR 2XXX Radar Control Menu parameters	

Video

V 1. Video Input Screen

The video input screen 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 screen is black and **NO VIDEO IMAGE AVAILABLE** is displayed in white on the center of the screen. To aid in diagnosing problems with undetected video signals, the following annunciations are also 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.

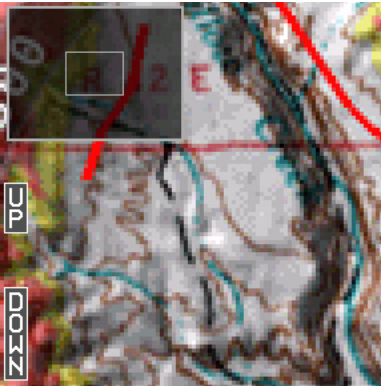
V 1.1. ZOOM Level

Scroll **1** CW to increase or CCW to decrease zoom levels from 1 (no pixel replication) to 10 in increments of 1.



Figure V-1: Encoder Functions for MFD Video Page

V 1.2. Pan Mode



When the ZOOM level is greater than 1, the Video Input screen 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.

Figure V-2: Video Pan View

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: Top-Level Auto Pop-Up Function Descriptions With Pan Mode Enabled

Note 1	Note 2	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	
Note 1: Function tied to page in top area.			
Note 2: Function tied to page in bottom area or transmit enabled.			

V 2. Video Input Status Display

When selected, the following are optionally displayed in the upper right corner of the Video Input display.

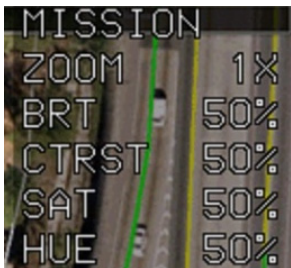


Figure V-3: Video Status

- 1) **Label:** Identifies video input source and is configurable to one of a set of predefined labels. If no label is configured, the label is **VIDEO-n** where **n** is the video input source number.
- 2) **ZOOM:** Amount of pixel expansion is displayed as **ZOOM nnX** where **nn** is the ZOOM level.
- 3) **Brightness:** Displayed as **BRT nnn%** where **nnn** is the brightness setting as a percentage of the maximum value.
- 4) **Contrast:** Displayed as **CTRST nnn%** where **nnn** is the contrast setting as a percentage of the maximum value.
- 5) **Saturation:** Chroma saturation is displayed as **SAT nnn%** where **nnn** is the saturation setting as a percentage of the maximum value.
- 6) **Hue:** Chroma hue is displayed as **HUE nnn%** where **nnn** is the hue setting as a percentage of the maximum value.

V 3. MFD Page (PAGE) Menu

VIDEO: Only available when a minimum of one video input is available. This page is not available when in Essential mode and essential EICAS page (MFD overlay) is assigned.

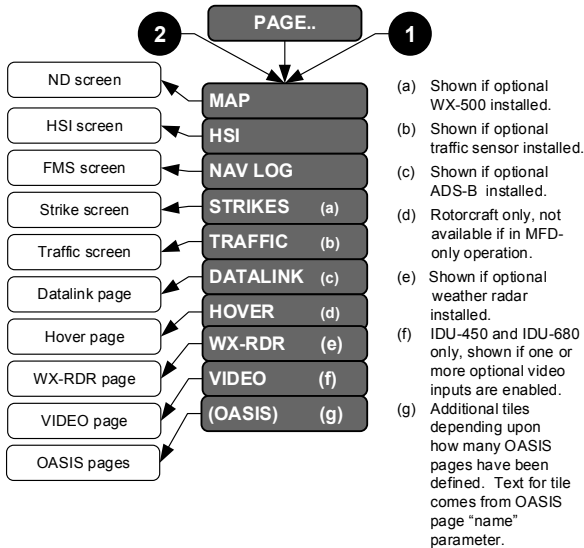


Figure V-4: MFD Page (PAGE) Menu

V 4. OASIS Video Screen Overlays

Up to 8 symbology OASIS video screen overlays are possible to appear on top of all other video screen symbology but below CAS warnings.

V 5. MFD Video Input Format (FORMAT) Menu

Upon selecting the MFD format menu, **FORMAT (R8)** when in the Video Input page, a list appears with the following options.

Upon selecting the MFD format menu when in the video page, **3** is a dedicated brightness control, and **2** is a dedicated contrast control.

Scroll to activate the **BRT** or **CTRST** menus. **DFLT (R8)** resets to nominal default (50%) value.

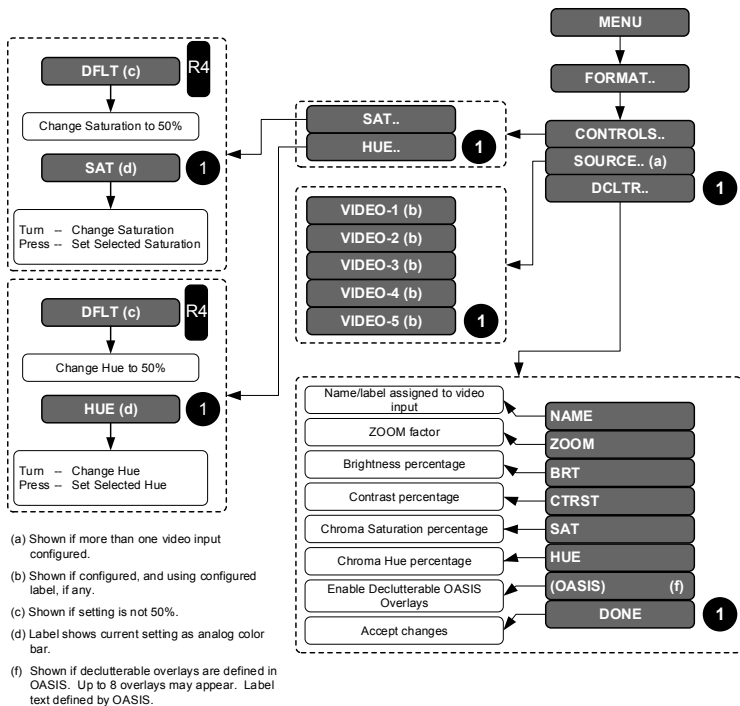


Figure V-5: MFD Video Input Format (FORMAT) Menu

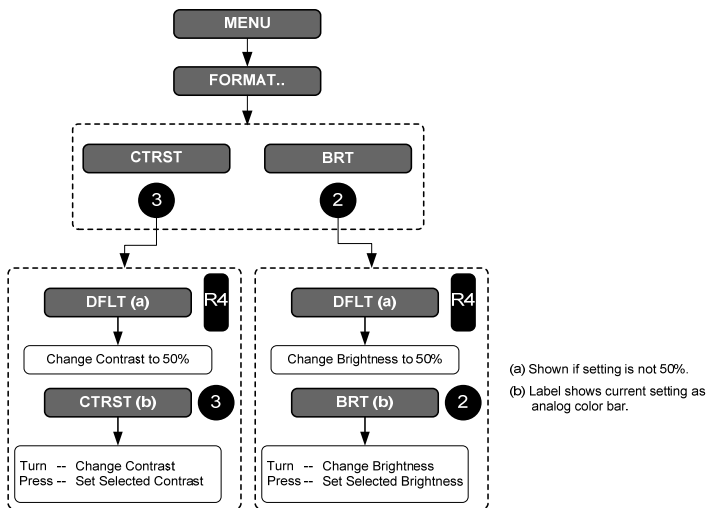


Figure V-6: IDU-680 Center Rotary Encoder Controls

Table V-2: Video Input Controls

Controls Settings	Definition	Notes
BRT	Adjust brightness setting	DFLT (R4) resets to nominal default (50%) value.
CTRST	Adjust contrast setting	DFLT (R4) resets to nominal default (50%) value.
SAT	Adjust chroma saturation (color intensity) setting	DFLT (R4) resets to nominal default (50%) value.
HUE	Adjust chroma hue (red-green balance) settings	DFLT (R4) resets to nominal default value (50%) value.
SOURCE	Select optional video source	Displays selected video input, only if more than one video input is enabled.
DCLTR	Activate option list to select video input status	Video input status settings as in V 2.

V 6. Menu Synchronization

Table V-3: Menu Synchronization

Menu Parameter	Notes
<i>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.</i>	
MFD Video Page Settings	Video hardware settings: <ul style="list-style-type: none"> • Selected Input • Brightness • Contrast • Saturation • Hue

Round Dials

RD 1. Airspeed Display

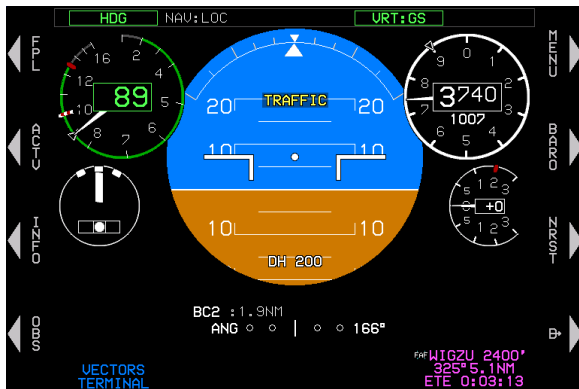
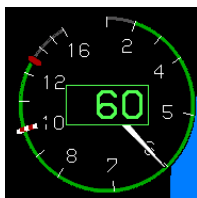
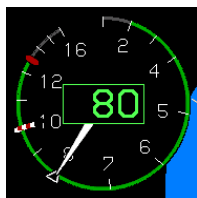


Figure RD-1: Round Dials Airspeed Display

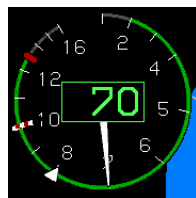
The airspeed display digitally displays indicated airspeed in knots, miles, or kilometers per hour (as per aircraft “Speed Units” system limit) and is scaled to show the entire operating range of the aircraft. Clockwise movement indicates increasing speed. When an ADC sensor fails, the display appears as shown in Figure RD-8.



Without airspeed bugs



IAS bug set to 80 and indicating 80 KIAS



IAS bug set to 80 and indicating 70 KIAS

Figure RD-2: Round Dials Airspeed Display Limits

- 1) Gray safe-operating area from bottom of dial to V_{MIN} . Airspeed is gray at 0 (indicating “dead” airspeed) but otherwise green.
- 2) Green safe operating range area from V_{MIN} to V_{NO} . V_{MIN} refers to the minimum speed for effective airspeed indication (usually

20KIAS, depending on the connected ADC). Airspeed readout is gray at 0 (indicating “dead” airspeed) but otherwise green.

- 3) Amber (yellow) caution range area from V_{NO} to V_{NE} (power-on). Airspeed readout is yellow.
- 4) Red radial line at V_{NE} (power-on). Airspeed readout is red at or above the red radial line.

The airspeed dial for Part 27 and Part 29 rotorcraft has additional specific airspeed markings as follows:

A red cross-hatched radial line at V_{NE} (power-off).

RD 2. Round Dials PFD

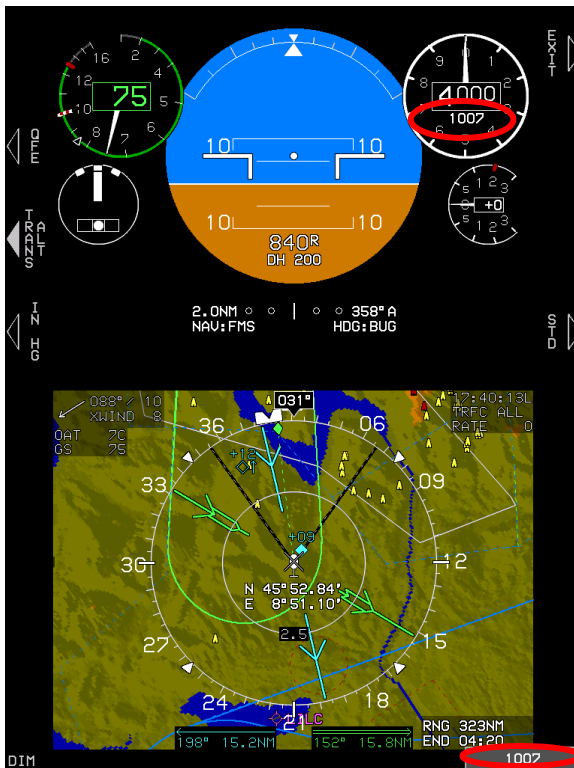


Figure RD-3: Round Dials PFI Area (QNH)

RD 3. Round Dials PFI Configuration

Altitude display and changing altimeter setting:

- 1) Press **BARO (R2)** to enter BARO mode and view the inches of mercury (inHg) or millibars (mbar) value in the lower right corner.
- 2) Scroll **1** CW to increase or CCW to decrease QNH. (As shown in Figure RD-3, Figure RD-4, and Figure RD-5 encircled in red)
- 3) Push **1** or press **EXIT (R1)** to enter the new value.



The altimeter setting digitally displays the altimeter setting in either inches of mercury (inHg) or millibars (mbar) according to the pilot-selected units.

Figure RD-4: Altimeter QNH



The mode is annunciated as QFE operations otherwise, no mode is annunciated

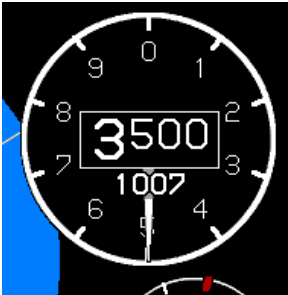
Figure RD-5: Altimeter QFE

QFE: Barometric setting resulting in the altimeter displaying height above a reference elevation (i.e., airport or runway threshold).

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.

RD 4. Altitude Display



The altitude readout digitally displays barometric altitude to the nearest ten feet as adjusted by an altimeter setting and shows a 1000-foot range with labels and graduations every 100 feet. CW rotation of the pointer indicates increasing altitude. All graduations are removed when below sea level.

Figure RD-6: Altitude Display

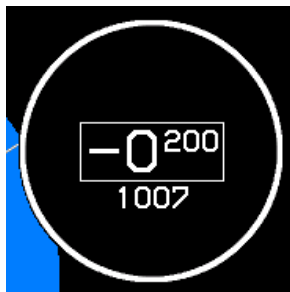


Figure RD-7: Altitude Display (When Below Sea Level)

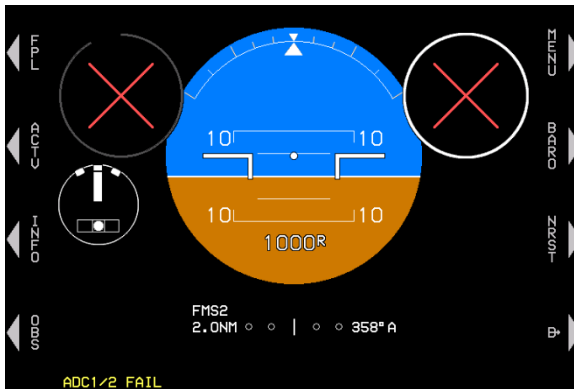


Figure RD-8: Airspeed and Altitude with Loss of ADC



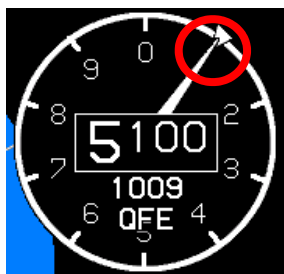
Altitude sub-mode user-selectable triangular target altitude bug shown here at 4,400'. The bug is limited to -1,000' up to the service ceiling and is removed when more than 500' away from current altitude.

Figure RD-9: Target Altitude Bug

The target altitude bug can be used as a visual reference or when vertically integrated with the Genesys HeliSAS-E or other autopilot, the bug characteristics indicate the following modes:

- 1) Filled-white when in altitude hold mode.
- 2) Hollow-white when in a climb or descent mode.
- 3) Filled-white during altitude hold capture.

When not vertically integrated with the Genesys HeliSAS-E or other autopilot, the target altitude bug is filled-white at all times.



When in VNAV sub-mode, the VNAV altitude bug appears when within 500' from the current altitude. In this example, the VNAV altitude is 5,100'.

Figure RD-10: VNAV Sub-Mode

The VNAV bug can be used as a visual reference or when vertically integrated with the Genesys HeliSAS-E or partially integrated through use of the vertical mode discrete input as a control parameter for climbs or descents with another autopilot. The following bug characteristics indicate the following modes:

- 1) Filled-magenta when in altitude hold mode.
- 2) Hollow-magenta when in a climb or descent mode.
- 3) Filled-magenta during altitude hold capture.

When not vertically integrated with an autopilot, the VNAV bug is filled-white at all times.



Metric altitude values may be selected from within the declutter menu with a resolution of 1 meter.

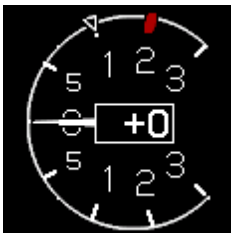
Figure RD-11: Metric Altitude

RD 5. Vertical Speed Indicator

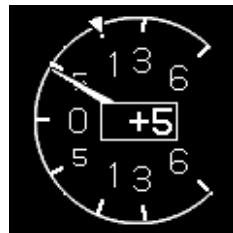


The VSI is located below the altitude display with a readout and dial pointer and scale of $\pm 6,000$ feet per minute. The integral scale graduations are ± 500 , $\pm 1,000$, $\pm 3,000$, and $\pm 6,000$ feet per minute. CW (upward) rotation of the pointer indicates increasing vertical speed while CCW indicates decreasing speed.

Figure RD-12: Vertical Speed Indicator



VSI bug set to +1,000 fpm with HeliSAS enabled



VSI bug set to +1,000 fpm without autopilot enabled.

Figure RD-13: VSI Bugs

The vertical speed bug is mutually exclusive with the IAS bug and can be used either as a visual reference or when vertically integrated with the HeliSAS-E or other autopilot as a control parameter for climbs or descents. When vertically integrated, the vertical speed bug is filled-white when in VSI climb or descent mode. Otherwise, the vertical speed bug is hollow-white as shown above on the left. When not vertically integrated with an autopilot, the vertical bug is filled-white at all times.

RD 6. 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.

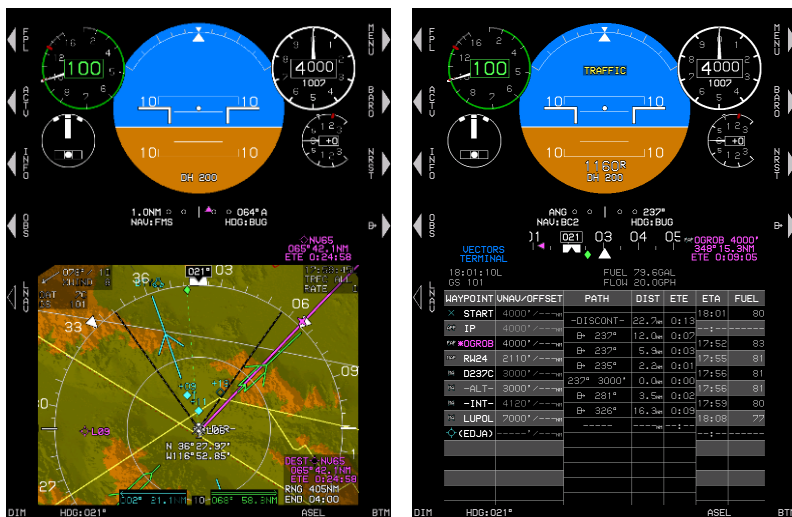


Figure RD-14: Heading Display

RD 7. 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.

Figure RD-15: Turn Rate Indicator

RD 8. Timer Indication

A countdown or count-up timer can be displayed above the large aircraft reference marks when selected through the menu as described in Section 3 Display Symbology.

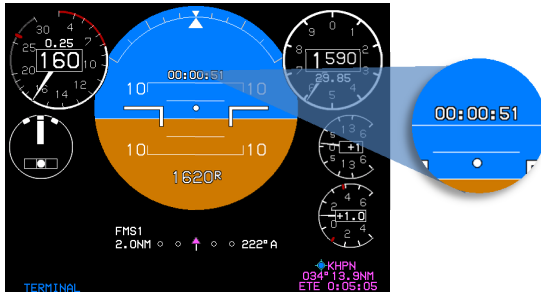


Figure RD-16: Timer Indication

RD 9. Vertical Deviation Indicator (VDI)

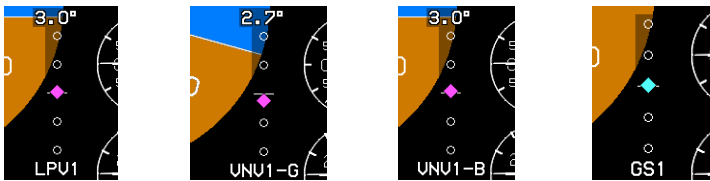


Figure RD-17: Vertical Deviation Indicator (VDI)

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.

- 1) **LPV Mode and LPV1 or LPV2:** When descending on final approach segment in LPV mode. GPS altitude used to generate VDI; pilot may follow guidance to LPV minima regardless of temperature.
- 2) **LNAV Mode and VNAV1-G or VNAV2-G:** When descending on final approach segment in LP, LNAV/VNAV, and LNAV or RNP modes when using GPS VNAV. GPS altitude used to generate VDI; pilot may follow guidance to LNAV minima regardless of temperature.
- 3) **LNAV Mode and VNV1-B or VNV2-B:** Default FMS barometric VNAV mode. Using barometric altitude to generate the VDI, pilot may follow guidance to LNAV minima as long as the specified temperature is within limits.
- 4) **GS1 or GS2:** Glideslope receiver #1 or #2 as indicated. Pilot follows guidance to published barometric DH.

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Glossary

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 WAAS geodetic altitude less local ground elevation), or B (barometric altitude less local ground elevation).

Air Data and Groundspeed – Display of density altitude, outside air temperature, ISA temperature deviation, true airspeed, and groundspeed.

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 V-speeds set in the EFIS limits.

Altitude Information – Display of altitude information is the altitude tape and altitude readout.

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 (glideslope output). Signals are based on the selected ILS 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 $\pm 10^\circ$ from the flight path marker or aircraft waterline, whichever is greater. The unusual attitude display appears when the aircraft pitch exceeds $\pm 30^\circ$ or bank angle exceeds 65° (fixed wing) or 50° (rotorcraft).

Autoset – Automatically selects features or settings.

Azimuth – Angle between the north vector and the perpendicular projection of the star down onto the horizon. Usually measured in degrees ($^\circ$).

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 pushbuttons along the pushbuttons along the sides and rotary encoders along the bottom.

Chroma – Colorfulness relative to the brightness.

Conformally – Angle-preserving. Example: Traffic appears conformally on the PFD.

Course Deviation Indicator – Display of course deviation from selected course, including a To-From indicator.

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 EFIS systems.

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. All MFD pages include a form of the compass rose with current heading pointer and aircraft “ownship” symbol.

Discrete – A logic input or output that identifies a condition or status of or for an ancillary system. Discrettes are defined by the operating software or settings programmed specifically for the aircraft.

Display of ADF – Display of single ADF bearing information in the form of an RMI needle.

Display of Glideslope – Display of Glideslope 1 or Glideslope 2 in the form of vertical deviation dots and deviation on PFD or MFD HSI page.

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.

Display of Localizer – Display of Localizer 1 or Localizer 2 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 (O, M, I).

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 PFD and 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.

Display of VOR RMI – Display of VOR1 and VOR2 bearing in the form of RMI needles.

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 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.

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 WAAS/SBAS-based flight plan, including course line, waypoints, ground track, glide range, 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 and Fast/Slow Indicator – Indications to show the G-force on the aircraft or, for aircraft equipped with a compatible angle of attack computer, the deviation from the reference speed while in the landing configuration.

Glideslope Sidelobes – False glideslope signals.

GPS 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.

GPS WAAS Functions – The EFIS meets the GPS WAAS navigation and flight planning/management requirements of TSO-C146a (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 WAAS functions meets the integrity requirements of RTCA/DO-200A.

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.

Heading Display – Display of heading with directional scale is provided at the top of the PFD. This is the same heading information provided on the MFD.

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).

HeliSAS – Genesys Aerosystems' helicopter autopilot and stability augmentation system.

Horizontal Situation Indicator (Selectable Function) – Display of VOR or localizer and glideslope deviation when selected for display on the PFD.

HOTAS – Hands On Throttle And Stick

Hover Vector Display (Rotorcraft Only) – Display of hover drift in a rotorcraft installation when the helicopter is traveling less than 30 knots groundspeed.

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 and **TAWS INHBT**.

Integrated Peripherals – Internal devices of the essential unit.

Intelliflight – Genesys Aerosystems' digital autopilot.

Ionosphere – Region of the atmosphere between the stratosphere and exosphere, 50 to 250 miles (80 to 400 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.

Landing Gear Indication – When enabled on retractable landing gear aircraft, PFD shows indication of landing gear extended.

Lubber Line – 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 nav aids such as VOR/NDB/DME, jet/victor airways, 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	ATT MISCOMP	GPS MISCOMP
GS MISCOMP	HDG MISCOMP	IAS MISCOMP
LOC MISCOMP	PLT MISCOMP	RALT MISCOMP
	CPLT MISCOMP	and BARO MISCOMP

NavData® – Jeppesen's aeronautical database to navigate the global airspace system.

Navigation Data 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 (thumbnail map). These functions are analyzed as part of the GPS 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 WAAS functions not the MFD functions.

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, GPS).

Nondirectional – Functions in all directions.

Noodle – Navigation Display (ND) projected path; curving path based upon the aircraft bank angle and groundspeed used effectively to assist in course interception and making small adjustments to bank angle for proper roll out.

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 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. The database used with the obstruction functions meets the integrity requirements of RTCA/DO-200A.

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.

Ownship – Principal eye-point; referring to icon of aircraft represented on display.

Pitch Limit Indicator – Appears when the aircraft is within 10 knots of stall speed, based on the VSI setting in the EFIS limits. The intent is to notify the pilot of a possible stall condition so

corrective action is taken before the stall occurs. This function may be deselected by a setting in the IDU configuration (limits) file.

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. In addition, the pilot may set certain information at any time for reference during flight, including target airspeed (with corresponding bug) and target altitude (with corresponding bug).

Side in Command – Side of aircraft control responsible for its operation.

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.

Talker – 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 “talker” responsibilities. Only one talker (transmit enabled) per side, two talkers in a two sided system, and a master talker PFD when considering aircraft limits. Any IDU may become a talker through auto reversionary means in the event of the PFD failing.

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/HTAWS – Display of terrain, including identification and annunciation of threatening terrain in accordance with Terrain Awareness Warning System (TAWS) requirements. Coloring scheme for SVS-TAWS PFD and MAP has been simplified as follows:

Non-alerting Terrain below aircraft – Olive Shades

Non-alerting terrain above aircraft – Brown Shades

TAWS FLTA Caution Terrain – Amber (Yellow)

TAWS FLTA Warning Terrain – Red

Obstacles Below aircraft – Amber (Yellow)

Obstacles above aircraft – Red

When over water – Deep Blue

Threatening terrain is determined by the requirements of TAWS TSO-C151b (fixed wing) and TSO-C194 HTAWS (rotorcraft). Threatening terrain is shaded amber (yellow) for caution situations or shaded red for warning situations per TSO-C151b and TSO-C194. TAWS cautions and warnings are accompanied by an amber (yellow) or red flag and an aural annunciation. TAWS Class A, TAWS Class B, TAWS Class C, Enhanced HTAWS, or HTAWS functions may be activated in the system prior to installation. The database used with the TAWS functions meets the integrity requirements of RTCA/DO-200A.

Timer Indication – Pilot-selected function for a count-up or count-down timer.

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.

Vertical Speed Display – Display of altitude rate of change (vertical speed or climb rate).

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 inside the limits.

Warning, Caution, and Advisory Flags – 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, and cross wind component.

Zulu Clock, Timers – Display of Zulu time (based on GPS data) and pilot-selected timer.



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64-000098-080F



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