Pilot Guide

GENESYS
AEROSYSTEMS

3D SYNTHETIC VISION EFIS

HIGHWAY-IN-THE-SKY NAVIGATION

GRAPHICAL FLIGHT MANAGEMENT SYSTEM

INTEGRATED AUDIO/RADIO MANAGEMENT

IDU-680 Version 8.0E Pilot Guide (Rotorcraft)

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1.1. Introduction

In the last two decades, aviation has become more complex. As a result, cockpit resources have followed the commercial carriers' trend toward "automation centered" systems. These sophisticated systems minimize pilot involvement and automate control of the aircraft and its systems to the greatest extent possible, thereby relegating the pilot to the role of manager and emergency backup. Examples are flight directors and fly-by-wire systems where the pilot is removed from the information loop.

The Genesys Aerosystems Electronic Flight Instrument System (EFIS) installed in this rotorcraft was conceived and designed as a "pilot-centered" system. While still highly automated, this type of system, common in military tactical applications, presents the pilot with information necessary to make decisions about the flight and take the appropriate actions. An example is the Highway-In-The-Sky (HITS), which allows for highly automated approaches, but its predictive nature provides the pilot unprecedented awareness of upcoming maneuvers. Contrary to the traditional idea of overloading the pilot with information and options, this Genesys Aerosystems EFIS clearly and concisely presents only necessary information. This reduces pilot workload while greatly decreasing task complexity as it minimizes confusion. The result is safer flying with less stress and fatigue.

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

1.2. EFIS/FMS Description

The IDU (Integrated Display Unit) is manufactured from machined, anodized aluminum and has 16 pushbuttons along the vertical sides numbered L1 through L8 starting at the top left corner of the display moving down from a pilot's perspective and R1 through R8 from the top right corner moving down the display.

Figure 1-1: IDU-680 Input Identification

There are four encoders along the bottom with the left encoder only controlling the backlighting intensity. The remaining three encoders from right to left across the bottom of the bezel are designated encoder ❶, ❷, and ❸. References in Section 5 Menu Functions and Step-By-Step Procedures refer to which encoder to push and/or scroll for desired outcomes. Between the two center encoders on the bezel, a USB port with provisions for a slip indicator or blank housing acts as a movable door. When this door is lifted, an optical switch initiates the Ground Maintenance mode to gain access to the maintenance program once a USB memory device is inserted.

The IDU bezel includes an ambient light sensor located on the front face to measure ambient light levels. The left encoder is used only to set backlight illumination levels. The brightness control independently controls the panel lighting and display lighting brightness. Panel lighting refers to the illumination of legends, encoders, and buttons (push and scroll clockwise to increase and counter clockwise to decrease). Display lighting refers to the illumination of the LCD display (without pressing and as described with panel lighting). This lighting may be controlled locally or remotely with a default state being with the local control.

NOTE:

If entering the Ground Maintenance mode with bright light shining or reflecting directly on the display, shield the light sensor if necessary.

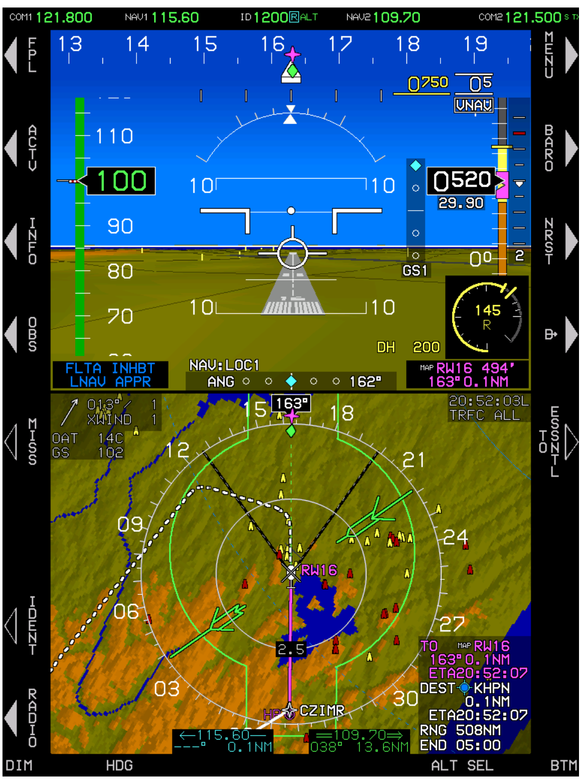


Figure 1-2: IDU-680 Primary Flight Display (PFD) and Multifunction Display (MFD)

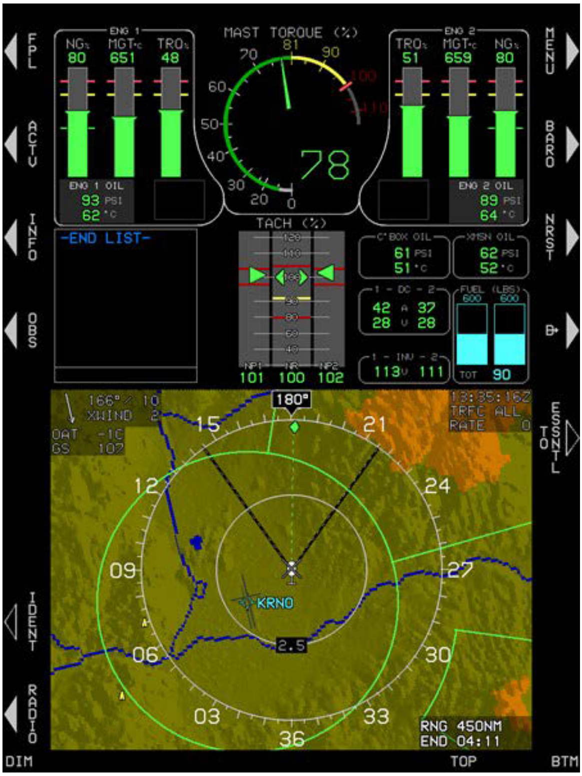


Figure 1-3: IDU-680 Multifunction Display (MFD)

1.3. Run Demonstrator/Training Application

Using the built in demonstration application, the EFIS may be used to fly anywhere in the world while performing any procedure (except takeoff and landing) based on the current Jeppesen navigation database. To use this feature on the ground with the Ground Mode being electronically satisfied:

1) With power off, lift the USB memory flash door. Insert a USB flash memory storage device in the IDU lower bezel.

2) Power the system on and use ❶ (scroll and push to enter) to select **RUN DEMONSTRATION/TRAINING APPLICATION**.

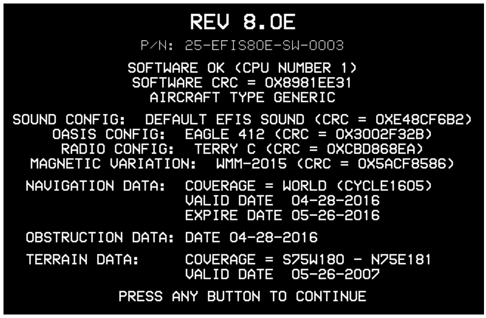


Figure 1-4: Run Demonstrator/Training Application

With the demonstrator, the pilot gains 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 sequence of events to be expected with the aircraft flying the same speeds normally flown as read from the preset limits.

The demonstrator program automatically begins flying over Reno Nevada USA. The altitude begins at approximately 7900’ MSL and may be changed with the use of the menu and target altitude control. The 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 due to the worldwide terrain database loaded in the system by activating a flight plan stored in the memory. However, the Jeppesen navigation database must be updated to match the area of the world navigation as anticipated.

All appropriate navigation signals are simulated, allowing for precision and non-precision instrument approaches found within the current navigation database. All obstructions in the latest obstruction database and all Warning, Caution, and Advisory System aural and flag annunciations are presented as appropriate during the simulated demonstration flights.

In addition to the demonstrator program, a training tool is available to load on a personal computer for purposes of flying like the aircraft.

1.4. EFIS Training Tool

The EFIS Training Tool (ETT) is an application entirely based on the EFIS code and 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. This tool may be used to create routes and user waypoints for saving and uploading into the aircraft mounted IDUs. 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-680, which begins flight in Reno, Nevada at approximately 7900’ MSL. If different ETT startup conditions are required, they may be edited. See user guide distributed with the ETT install files as described in Section 9 Appendix for further details.

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 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 7900’ MSL (unless the simulate.ini program is loaded) intercepting the first leg at a 45° angle.

1.5. About This Guide

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

TABLE OF CONTENTS

Use this section to locate areas by topic…

INTRODUCTION (Section 1)

Use this section to gain basic understanding of how this pilot guide is constructed and where to begin…

SYSTEM OVERVIEW (Section 2)

This section provides a basic system description and block diagram; operational warnings; acronyms, and abbreviations; coloring conventions; and detailed descriptions of the EFIS hardware. This section contains the Warnings, Cautions, and Advisories table describing annunciations for each category, where the flag appears, and on which position of each display under identified conditions.

Use this section to gain better understanding of the system and learn terminology, abbreviations, acronyms, and what the warnings, cautions, and advisories mean. This is where a basic description of all encoder and button functions and coloring conventions are introduced with menu tile definitions, as well as, database updating procedures and how the IDU behaves during initialization…

DISPLAY SYMBOLOGY (Section 3)

This section provides identification of each screen element of the PFD and MFD. For each separate screen, every element of the symbology is identified on a sample screen. Immediately following the sample screens, all elements for that screen are listed.

Use this section to gain familiarity and understand what symbology to anticipate and define after viewing for every possible PFD and ND presentation…

REVERSIONARY MODES (Section 4)

This section provides views of the IDU-680 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.

Use this section to understand 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)

This section shows a flow diagram and selection options with step-by-step procedures for each configured possibility with this EFIS system. The basis for this section has been the Systems Requirement Documentation for this operating system software.

Use this section to understand the menu structure of each feature and how to go step-by-step during operation of each specific task…

QUICK START TUTORIAL (Section 6)

This section provides the basics necessary for flying a familiarization flight with this system. With a few simple steps, an active waypoint may be created and the view may be controlled to manage the displays for the existing flight conditions.

Use this section to quickly gain familiarity with where to locate controls to manipulate the system for each operation…

IFR PROCEDURES (Section 7)

This section provides detailed information and instruction about selecting and flying instrument procedures found within the Jeppesen navigation database.

Use this section to gain familiarity with selection of departure, published instrument approach, and standard terminal arrival procedures. This section describes how ATC clearances may often change and how the active flight plan quickly reflects these changes. Additionally, this section defines examples of the most popular published procedures with views of referenced published procedures…

TERRAIN AWARENESS WARNING SYSTEM (Section 8)

This section contains a description of the TSO-C194 Enhanced HTAWS and HTAWS functionality for this rotorcraft with all configurations.

Use this section for understanding the HTAWS functions provided for the various phases of flight in addition to the call-outs for each GPWS Mode as described in detail for all possible configurations. This section defines the various parameters, which automatically apply to each mode of flight…

APPENDIX (Section 9)

This section contains support material and other useful information about system operation, ancillary guidance from Jeppesen, and supplemental information. The appendix contains individual sections on equipment and features not installed in every aircraft and may be removed at the discretion of the end-user.

Use this section for understanding domestic flight planning; Magnetic vs. True North modes of operation; Airspeed/Altitude Miscompare thresholds; EFIS Training Tool accessibility; naming conventions used by the navigation database provider; flight data recorded information format; downloading routes and user waypoints; and sourcing a copy of the Service Difficulty Report form…

INDEX

The index provides an alphabetical listing of terms used in the pilot guide with corresponding page numbers.

Use to look up a key word and locate where it is used in the text.

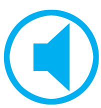
GLOSSARY

The glossary provides an alphabetical listing of definitions for terms used in the pilot guide.

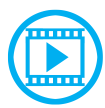
Use to look up definitions for key words and terms.

1.5.1. 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 1-5: Audio and Video Icons

Genesys Aerosystems is committed to producing the highest quality product possible and welcomes comments and suggestions concerning this publication. Please e-mail comments and suggestions to:

genesys-support@genesys-aerosystems.com

If you encounter problems with the operation of your Genesys Aerosystems EFIS, please complete and return the Service Difficulty Report in Section 9 Appendix directly to:

Genesys Aerosystems
One S-Tec Way
Mineral Wells Municipal Airport
Mineral Wells, Texas 76067 or Fax: (940) 325-3904

Section 2 System Overview

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2.1. Abbreviations and Acronyms

µm Hg	Micrometer of Mercury
0R	No Radius
3-D	Three-Dimensional
AC	Advisory Circular
ACTV	Active
AD	Airworthiness Directive
A-D	Analog to Digital (converter)
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
ALTA	Equal to "Selected Altitude Submode" (AW 109SP)
AMLCD	Active Matrix Liquid Crystal Display
ANP	Actual Navigation Performance
ANSI	American National Standards Institute
ANT	Antenna
APP	Waypoint is part of an Instrument Approach Procedure
APPR	Approach
APT	Airport
APV	Approach with Vertical Guidance
AR	Audio Radio
ARINC	Aeronautical Radio, Inc.
ARP	SAE Aerospace Recommended Practice

AS	SAE Aerospace Standard
ASEL	Aircraft Selected Altitude
ATA	AT Attachment (hard disk storage interface)
ATC	Air Traffic Control
ATT	Attitude
BARO	Barometric setting
BC	Backcourse navigation
BFO	Beat Frequency Oscillator
BRT	Brightness
BTM	Bottom
C	Celsius
CA	Course to Altitude (ARINC-424 Leg)
CALC	as in RAIM (R6)
CAS	Crew Alerting System
CD	Course to DME Distance (ARINC-424 Leg)
CCW	Counter Clockwise
CDA	Continuous Descent Approach
CDI	Course Deviation Indicator
CDR	Critical Design Review
CDTI	Cockpit Display of Traffic Information
CF	Course to Fix (ARINC-424 Leg)
CI	Course to Intercept (ARINC-424 Leg)
CLR	Clear
CM	Configuration Management
CNS	Communications/Navigation/Surveillance
CNX	Cancel
COM	Communication
CONT	Continue
CPLT	Co-Pilot
CPM	Company Project Manager; Computer Processor Module
CPU	Central Processing Unit

CR	Change Request; Course to Radial Termination (ARINC-424 Leg)
CRC	Cyclic Redundancy Check
CRS	Course
CSA	Conflict Situation Awareness (ADS-B)
CTRST	Contrast
CW	Clockwise
DA	Decision Altitude
D-A	Digital to Analog (converter)
DAICD	Digital Aeronautical Information CD
DAR	Designated Airworthiness Representative
dBZ	Decibel relative to radar reflectivity (Z)
DCLTR	Declutter
DCN	Document Change Notice
DCND	Descend
DEC HT	Decision Height Bug
DEL	Delete
DEM	Digital Elevation Model
DER	Designated Engineer Representative
DESIG	Designate
DF	Direct to Fix (ARINC-424 Leg)
DFLT	Default
DG	Directional Gyro
DH	Decision Height
DL	Data Link
DME	Distance Measuring Equipment
DMIR	Designated Manufacturing Inspection Representative
DO	RTCA Document
DOD	Department of Defense
DOF	Digital Obstruction File
DP	Departure Procedure
DR	Dead Reckoning or; Defect Report
DSP	Digital Signal Processing

EFIS	Electronic Flight Instrument System
EGM	Earth Gravity Model
EGNOS	European Geostationary Navigation Overlay Service
EGPWS	Enhanced Ground Proximity Warning System
EIA	Electronics Industry Association
EICAS	Engine Indicating and Crew Alerting System
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
FHA	Functional Hazard Analysis
FIFO	"First in, First out"
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)
FMEA	Fault Mode and Effects Analysis

FMS	Flight Management System
FOV	Field of View
FPE	Floating Point Emulation
FPL	Flight Plan
FPM	Feet per Minute; Flight Path Marker
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
GLONASS	Russian Global Navigation Satellite System
GLS	GNSS Landing System
GMETAR	Graphical METAR (also GMTR)
GMF	Ground Maintenance Function
GN	Gain
GND	Ground (potential)
GNSS	Global Navigation Satellite System
GPH	Gallons Per Hour
GPI	Glidepath Intercept
GPIP	Glide Path Intercept Point
GPS	Global Positioning System
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
HORIZ	Horizontal
hPa	Hectopascal
HPL	Horizontal Protection Level
HSI	Horizontal Situation Indicator
HTAWS	Helicopter Terrain Awareness and Warning System
HUD	Head Up Display
HUL	Horizontal Uncertainty Limit
IAP	Instrument Approach Procedure; Initial Approach Point
IAS	Indicated Airspeed
IAWP	Initial Approach Waypoint (same as IAP)
IC	Integrated Circuit
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ID	Identity or Identification
IDENT	Identification (Transponder Ident)
IDS	Integrated Display System (AW-109SP)
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

ISR	Interrupt Service Routine
IVSI	Instantaneous Vertical Speed Indicator
IWP	Intermediate Approach Waypoint
JAD	Jeppesen Aviation Database
JTAG	Joint Test Action Group (IEEE 1149.1 Standard)
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
LRU	Line Replaceable Unit
LSB	Least Significant Bit or Byte
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
MAWPT	Missed Approach Waypoint
MB	Megabyte
mbar	Millibars
MDA	Minimum Descent Altitude
MEMS	Micro Electro Mechanical System
MESO	Mesocyclonic
METAR	Routine hourly weather report
MFD	Multifunction Display (IDU with software for showing multiple display screens)
MIN	Minimum
MM	Middle Marker
M_{MO}	Maximum Operating Mach Number
MOA	Military Operations Area
MOPS	Minimum Operational Performance Standard
MOT	Mark On Target
MSAS	Japan's MTSAT-based Satellite Augmentation System
MSB	Most Significant Bit or Byte
MSL	Mean Sea Level
MSU	Magnetic Sensor Unit
MTBF	Mean Time Between Failures
MVFR	Marginal Visual Flight Rules
NACO	National Aeronautical Charting Office
NAS	U.S. National Airspace System
NASA	National Aeronautics and Space Administration
NAV	Navigation
NAVAID	Device or system providing navigational assistance
ND	Navigation Display
NDB	Nondirectional Beacon
NED	National Elevation Dataset

NEXRAD	(Next-Generation Radar) network of weather radars operated by the National Weather Service (NWS) (also NXRD)
NI	Navigational Information
NIMA	National Imagery and Mapping Agency
NM	Nautical Mile
NPA	Non-Precision Approach
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
NXT	Next
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
PDR	Preliminary Design Review
PFD	Primary Flight Display (display screen showing primary instrumentation -- also refers to the primary IDU with software that only shows primary instrumentation)
PFDE	Predictive Fault Detection and Exclusion
PFI	Primary Flight Information
PI	Procedure Turn (ARINC-424 Leg)
PIC	Peripheral Interface Controller
PLI	Pitch Limit Indicator

PLT	Pilot
PM	Personality Module
PN	Part Number; Pan
PRAIM	Predictive Receiver Autonomous Integrity Monitoring
PROC	Procedure
PRV	Previous
PSAC	Plan for Software Aspects of Certification
PSCP	Project Specific Certification Plan
PSP	Partnership for Safety Plan
PTK	Parallel offset (Parallel Track)
PTN	Problem Tracking Number
PTRS	Pointers
QA	Quality Assurance
QFE	Altimeter setting provides height above reference point
QM	Quality Management
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
RAM	Random Access Memory
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)
RFMS	Rotorcraft Flight Manual Supplement
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
RS	EIA Recommended Standard
RTC	Real Time Computing
RTCA	Radio Telephone Commission for Aeronautics
RTD	Resistive Thermal Detector
RTL	Run Time Library
RTN	Return
RW	Runway
Rx	Receive
SA	Selective Availability
SAE	Society of Automotive Engineers
SAS	Software Accomplishment Summary
SAT	Saturation
SBAS	Satellite Based Augmentation System
SCC	System Configuration Card (personality module)
SCI	Software Configuration Index
SCMP	Software Configuration Management Plan
SCR	Software Conformity Review
SCS	Software Coding Standards
SDCM	System of Differential Correction and Monitoring
SDD	Software Design Document
SDP	Software Development Plan
SDS	Software Design Standards
SECAM	Analog color television system used in France
SECI	Software Environment Configuration Index
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Advisory
SLCT	Select
SMA	Sub-Miniature version A connector
SN	Serial Number
SNI	Serial Number Information

SOI	Stage of Involvement (FAA software audit)
SPR	Software Problem Report
SQA	Software Quality Assurance
SQAP	Software Quality Assurance Plan
SQAR	Software Quality Assurance Representative
SRD	Software Requirements Document
SRS	Software Requirements Standards
SRTM	Shuttle Radar Topographical Mission
SSA	System Safety Assessment
SSM	Sign Status Matrix
STAB	Stability
STAR	Standard Terminal Arrival Routes
STBY	Stand-by
STC	Supplemental Type Certificate
STP	Software Test Protocol
STRKS	Strikes (Lightning detection)
STS	Software Test Specification
SUA	Special Use Airspace
SV	Service Vehicle
SVCP	Software Verification Cases and Procedures
SVP	Software Verification Plan
SVR	Software Verification Results
SVS	Synthetic Vision System
SYMB	Symbol
SYNC	Synchronize (also SYNCH)
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
TCH	Threshold Crossing Height
TD	Traffic Display
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
TMS	Texas Instruments family of DSP processors
TQP	Tool Qualification Plan
TRANS	Transition
TRK	Track
TRNDO	Tornadic
TSO	Technical Standard Order
TSRA	Terminal Radar Service Area
TTA	Time to Alert
TURB	Turbulence
Tx	Transmit
UART	Universal Asynchronous Receiver-Transmitter
UIM	User Interface Module
USB	Universal Serial Bus, data storage device
USGS	United States Geological Survey
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_{MIN}	Minimum speed for IFR for helicopters
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
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
VSI	Vertical Speed Indicator
VTF	Vectors to Final
V_{TOS}	Minimum speed for a positive rate of climb with one engine inoperative
VUL	Vertical Uncertainty Limit
WAAS	Wide Area Augmentation System
WGS84	World Geodetic System 1984

WPT	Waypoint
WX	Weather
XFILL	Cross-fill

2.2. System Overview

The IDU-680 EFIS System is a complete flight and navigation instrumentation system that intuitively provides information to a pilot via computer generated screen displays. The screen displays include three-dimensional, enhanced situational awareness Primary Flight Display (PFD) and Multi-Function Display (MFD). The MFD may be configured to show a moving map, HSI, terrain, traffic, datalink weather, radar, video, or dedicated EICAS (Engine Indicating and Crew Alerting System) displays.

At any given time, each system may only have 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.

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, etc.). This provides an exceptional level of redundancy as compared to traditional display architectures where most of these functions were performed by external LRUs. Figure 2-1 depicts a typical architecture used by IDUs.

The IDUs depend upon intra-system (between IDUs on a side – depicted as “Synch” in Figure 2-1) and inter-system (between IDUs on opposite sides – depicted as “Crosslink” in Figure 2-1) 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 aural alerts.

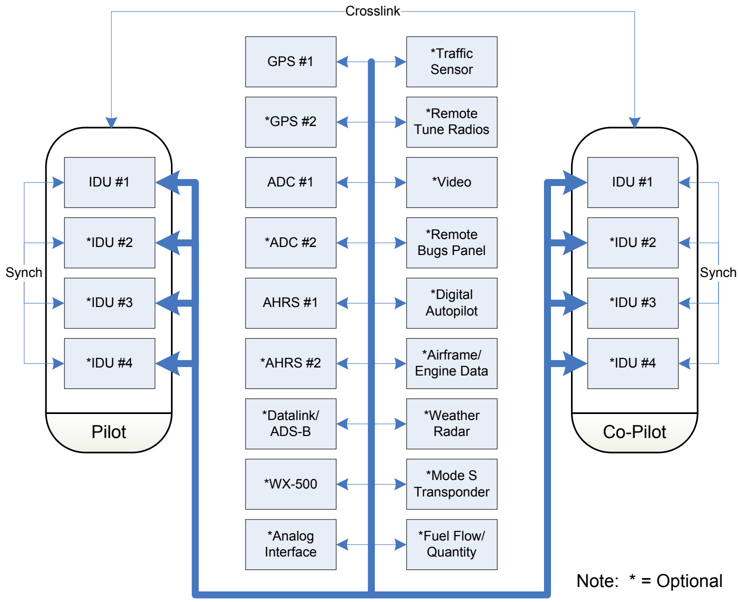

Figure 2-1: System Diagram

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., "E").

Table 2-1: IDU Initialization Software Version and Part Number

Version Number	Part Number
Rev 8.0E	25-EFIS80E-SW-0003

Aircraft configurations are initially read from flash drive storage. This provides the IDUs with a default configuration setup in the event of personality module failure. The Pilot System #0 or #1 IDU reads aircraft configuration from its personality module and, in the case of a multi-screen installation with a #1 IDU, transmits this configuration to the other IDUs, including all Co-Pilot System IDUs. Upon reception of the configurations transmission from the Pilot System #0 or #1 IDU, 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 to initialize the system. This allows for a good initialization, even if system sensors are failed or not yet initialized. For a future application update (i.e., updating software version 8.0A 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 with the exception of the following default values:

1) Active flight plan structure and associated values are cleared.
2) ADAHRS are set to slaved mode and the slewing value is initialized to zero.
3) Timers are turned off.
4) Minimum altitude setting is turned off.
5) FMS OBS setting is set to automatic.
6) VOR/LOC 1 OBS setting is set to 360°.
7) VOR/LOC 2 OBS setting is set to 360°.
8) Parallel offset is set to 0 NM.
9) Airspeed bug is turned off.
10) Target altitude bug is turned off.
11) Vertical speed bug is turned off.
12) HSI navigation source is set to FMS.
13) Heading bug is set to 360°
14) Datalink and map panning modes are set to off.
15) PFD zoom mode is set to off.
16) Manual RNP is set to off.
17) PFD skyway is set to on.

18) RDR-2000/2100 scale is initialized to 80NM.

19) Crosslink is initialized to on.

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

1) OASIS configuration.

2) Radios.

3) The 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.

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

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

3) If the CRC-32 check fails, the program exits with an error message and creates a bit result file indicating failure.

4) If the CRC-32 check passes, the program continues to initialize and creates a bit result file indicating passage.

5) The application auto-sets the altimeter based upon the terrain elevation at the startup point. (Providing the Baro Autosetting on Startup is enabled.)

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 the message “**PRESS ANY BUTTON TO CONTINUE**.”

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

8) If any critical sensor is not in normal condition, a logo screen with a two-minute countdown timer is displayed along with the message “**PRESS ANY BUTTON TO SKIP**.” The display screens initialize at the earliest of:

a) when two 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, MFD on bottom).

b) Other IDUs: If OASIS is configured, IDU #2 initializes to 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.

10) On the IDU #0 or #2 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.

2) The bit result file created during the last ground boot is checked. If the bit result file indicates a failure, the program exits with an error message. If the bit result file indicates passage, the program continues.

3) The display screens initialize immediately.

4) Display screens initialize as follows:

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

b) 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, it is best to press **EXIT (R1)** on each display and wait at least 20 seconds. This allows PFDs to sync with MFDs and allows pilot and co-pilot sides to sync (as applicable). External devices such as audio controllers, radios, and transponders may have different start-up times and initialization requirements. If any IDU menu is active, intra-system and inter-system synchronization messages are paused.

2.3. Software Safety Functions

The IDU software has a “Normal” and an “Essential” state. “Normal” state for IDUs configured as #1 is a PFI page in the top area and a pilot-selectable multi-function page in the bottom area.

2.3.1. Normal and Essential States

“Normal” state 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” state is pilot-selectable multi-function pages in both areas.

“Essential” state presents a PFI page in the top area and EICAS in the bottom area and is always available with a single-button press **(R5)**. The state 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” states; the legend changes between **TO ESSNTL** and **TO NORMAL** to indicate the button action. State change is instantaneous.

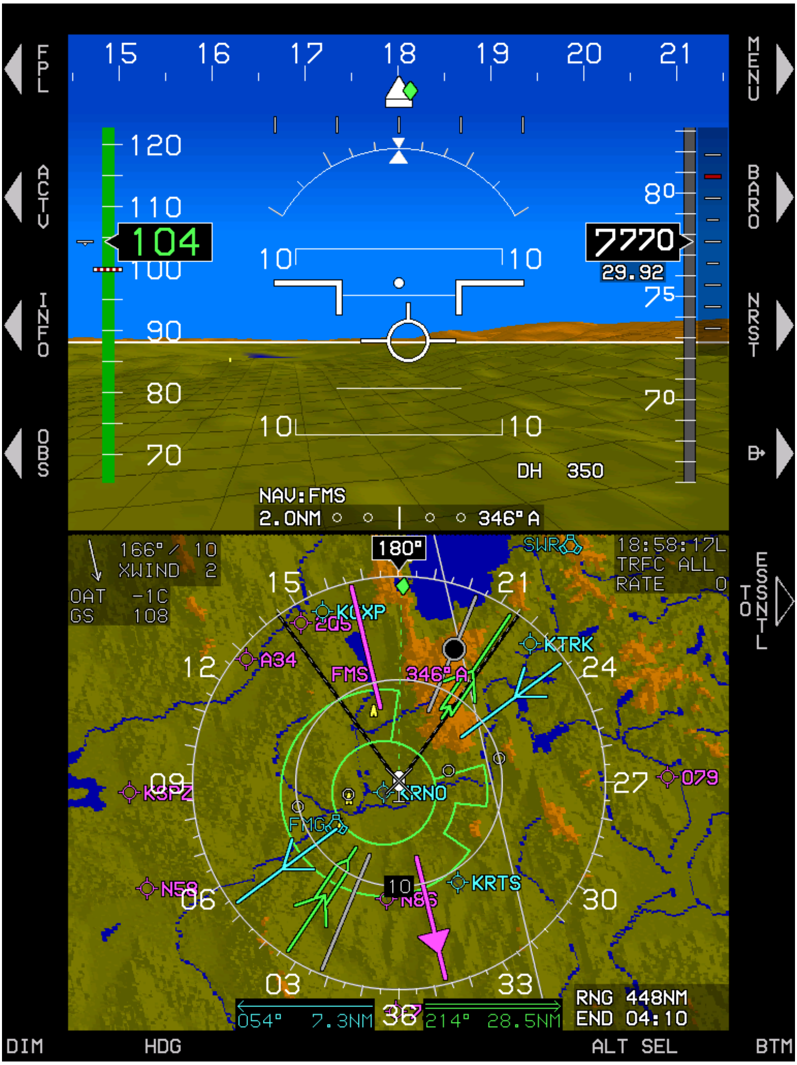

Figure 2-2: Normal and Essential States

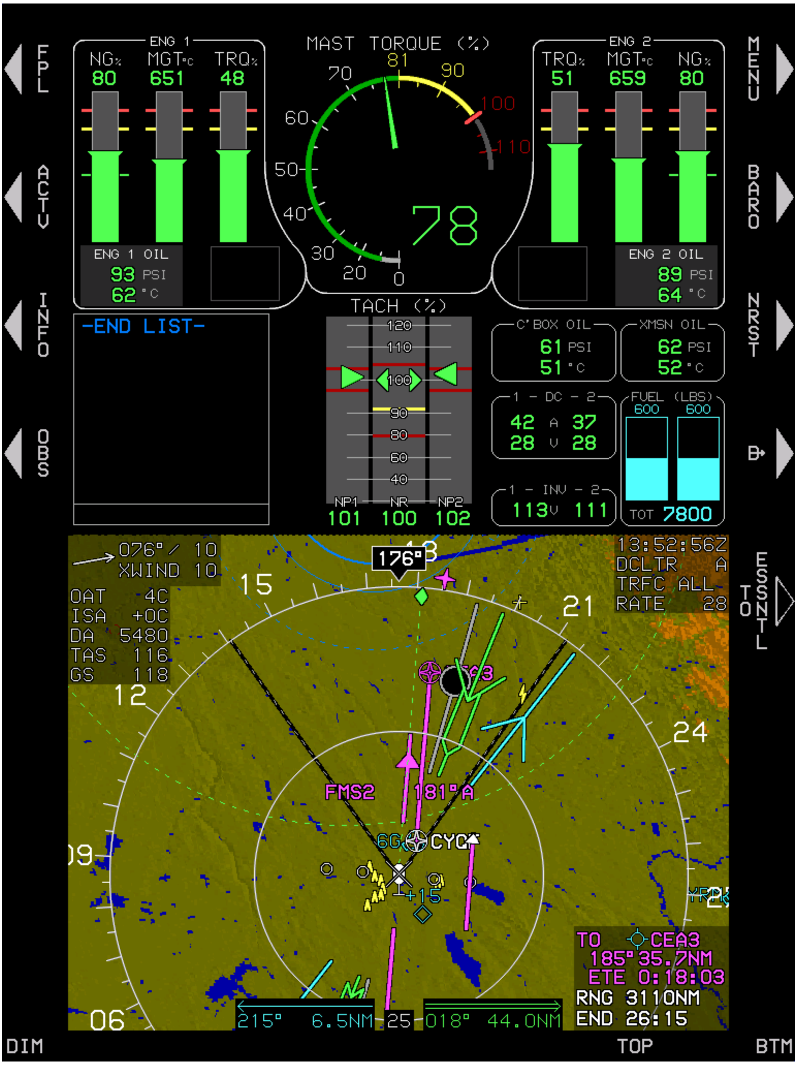

Figure 2-3: MFD with EICAS Normal Mode

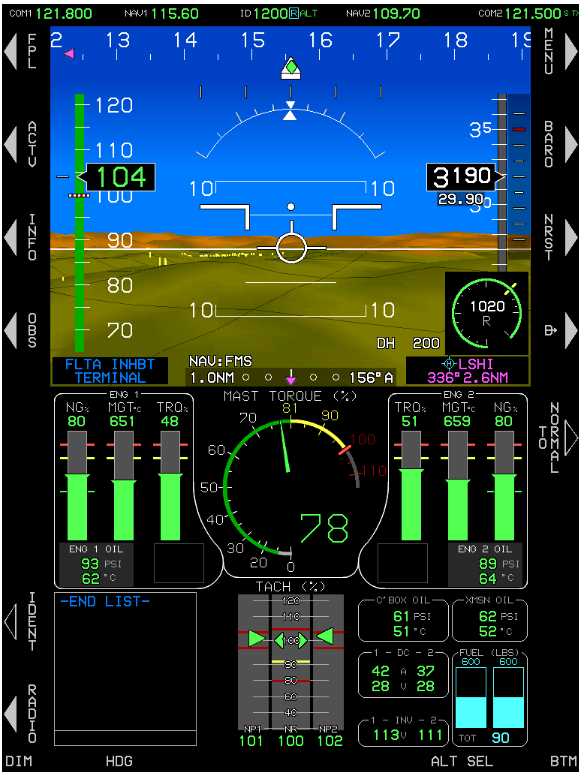

Figure 2-4: MFD with EICAS Essential Mode

2.3.2. Menu Philosophy

Due to the integrated functionality of the IDUs, the menu system ends up being complex. To help the pilot with the unavoidable complexity, the following rules are in the design of the menu system:

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

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

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

Labeling: All buttons with an action are clearly labeled to minimize reliance upon memory for menu operation.

2.3.3. Avoidance of Autonomous Behavior

The displays are designed to always be under the control of the pilot with pains taken to ensure critical functions are placed at the top level (i.e., **TO ESSNTL**). Autonomous changes in function that may surprise the pilot are avoided to the extent possible. The following are the 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 the "Essential" state upon determining the higher priority IDU has failed. The "Essential" state 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 IDU software.

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.

2.3.4. Data Source Monitors

In installations with redundant sensors, the IDUs continuously monitor the sensors to detect disagreements. The following parameters from redundant sensors are compared:

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

2.3.5. IDU Intra-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
2) Screen counter incrementing (i.e., screen not frozen)
3) Airspeed agreement
4) Altitude agreement
5) Attitude agreement
6) Barometric setting agreement
7) GPS position, track, and groundspeed agreement
8) Heading agreement
9) Localizer and glideslope deviation agreement
10) Radar altitude agreement

2.4. General Arrangement

The IDU-680 is 7.500”W x 10.250”H x 4.750”D and weighs less than 9.5 lbs. The IDU-680 is composed of two major sub-assemblies mechanically connected by through-bolts, the User Interface Module (UIM) and the Computer Processor Module (CPM). The IDU-680 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 consists of up to two compact flash cards sufficiently sized to hold world terrain, navigation, and obstruction databases. Because the receive ports of the IDUs are connected to the digital sensor modules in parallel, each IDU is independent from all other IDUs. In an IFR installation, the software of the primary IDU-680 is configured so only the primary screen Primary Flight Information (PFI) display top half plus Multi-Function display (MFD) bottom half may be displayed (Figure 2-5).

Figure 2-5: Primary IDU-680 PFI on Top Half, ND on Bottom Half

2.4.1. 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. 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, the aircrew should 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.

2.5. EICAS Display

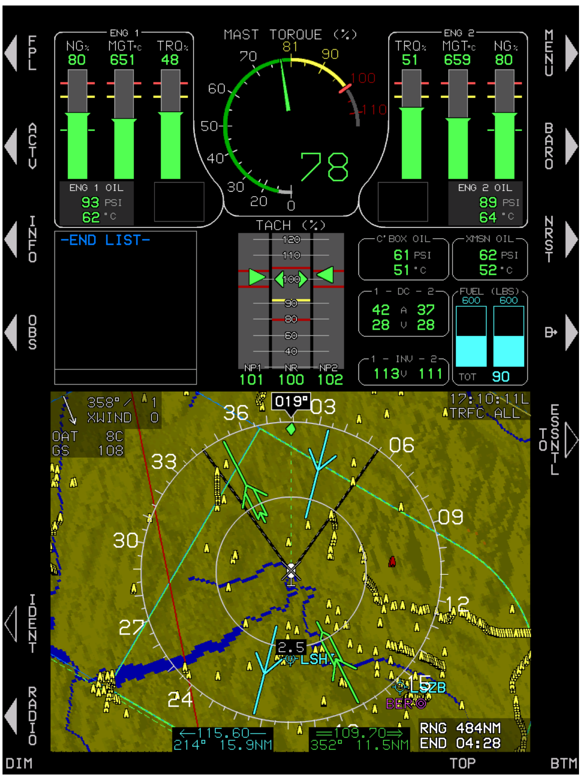

Figure 2-6: EICAS

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 2-6 is an IDU-680 Multi-Function display with the top display area showing the EICAS and bottom area configured to the MAP page.

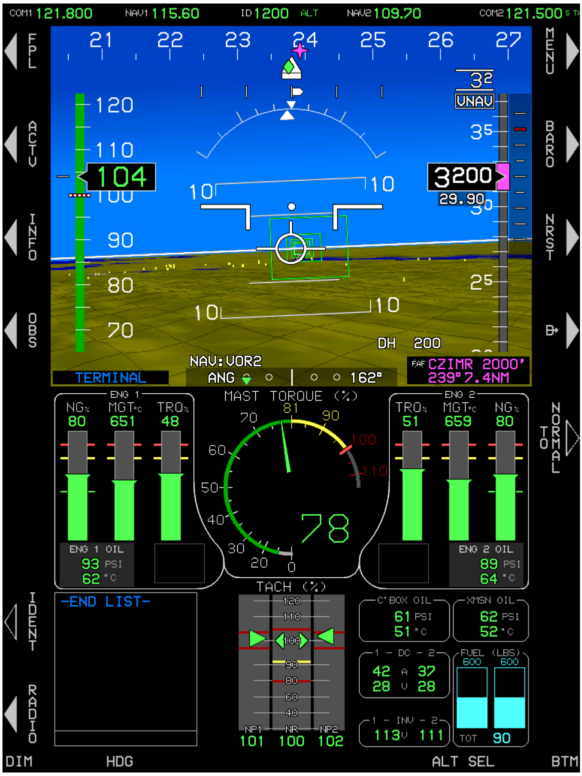

Figure 2-7: PFD with EICAS

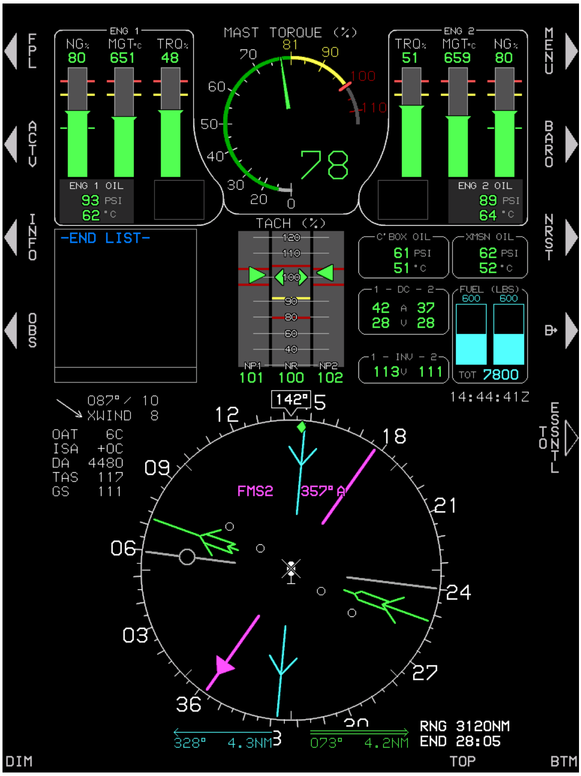

Figure 2-8: MFD with HSI and EICAS

2.6. Color Conventions

The Genesys Aerosystems EFIS uses a consistent set of colors for displaying information on display. (Any color representation may not be identical as it appears on the IDU.)

WHITE is used for items set by the pilot and held internally by the EFIS system or items where device feedback is not expected, such as STBY frequency/codes, TX indicator when there is no TX feedback, or Marker Beacon Receiver High/Low sensitivity modes. Used for 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 become overwhelming.

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

MAGENTA (light magenta for visibility) is used for pilot-set items sent to devices but awaiting feedback confirmation such as ACTV frequency/codes, operating modes, transmit enabled indications, and IDENT indication. Used to indicate electronically 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 is used as a figure background for airspeed and altitude readout and for conformal runway depiction (light gray for usable portion of the active runway, dark gray for other runway surfaces).

GREEN (light green used for visibility) is used for pilot-settable items confirmed as set via feedback from the device, such as ACTV frequency/codes, operating modes, transmit enabled indications, and IDENT feedback. Used 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 is used for the terrain indication on the moving map. The slope between adjacent terrain pixels in an increasing longitude direction determines the shade used.

AMBER (YELLOW) is used to identify conditions requiring immediate pilot awareness and may require subsequent pilot action. Also used for stuck mic and DME hold indications.

OLIVE is used in various shades to show terrain within 2000' and below aircraft altitude.

BROWN is used in a variety of shades to indicate earth/terrain portion of the primary flight display. Shades of brown are used when terrain is at or above the aircraft altitude on the MFD.

BLUE is used in a variety of shades to indicate the sky portion of the PFD, bodies of water on the moving map, and advisory text on black background.

RED is used to indicate aircraft limitations or conditions, which require immediate pilot action. Currently only used to indicate a device failure (red "X").

BLACK is used for the field of view angle lines on the moving map, for figures on a gray background, and for outlining borders and certain figures/elements on backgrounds where contrast is minimal, e.g., airspeed, altitude, and menu tiles on the PFD/MFD.

2.7. Warning/Caution/Advisory System

The IDU has an integrated audio/visual warning system monitoring a wide variety of parameters and providing annunciations for conditions demanding pilot awareness. There are three categories of annunciations: **WARNINGS**, **CAUTIONS**, and **ADVISORIES**. Where time delay is referenced, it is the programmed delay in seconds prior to the annunciation appearing. Table 2-2 lists the annunciations provided by the IDU.

WARNING Displayed with red flag and an aural annunciation repeating until the condition goes away or is acknowledged by the pilot.

CAUTION Displayed with amber (yellow) flag and a single aural annunciation.

ADVISORY Displayed with black flag and blue letters with a single aural annunciation.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
GLIDESLOPE	"Glideslope, Glideslope"	Within GPWS Mode 5 warning envelope. Half second time delay.
LOW FUEL	"Fuel Low, Fuel Low"	One of the following conditions is true: 1) One of the low fuel warning discrete inputs is active. 2) One of the sensed fuel tank quantities is below its low fuel warning threshold. 3) Total aircraft fuel is below the pilot-set emergency fuel threshold. 1-minute time delay.
OBSTRUCTION	"Warning Obstruction, Warning Obstruction"	Obstruction within TAWS FLTA warning envelope. Half second time delay.
PULL UP	"Pull Up, Pull Up"	Within GPWS Mode 1 warning envelope. Half second time delay.
	"Terrain, Terrain, Pull Up, Pull Up"	Within GPWS Mode 2 warning envelope. Half second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
TERRAIN	"Warning Terrain, Warning Terrain"	Terrain cell within TAWS FLTA warning envelope. Half second time delay.
TRAFFIC	"Traffic, Traffic"	Resolution advisory. Not given if own aircraft below 400' AGL nor if target is below 200'AGL (ground target). Audio not generated with TCAS-II system. No time delay.
CAUTIONS		
ADC1 FAIL	Alert Tone	Only active in dual-ADC installation. Indicates no valid indicated airspeed, pressure altitude, or VSI received from ADC #1 for more than 1 second. No time delay.
ADC2 FAIL	Alert Tone	Only active in dual-ADC installation. Indicates no valid indicated airspeed, pressure altitude, or VSI received from ADC #2 for more than 1 second. No time delay.
ADS-B FAIL	Alert Tone	Enabled by ADS-B out fail warning limits setting. Mode-S transponder indicates bad ADS-B out status. 2-second time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
AHRS1 FAIL	Alert Tone	Only active in dual-AHRS installation. Indicates no valid bank, pitch, or heading received from AHRS #1 for more than 1 second. No delay. Inhibited during and for 10 seconds after unusual attitude mode.
AHRS2 FAIL	Alert Tone	Only active in dual-AHRS installation. Indicates no valid bank, pitch, or heading received from AHRS #2 for more than 1 second. No delay. Inhibited during and for 10 seconds after unusual attitude mode.
ALT MISCOMP	Alert Tone	Only active in dual-ADC installation with neither ADC in failure condition. Indicates pressure altitude difference between ADCs is beyond limits. 10-second time delay. Inhibit for 5 minutes after startup.
ATT MISCOMP	Alert Tone	Only active in dual-AHRS installation with neither AHRS in failure condition. Indicates pitch or roll difference between AHRS is beyond limits (6°). 10-second time delay. Inhibit for 5 minutes after startup.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
AUX SENSOR	"Auxiliary Sensor Failure, Auxiliary Sensor Failure"	No valid message or bad status received from installed optional sensors. Sensor status displayed in FAULTS menu. 5-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. Applies to the following optional sensors: 1) RS-232 TAS System 2) ADS-B System 3) WSI Datalink System 4) WX-500 Lightning System 5) Analog Interface System 6) Weather Radar 7) Weather Radar Control Panel
CHECK GEAR	"Check Gear, Check Gear"	Activated if RG flag is set to 1, aircraft is below 150' AGL, aircraft is descending, and any landing gear is not down. 2-second time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
CHECK IDU 1 CHECK IDU 2 CHECK IDU 3 CHECK IDU 4	Alert Tone	When armed (i.e., at least one intra-system monitor message has been received from the transmitting display), checks intra-system monitor messages. Indicates either: 1) screen counter value has not changed in the last 1 second ± 0.1 seconds; or 2) intra-system monitor message is not fresh (i.e., no message received for longer than 1 second ± 0.1 second). "#" indicates which IDU is failing the check (IDU1, IDU2, IDU3, or IDU4.) No time delay.
COOLING FAN	Alert Tone	Triggered when external cooling fan is commanded on by the cooling fan discrete output, and the cooling fan status discrete input indicates the cooling fan is not rotating. 1-minute time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
CHECK RANGE	"Check Range, Check Range"	Less than 30 minutes buffer (at current groundspeed) between calculated range and distance to: 1) last waypoint if it is active; or 2) airport if on a missed approach; or 3) along-route distance to destination. Not activated in climbing flight nor if below 60 knots groundspeed. 5-minute time delay.
LOW FUEL	"Fuel Low, Fuel Low"	Low Fuel warning is not active and one of the following conditions is true: 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. 1-minute time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
FUEL SPLIT	Alert Tone	Compares the volume of fuel designated left wing tank fuel vs. volume of fuel designated right wing tank fuel to the Fuel Split caution threshold. Issued if the difference exceeds the Fuel Split caution threshold. Only performed if the Fuel Split caution threshold is non-zero, and both left and right wing tank fuel are monitored and valid. 1-minute time delay.
GLIDESLOPE	"Glideslope' Glideslope"	Within GPWS Mode 5 caution envelope. Half second time delay.
GPS LOI	Alert Tone	GPS/SBAS loss of integrity caution. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.
GPS LON	Alert Tone	GPS/SBAS loss of navigation caution. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.
VERT LON	Alert Tone	Loss of Vertical Navigation caution. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
GPS MISCOMP	Alert Tone	Only active in dual-GPS/SBAS installation with neither GPS/SBAS in failure condition. Indicates position, track, or groundspeed difference between GPS/SBAS units is beyond limits. Limits are as follows: **Position**: Enroute Mode 4NM Terminal Mode 2NM Departure Mode .6NM IFR Approach Mode .6NM VFR Approach Mode .6NM **Track**: If groundspeed is greater than 30 kts, mis-compare if difference is more than 4°. **Groundspeed**: If difference between GPS#1 and GPS#2 miscompare is more than 10 kts. 10-second time delay. Inhibited during and for 10 seconds after unusual attitude mode.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
GPS1 FAIL	Alert Tone	Only active in dual-GPS/SBAS installation. Indicates no valid message received from GPS/SBAS #1 for more than 5 seconds. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.
GPS2 FAIL	Alert Tone	Only active in dual-GPS/SBAS installation. Indicates no valid message received from GPS/SBAS #2 for more than 5 seconds. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.
NO POSITION	Alert Tone	No valid position data available from selected GPS/SBAS for more than 5 seconds and dead reckoning not available. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
GS MISCOMP	Alert Tone	Only active when two valid glideslopes are received. 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). 10-second time delay.
HDG MISCOMP	Alert Tone	Only active in dual-AHRS installation with neither AHRS in failure condition 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	Only active in dual-ADC installation with neither ADC in failure condition. Indicates indicated airspeed difference between ADCs is beyond limits. Inhibit for 5 minutes after startup. 10-second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
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.
NO HEADING	Alert Tone	No valid heading received from selected AHRS for more than 1 second Inhibited during and for 10 seconds after unusual attitude mode. Disabled if in MFD-only operation. Not shown if PFD heading scale is red-X'd (Red-X provides sufficient pilot cue). No time delay.
NO TAWS	Alert Tone	Indicates aircraft is currently beyond extent of terrain database or a failure condition exists preventing the TAWS FLTA function from operating. Half second time delay. Inhibited during and for 10 seconds after unusual attitude mode.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
OAT SENSOR OAT1 SENSOR OAT2 SENSOR	Alert Tone	Indicates OAT sensor has failed. "OAT SENSOR" applicable to single ADC installation. "OAT# SENSOR" applicable to dual ADC installation. Indicates OAT indication is invalid, but other air data parameters are normal (i.e., air data is not red-X'd). Half second time delay.
OBSTRUCTION	"Caution Obstruction, Caution Obstruction"	Obstruction within TAWS FLTA caution envelope. Half second time delay.
PLT MISCOMP CPLT MISCOMP	Alert Tone	Only active when fresh intra-system monitor messages are received. Indicates a critical parameter is used by another display exceeds the miscompare thresholds when compared to the monitoring display. Compares the following critical parameters: 1) Attitude (Pitch and Roll) (use Attitude Miscompare logic) 2) Heading (use Heading Miscompare logic) 3) Pressure Altitude (use Altitude Miscompare logic)

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
		4) Indicated Airspeed (use Airspeed Miscompare logic) 5) Localizer (both inputs) (use Localizer Miscompare logic) 6) Glideslope (both inputs) (use Glideslope Mis-compare logic) 7) Radar Altitude (use Radar Altitude Miscompare logic) 8) Latitude (Use GPS/SBAS Mis-compare logic) 9) Longitude (Use GPS/SBAS Mis-compare logic) 10) Track (Use GPS/SBAS Mis-compare logic) 11) Groundspeed (Use GPS/SBAS Mis-compare logic) 1-second time delay. Inhibited during and for 10 seconds after unusual attitude mode.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
PLT1 OVRTMP PLT2 OVRTMP PLT3 OVRTMP PLT4 OVRTMP CPLT1 OVRTMP CPLT2 OVRTMP CPLT3 OVRTMP CPLT4 OVRTMP	Alert Tone	IDU core temperature greater than 95°C. 2-second time delay.
PLT1 SCC PLT2 SCC PLT3 SCC PLT4 SCC CPLT1 SCC CPLT2 SCC CPLT3 SCC CPLT4 SCC	Alert Tone	Indicates SCC card (Personality Module) could not be read upon power-up. Limits internal to the IDU are in use by the system. Only active on the ground.
RADALT FAIL	Alert Tone	Only active in single-Radar Altimeter installation. For analog radar altimeter, indicates 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.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
RADALT1 FAIL	Alert Tone	Only active in dual-Radar Altimeter installation. Indicates no-radar altimeter reading received from Radar Altimeter #1 for more than 1 second. Also displayed in Ground Mode. Inhibited when radar altimeter value received from ARINC 429, except when SSM of radar altimeter message indicates failure warning. 2-second time delay.
RADALT2 FAIL	Alert Tone	Only active in dual-Radar Altimeter installation. Indicates no radar altimeter reading received from Radar Altimeter #2 for more than 1 second. Also displayed in Ground Mode. Inhibited when radar altimeter value received from ARINC 429, except when SSM of radar altimeter message indicates failure warning. 2-second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
RALT MISCOMP	Alert Tone	Only active in dual-Radar Altimeter installation with neither radar altimeter in failure condition. Indicates radar altitude difference between radar altimeters is beyond limits. Limits are as follows: >= 500'AGL Δ14% 100 – 500'AGL Δ10% < 100'AGL Δ10' 10-second time delay.
SAME ADC	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-ADC installation with good inter-system communications, and neither ADC in failure condition. Indicates both systems are operating from same ADC source. No time delay.
SAME AHRS	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-AHRS installation with good inter-system communications, and neither AHRS in failure condition. Indicates systems are operating from same AHRS source. No time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
SAME EICAS	Alert Tone	Only active in dual-system (pilot and co-pilot), installation with good inter-system communications. Indicates both systems are operating from the same EICAS data source for labels where dual sources are setup in the OASIS configuration file. No time delay.
SAME GPS	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-GPS/SBAS installation with good inter-system communications, and neither GPS/SBAS in failure condition. Indicates both systems are operating from same GPS/SBAS source. No time delay.
SAME NAV	Alert Tone	Only active in dual-system (pilot and co-pilot) with good inter-system communications. Indicates both systems are operating from same navigation source. Alert inhibited if both systems are operating from GPS/SBAS in a single-GPS/SBAS installation. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
SAME RADALT	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-radar altimeter installation with good inter-system communications, and neither radar altimeter in failure condition. Indicates both systems are operating from same radar altimeter source. No time delay.
SINK RATE	"Sink Rate, Sink Rate"	Within GPWS Mode 1 caution envelope. Half second time delay.
TAWS AUTOROT	Alert Tone	TAWS Autorotation mode activated through use of discrete input. No time delay.
TRAFFIC	"Traffic, Traffic"	Traffic advisory. Not given if own aircraft below 400' AGL nor if target is below 200'AGL (ground target). Audio not generated with TCAS-II system. No time delay.
TCAS FAIL	Alert Tone	Only active with ARINC 735A-1 TCAS-II, TCAS-I, or TAS system. Indicates lack of communications with system or failure indication from system. No time delay.
TERRAIN	"Caution Terrain' Caution Terrain"	Terrain cell within TAWS FLTA caution envelope. Half second time delay.
		Within GPWS Mode 2 caution envelope. Half second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
TOO LOW	"Too Low Terrain, Too Low Terrain"	Within GPWS Mode 3 envelope. Half second time delay.
		Within GPWS Mode 4 "Too Low Terrain" envelope. Half second time delay.
		Within TAWS PDA envelope. Half second time delay.
	"Too Low Gear, Too Low Gear"	Within GPWS Mode 4 "Too Low Gear" envelope. Half second time delay.
	"Too Low Flaps, Too Low Flaps"	Within GPWS Mode 4 "Too Low Flaps" envelope. Half second time delay.
TOTALZR QTY	Alert Tone	Compares the volume of sensed fuel to the fuel totalizer calculation. Issues a caution if the difference exceeds the Totalizer Mis-match caution threshold. Only performed if: 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.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
XFILL FAIL	Alert Tone	Only active in dual-system (pilot and co-pilot). Indicates lack of inter-system communications. Inhibit for 30 seconds after startup. 2-second time delay.
--	"Altitude, Altitude"	Deviation greater than 150' from selected altitude after capture. Altitude capture defined as within 100' of altitude. 2-second time delay.
		If not on a descending VNAV profile, deviation greater than 150' from altitude of the current or prior VNAV waypoint after capture. Altitude capture defined as within 100' of altitude. 2-second time delay.
--	"Decision Height"	Deviation from above to below decision height bug. Causes decision height readout to turn amber (yellow) and flash. No time delay.
--	"Minimums, Minimums"	Deviation from above to below minimum altitude bug. Causes minimum altitude readout to turn amber (yellow) and flash. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
ADVISORIES		
AHRS1 DG	Chime	Only active in dual-AHRS installation. Indicates AHRS 1 in DG mode. No time delay.
AHRS2 DG	Chime	Only active in dual-AHRS installation. Indicates AHRS 2 in DG mode. No time delay.
ADC INIT	Chime	ADC not at full accuracy during warm-up. No time delay.
AHRS DG	Chime	Activated DG mode if available.
ANP: 0.01 ANP: 15.0	Chime	GPS/SBAS Actual Navigation Performance based upon current GPS/SBAS HPL.
BARO MISCOMP	Chime	Only active in dual-system (pilot and co-pilot) installation. Indicates mismatch of altimeter settings or altimeter modes between systems. 10-second 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.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
CREW CALL	Chime	Only active with EFIS control of an audio controller with pilot isolate function, and call notice is received from the controller.
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 to indicate quality of DR solution. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.
FLTA INHBT	Chime	Shown when the FLTA function is automatically inhibited during normal operation. "NO TAWS" caution and "TAWS IN-HBT" advisory have priority over this message. No time delay.
FPM INHBT	Chime	Flight Path Marker inhibit function activated through momentary discrete input. No time delay.
LNAV APPR	Chime	GPS/SBAS in LNAV Approach Mode. No time delay.
LNV/VNV APPR	Chime	GPS/SBAS in LNAV/VNAV Approach Mode. No time delay.
LP APPR	Chime	GPS/SBAS in LP Approach Mode. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
LPV APPR	Chime	GPS/SBAS in LPV Approach Mode. No time delay.
MORE-PRS MENU	None	Number of active messages exceeds 11. Guides pilot in accessing the EXPAND CAS menu. No time delay.
PLT1 PWR PLT2 PWR PLT3 PWR PLT4 PWR CPLT1 PWR CPLT2 PWR CPLT3 PWR CPLT4 PWR	Chime	Indicates one of the dual redundant power supplies within an IDU is not functioning correctly. 1-minute time delay.
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. No time delay.
RNP: 0.10A RNP: 15.0A	Chime	GPS/SBAS Automatic Required Navigation Performance as acquired from navigation database
RNP: 0.10M RNP: 15.0M	Chime	GPS/SBAS Manual Required Navigation Performance as set by pilot.
SUSPEND	Chime	GPS/SBAS automatic waypoint sequencing is suspended. Caused by being on final approach segment prior to arming missed approach, selecting manual GPS/SBAS OBS, or being in holding prior to activating the **CONTINUE** tile. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
TA ONLY	Chime	Only active with TCAS-II system. Indicates TCAS-II system is unable to display resolution advisories. No time delay.
TAS INHBT	Chime	TAS aural inhibited through activation of TCAS/TAS Audio inhibit discrete input. No time delay.
TAWS GS CNX	Chime	TAWS glideslope cancel (GPWS Mode 5) activated through use of discrete input. Enhanced HTAWS only. No time delay.
TAWS INHBT	Chime	TAWS inhibited through use of discrete input. No time delay.
TAWS LOW ALT	Chime	TAWS low altitude mode activated through use of discrete input. No time delay.
TCAS STBY	Chime	Only active with TCAS-II system. Indicates system is: (1) in standby or (2) executing functional test in flight. No time delay.
TCAS TEST	Chime	Only active with TCAS-II system. Indicates system is in functional test on ground. No time delay.
TERMINAL	Chime	GPS/SBAS in Terminal Mode. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
TRUE NORTH	Chime	True North Mode input discrete is asserted, and system is operating in True North Mode. No time delay.
VECTORS	Chime	GPS/SBAS in Vectors to Final Approach Mode prior to sequencing FAWP. No time delay.
VFR APPR	Chime	GPS/SBAS in VFR Approach Mode. No time delay.
XFILL ARM	Chime	Only active in dual-system (pilot and co-pilot) with good inter-system communications and crossfill not inhibited. Indicates systems are not synchronized, and synchronization function is available. No time delay.
XFILL INHBT	Chime	Only active in dual-system (pilot and co-pilot) with good inter-system communications. Indicates crossfill is manually inhibited through discrete input. No time delay.
--	Altitude Alert Tone	Tone given when within the greater of 500' or 50% of VSI from uncaptured selected or VNAV waypoint altitude. Inhibited in approach procedures. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
--	Chime	Sounds chime when countdown timer reaches 00:00:00. No time delay.

Volume of aural annunciations is adjusted according to severity:

WARNING = Full volume set into aircraft limits

CAUTION = 80% of volume set into aircraft limits

ADVISORY = 60% of volume set into aircraft limits

Press the audio mute switch to mute the active aural annunciation.

Flags are visually prioritized so active warning flags are displayed above active caution flags, which are displayed above active advisory flags. Within categories, active flags are stacked in chronological order with the most recent annunciation appearing on top. Warning flags flash at 2Hz until acknowledged by pressing the audio mute switch. Caution flags flash at 1 Hz until acknowledged by pressing the audio mute switch. Only the highest priority (in criticality and recency), unacknowledged aural annunciation is played at any given time. In addition, to further minimize cockpit confusion, the above 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 2-3: 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

Table 2-3: Annunciations Priority
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 #).

Flags and custom CAS messages are logged in non-volatile memory at 1Hz in ASCII, comma delimited format. Active logging is to a file named “caslog00.csv” (files with the *.csv file extension may be directly opened by 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. This allows logging of custom CAS messages to be controlled by the EICAS configuration file. Within the data fields of the log file, values are written as follows.

Table 2-4: Log File Values

Category	Value
NORMAL	0
ADVISORY	1
CAUTION	2
WARNING	3

2.8. Database and Software Updates

2.8.1. Navigation and Obstruction Databases

The EFIS uses Jeppesen NavData® for the navigation database and Jeppesen data for the obstruction database, which are both secured directly through the Jeppesen Company.

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.

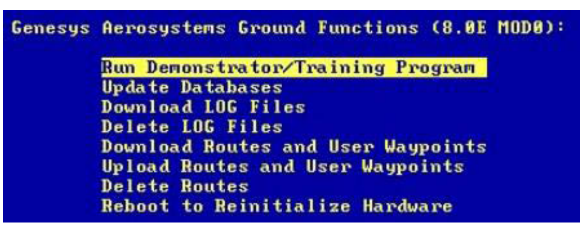

Figure 2-9: Ground Maintenance Page

2.8.2. Update Requirements

When an update is performed, the procedures must be performed on every IDU in the EFIS system separately. Scheduled updates are as follows:

Navigation Database - Every 28 days

Obstruction Database - Every 28 days

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

The EFIS software and terrain database are unscheduled and/or on-condition and covered under a service bulletin.

The Jeppesen navigation and obstruction databases are accessed through www.jeppesen.com to place the order for the correct database.

Three types of navigation databases may be used on this EFIS.

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

International - Containing all available coverage except North and South America.

World - Containing major airports and navigation with the Americas.

The navigation database is loaded on each IDU by placing the program **navdata.exe** on a USB memory card.

CAUTION:

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

Always install a valid USB memory device in the IDU prior to activating any Ground Maintenance Function. Operation of the Ground Maintenance Function without a valid USB memory device installed may cause erroneous failure indications or corruption of the IDU.

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

Once the NavData (navdata.exe) and obstruction database (obst.exe) are loaded on the USB memory device, insert the USB device into USB port with the power off. Turn on power to gain access to the GMF page. Scroll ➊ to highlight "**Update Databases**" and push to enter. Once each database is loaded, the pilot is prompted to press any button to continue to complete the process. Once both databases have successfully been uploaded, power the

IDU down, remove the USB memory device, and lower the USB door. Repeat this process for each IDU installed in the aircraft.

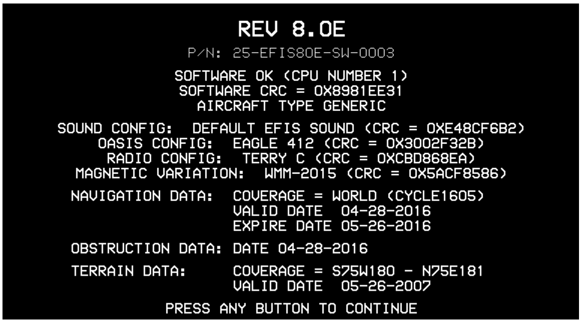

Figure 2-10: IDU-680 Startup Screen

Once each IDU has been updated, power up the entire EFIS system in normal flight mode and verify each IDU successfully updated with the latest database by noting the new NavData cycle expiration dates before acknowledging the startup screen. There is no expiration for the obstruction database.

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

The IDU provides an updateable navigation database containing 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 (selecting the airway by name results in leading the appropriate waypoints and

legs between the 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 (selecting the procedure by name results in loading 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, are retrievable as a procedure (selecting the procedure by name results in loading 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.

Selecting a procedure by name results in loading 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.

2.8.3. Terrain Database Update

The IDU-680 contains the entire World Terrain Database, which is updated on an as-needed basis and performed as required as described in a service bulletin.

2.9. Run Demonstrator/Training Program

Select "**Run Demonstrator/Training Program**" on the IDU to start the ground demonstration mode for that particular IDU. (All IDUs installed act independently when in the demonstrator mode.) The EFIS starts flying the demonstration, once a flight plan has been evoked, at the first waypoint of the flight plan and flies to the last waypoint. The program always flies through the boxes or by evoking one of the bugs (heading or target altitude). All IDU controls are functional during the ground demonstration program for the pilot to activate the menus and become familiar with the many features of the Genesys Aerosystems EFIS.

2.9.1. Application Software Air Mode and Ground Mode

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

1) If a Weight on Wheels/Weight on Ground discrete input is configured, the Air or Ground Modes are 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 Symbology

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3.1. Introduction

In an IFR installation, the software of the primary IDU-680 is configured so only the primary screen (Primary Flight Information in top half and Multifunction Display in bottom half) is displayed. The software is configured on all other IDU displays so any screen display may be shown at any time. The only limitation is where IDU displays are configured as a primary display of engine information; at least one of the MFD areas must show the engine display.

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. Reference is made where applicable to either Tapes or Round Dials.

3.2. IDU-680 PFD Display (Normal Mode) (Tapes)

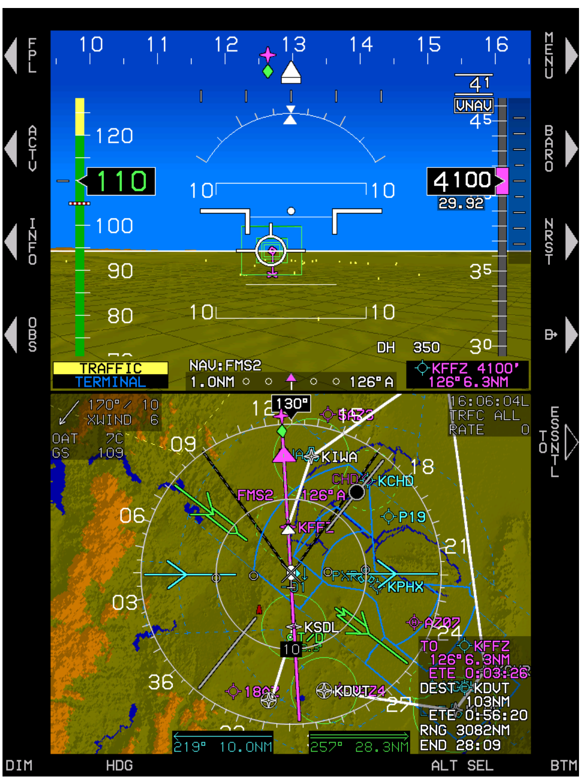


Figure 3-1: PFD in Normal Mode (Tapes)

3.2.1. IDU-680 PFD Display (Essential Mode) (Tapes)

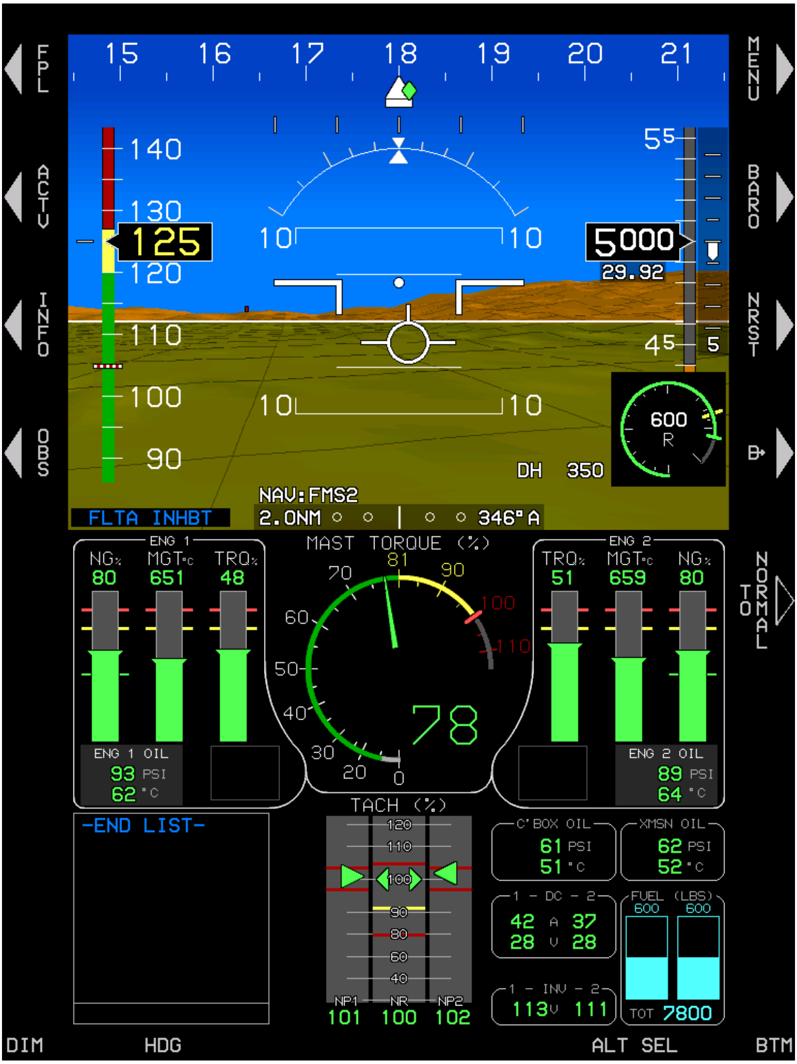


Figure 3-2: PFD in Essential Mode with EICAS Configured (Tapes)

3.2.2. IDU-680 PFD Display Basic Mode (Tapes)

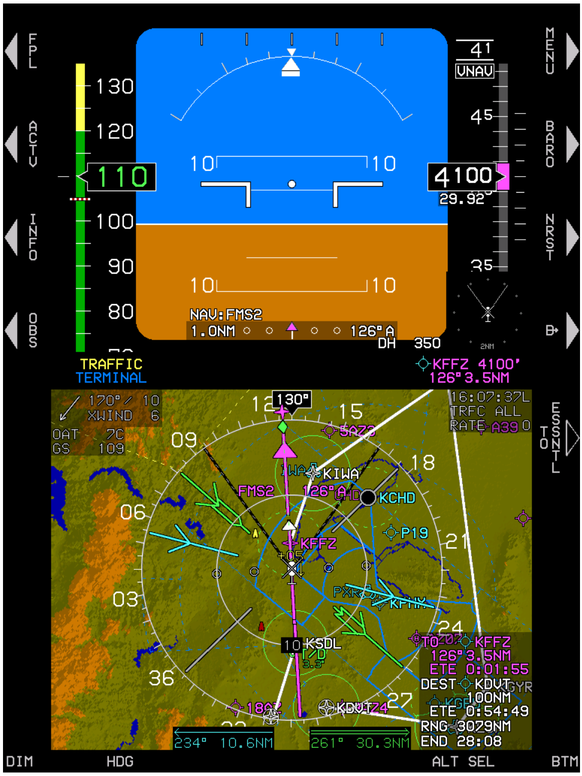


Figure 3-3: PFD in Basic Mode (with Compass Rose Detected on Bottom Area) (Tapes)

When enabled through mode selection, Basic Mode is a traditional attitude display with the airspeed, altitude, and heading scales appearing in blacked-out areas in a “Basic-T” arrangement but is disabled while Unusual Attitude Mode is active. The following are no longer present when Basic Mode is displayed:

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

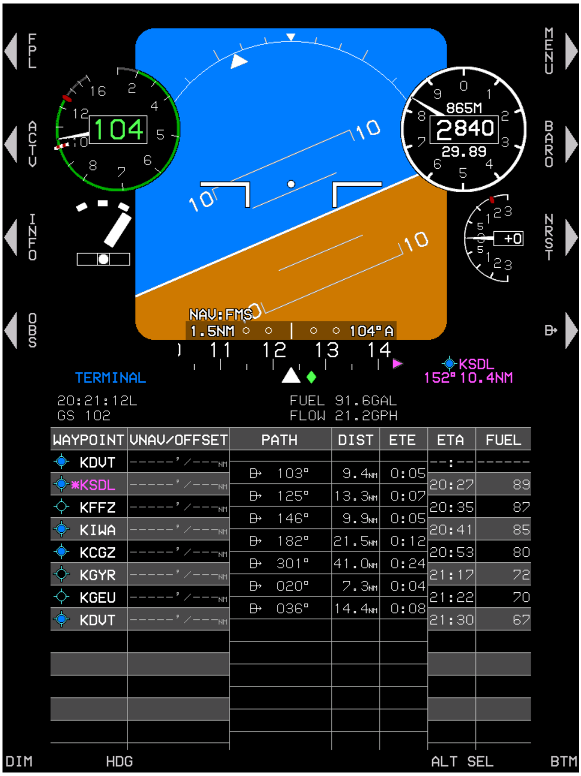


Figure 3-4: PFD in Basic Mode (Round Dials without Compass Rose Detected on ND)

When round dial instruments are enabled, the following are no longer present when Basic Mode is displayed:

1) Atmospheric perspective
2) Airspeed trend
3) Terrain rendering
4) Obstruction rendering
5) Flight Path Marker
6) Airport runways
7) Highway in the Sky
8) Mini MAP
9) Mini TRFC
10) Turn IND
11) Bank Scale Declutter

3.3. IDU-680 MFD Display (Normal Mode)

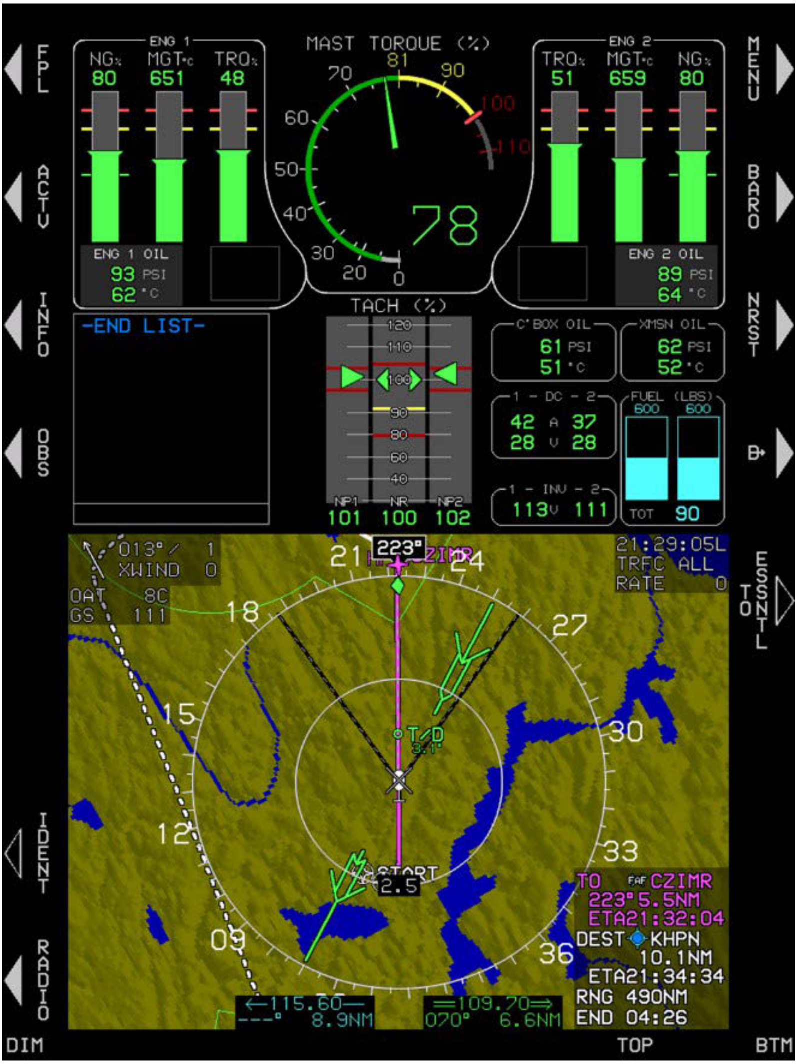


Figure 3-5: MFD in Normal Mode with EICAS Page on Top and MAP on Bottom

3.3.1. IDU-680 MFD Display (Essential Mode)

Figure 3-6: MFD in Essential Mode with EICAS Configured (Tapes)

3.3.2. IDU-680 MFD in Normal Mode

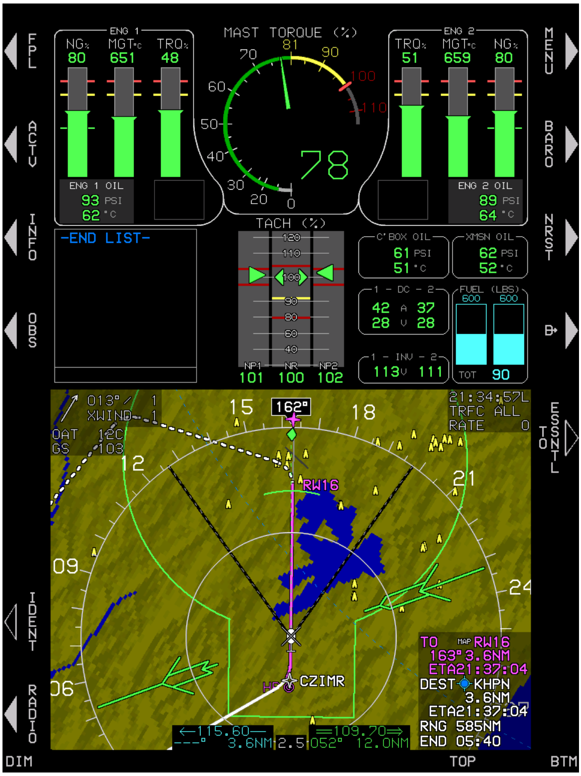


Figure 3-7: MFD in Normal Mode

3.4. Menu Functions

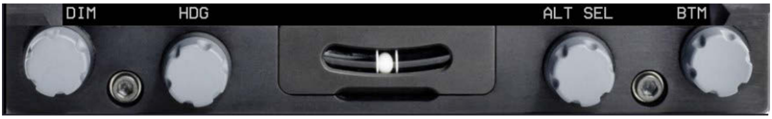
Further menu levels

Without further menu levels

Soft menu functions are used at both levels and displayed in the screen margins. Soft menu function tiles include an indication of further menu levels with a filled triangle (with further levels) or hollow triangle (without further levels) pointing to the associated peripheral button.

Figure 3-8: Menu Functions

Soft menu function tiles appear next to IDU buttons. Menu messages are adjacent to the encoders when appropriate and are displayed for five seconds. Any menu message is cleared if any IDU button is pressed or encoders ❶, ❷, or ❸ are pushed or scrolled.



❸ ❷ ❶

Figure 3-9: Encoder Functions

Selection lists too long to be presented in the space available provide an indication of location within the list. Whenever the menu system is beyond the top-level, **EXIT (R1)** provides a one touch escape to the top-level. Whenever a soft menu level is deeper than the first level, **BACK (L1)** regresses through the menu system by one level.

3.4.1. Selecting BARO

Press **BARO (R2)** to enter the BARO mode and view the inches of mercury (inHg) or millibars (mbar) value in the lower right corner. Scroll ❶ clockwise to increase or counter clockwise to decrease the QNH. Push ❶ to enter the new value.

Figure 3-10: Selecting BARO (Tapes)

The altimeter setting is immediately below the altitude readout box and digitally displays the altimeter setting in either inches of mercury (inHg) or millibars (mbar) according to the pilot-selected units. Immediately below the altimeter setting, the mode is identified as QFE operations; otherwise, no mode is indicated.

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.

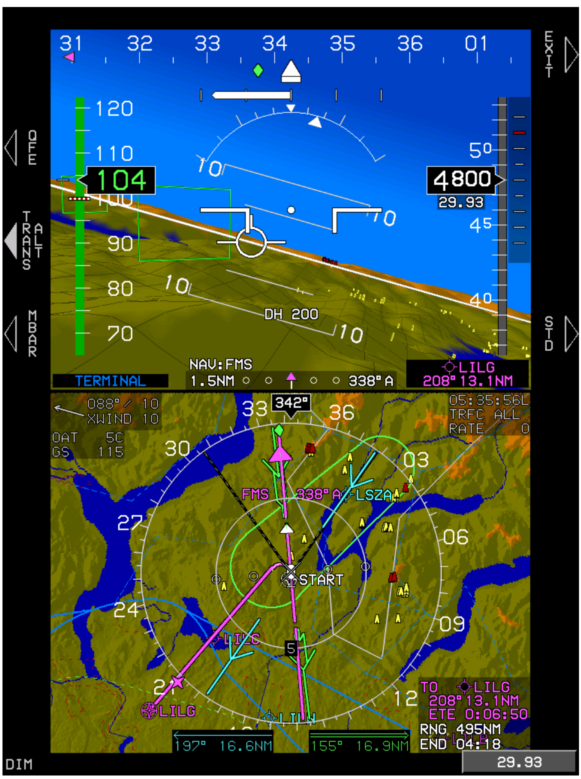


Figure 3-11: Altimeter Setting (Tapes)

Figure 3-12: Altimeter QFE (Tapes)

3.4.2. Selected Altitude Sub-Mode (Target Altitude) (Tapes)

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 setting is limited to -1000 feet at the low end and 20,000 feet at the high end, and is annunciated above the altitude scale with a resolution of 100 feet.

The target altitude bug setting annunciation is green, while the target altitude bug is filled-white when in altitude hold mode.

When in a climb or descent mode, the target altitude bug setting annunciation 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 3-13: Target Altitude Bug (Vertically Integrated) (Tapes)

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

Figure 3-14: Target Altitude Bug (Not Vertically Integrated) (Tapes)

3.4.3. 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 annunciation includes a legend with “VNAV” indicating the VNAV altitude sub-mode. When vertically integrated with a fully integrated digital autopilot, this legend is not needed, because an equivalent indication appears in the autopilot mode annunciation area.

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

Figure 3-15: VNAV Sub-Mode (Not Vertically Integrated) (Tapes)

When vertically integrated with an autopilot:

The VNAV altitude bug-setting annunciation is green, and the VNAV altitude bug is filled-magenta when in altitude hold mode.

The VNAV altitude bug-setting annunciation is green and flashes, while the VNAV altitude bug is filled-magenta during altitude hold capture.

The VNAV altitude bug-setting annunciation is white, and the VNAV altitude bug is hollow-magenta when in a climb or descent mode.

Figure 3-16: VNAV Sub-Mode (Vertically Integrated) (Tapes)

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 3-16.

3.4.4. Altitude Display (VNAV Tile)

When enabled for performing VNAV with a manually selected altitude entered, **VNAV** appears for “one-touch” engagement.

Figure 3-17: Altitude Display (VNAV Tile)

3.4.5. Altitude Display (Metric Units) (Tapes)

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

Figure 3-18: Altitude Display (Metric Units)

3.5. PFD Symbology (Tapes)

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.

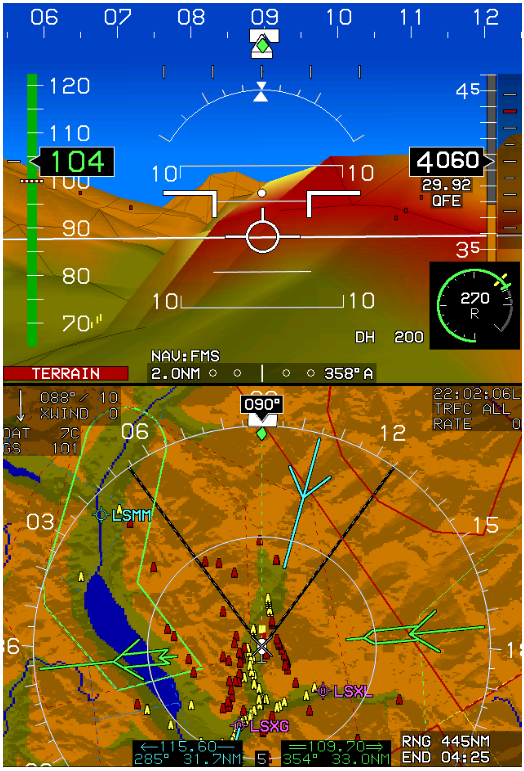


Figure 3-19: PFD Symbology (Tapes)

3.5.1. Minimum Altitude

When a minimum altitude is selected (in 10-foot increments), a bug in the form of a bold amber (yellow) bar is displayed in the appropriate position on the altitude tape and below in amber (yellow). Minimum altitude setting is indicated above the altitude tape with a line drawn below (see Figure 3-20). The minimum and target altitude/VNAV altitude bugs may be used simultaneously.

Audible Annunciation

When a minimum altitude is set, descending from above to below causes an aural annunciation of “Minimums, Minimums” and the minimum altitude to turn amber (yellow) and begin to flash.

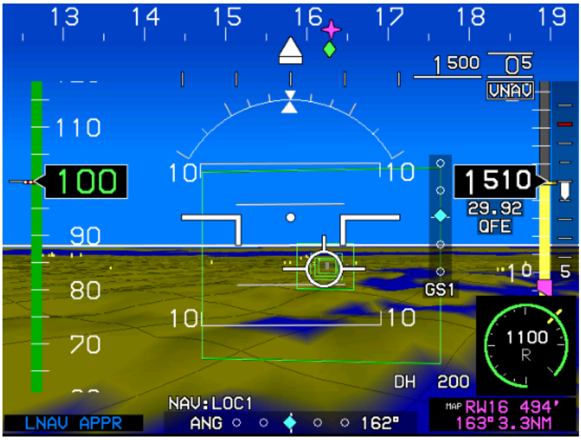
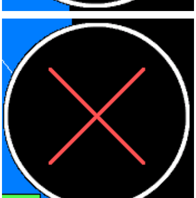


Figure 3-20: Minimum Altitude (Tapes)

3.5.2. Altitude Display (Round Dials)

The PFD has an altitude readout, dial, and pointer on the right side of the display. The altitude readout digitally displays barometric altitude to the nearest ten feet as adjusted by an altimeter setting. The altitude dial shows a 1000-foot range with labels and graduations every 100 feet. Clockwise rotation of the pointer and corresponds to increasing altitude.

When the altitude is negative, display of pointer, labels, bugs, and graduations are omitted.



When the ADC sensor fails, a black circle with red "X" is shown instead of the altitude readout, dial, and pointer.

Figure 3-21: Altitude Display (Round Dials)

When in selected altitude sub-mode, the altitude dial has a pilot-settable triangular target altitude bug. The target altitude bug is removed when more than 500’ away from current altitude. The target altitude bug setting is limited to -1000’ at the low end and 20,000’ at the high end. The target altitude bug setting is annunciated above the altitude dial with a resolution of 100 feet. The target altitude bug can be used either as a visual reference or, when vertically integrated with an autopilot, either fully-integrated (HeliSAS) or partially integrated through use of the vertical mode discrete input, as a control parameter for climbs or descents.

When vertically integrated with an autopilot, the target altitude bug color and behavior are identical to the Tapes Altitude display. When not vertically integrated with an autopilot, the target altitude bug setting annunciation is white, and the target altitude bug is filled-white at all times.

When in VNAV sub-mode, the altitude dial shows the active waypoint VNAV altitude (if it exists) with a triangular VNAV altitude bug. The VNAV altitude bug is removed when more than 500’ away from current altitude. The VNAV altitude bug setting is annunciated above the altitude dial with a resolution of 100 feet. The VNAV altitude bug can be used either as a visual reference or, when vertically integrated with an autopilot, either fully-integrated (HeliSAS) or partially integrated through use of the vertical mode discrete input, as a control parameter for climbs or descents.

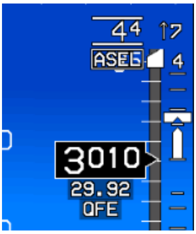
When vertically integrated with an autopilot, the VNAV altitude bug coloring and behavior is identical to the Tapes Altitude display. When not vertically integrated with an autopilot, the VNAV altitude bug setting annunciation is white, and the VNAV altitude bug is a filled-magenta at all times.

The minimum altitude bug settings is annunciation and behavior is identical to the Tapes Altitude display.

Metric altitude is pilot-selectable above the altitude ring. The resolution is one meter like the target altitude bug setting. The altimeter setting is displayed below the altitude readout and displays exactly as described above in § 3.4.1.

Figure 3-22: Metric Altitude (Round Dials)

3.5.3. Vertical Speed Indicator (Tapes)

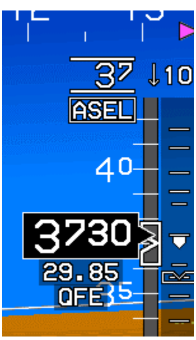


The vertical speed indicator (VSI) is located to the right of the altitude box, depicted as a "worm" format, and provides an analog and digital representation of VSI in feet per minute.

Figure 3-23: VSI (Tapes)

Table 3-1: Scale Graduations and Display

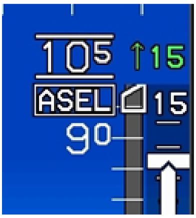
Type Traffic Installed	Scale Limit	Scale Graduations and Display
With TCAS-II	±6,000 FPM	±500, ±1,000, ±2,000, ±4,000, and ±6,000 FPM Background of the VSI functions as an RA display with green and red regions to provide RA maneuver guidance.
Without TCAS-II	±3,000 FPM	±500, ±1,000, ±2,000, and ±3,000 FPM



The VSI worm grows in proportion to the square root of the vertical speed so a change near 0 feet per minute displaces the worm to a much greater degree than an equivalent change at a larger feet per minute value. Vertical speed readouts rounded to the nearest 100 feet per minute appear above the VSI scale (for climbs) or below the VSI scale (for descents). In this example, the pilot-selectable VSI bug setting is set to 1000 FPM descent rate with a resolution of 100 FPM.

Figure 3-24: VSI Bug (Tapes)

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.



When vertically integrated with an autopilot, the VSI bug-setting annunciation 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 annunciation is white, and the vertical speed bug is filled-white at all times.

Figure 3-25: VSI Bug (Vertically Integrated) (Tapes)

3.5.4. Vertical Speed Indicator (Round Dials)

A vertical speed indicator (VSI) with a scale of the VSI limits is as described for the tapes vertical speed indicator (Table 3-1).

The readout digitally displays vertical speed rounded to the nearest 100 feet per minute. Clockwise (upward) rotation of the pointer corresponds to increasing vertical speed.

When TCAS-II is enabled, the background of the VSI dial functions as an RA display with green and red regions to provide RA maneuver guidance. The VSI has a pilot-settable triangular vertical speed bug, which is limited to ±2,000 feet per minute. The vertical speed bug is as described for the tapes vertical speed indicator.

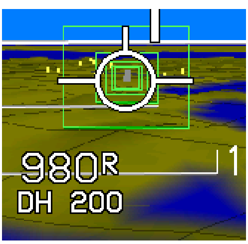
Figure 3-26: Vertical Speed Indicator (Round Dials)

3.5.5. Highway in the Sky/Skyway (Tapes only)

When not decluttered, the PFD displays the active navigation route or manual OBS course three-dimensionally 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.

Figure 3-27: Highway in the Sky

3.5.6. Normal AGL Indication (Tapes)



AGL altitude is displayed in two formats with one at the bottom-center of the display above the Course Deviation Indicator (Normal) and another as the (Analog) AGL Indicator. These are mutually exclusive of each other and driven by whichever AGL altitude source is used for TAWS but not displayed when the source is invalid.

Figure 3-28: Normal AGL Indication with DH 200 Displayed (Tapes)

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

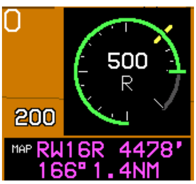
AGL altitude is not displayed in either format when it is greater than the radar altimeter maximum valid altitude nor when it is invalid. Additionally, AGL indication includes a display of the currently set decision height. Decision height turns amber (yellow) and flashes when the aircraft descends below decision height.

This is accompanied by “Decision Height” aural annunciation and causes the decision height readout to turn amber (yellow) and flash.

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

3.5.7. Analog AGL Indication (Tapes only)



A 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 radial line at its end and disappears above 1000’ AGL.

Figure 3-29: Analog AGL Indication

The Analog AGL indicator disappears in Unusual Attitude mode and is mutually exclusive with the mini-map and traffic thumbnail. Likewise, when the Analog AGL altitude display is shown, the normal AGL display is removed.

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’	✓	
200’		✓
300’		✓
400’		✓
500’	✓	
1000’	✓	

3.5.8. Decision Height

Tapes

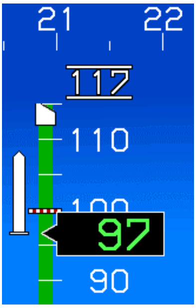
Round Dials

Figure 3-30: Decision Height

Analog AGL indication includes display of the currently set decision height to the left of the indication along with an amber (yellow) radial line on the circular tape. Decision height turns amber (yellow) and flashes when the aircraft descends below decision height. When below decision height, the circular tape and digital readout are amber (yellow).

Accompanied by “Decision Height” aural annunciation, and decision height readout turns amber (yellow) and flashes.

3.5.9. Airspeed Display (Tapes)



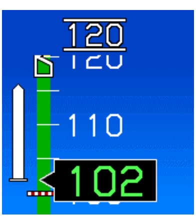
Airspeed is digitally displayed in same color as airspeed scale in knots, miles, or kilometers per hour with interactive pointer. The airspeed scale is commensurate with the certification category of the aircraft.

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.

Figure 3-31: Airspeed Display (Tapes)

The airspeed scale range has at least 40-75 measurement units. During an ADC failure, a red "X" is displayed in place of the airspeed scale.

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.



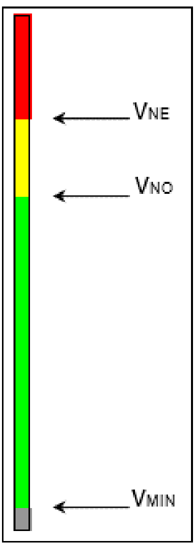
The pilot-settable airspeed bug geometrically interacts with the airspeed box pointer and is colored as per the following tables.

When the bug setting differs from aircraft speed to the extent the bug is off scale, the bug appears to be "parked" as in this example.

Figure 3-32: Airspeed Trend (Tapes)

Table 3-5: Airspeed Bug Limits	
Low end	**High end**
V_{MIN}	Red-line (**V_{NE}**)

Table 3-6: Airspeed Bug Setting Annunciation and Bug Colors		
	Without vertically integrated autopilot	**With vertically integrated autopilot**
Airspeed bug setting annunciation color	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.



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

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

If enabled (“White Triangle” not 0), a “white triangle” translational lift reference speed marker.

Figure 3-33: Airspeed Scale FAR Part 27 and 29

Airspeed bug parked in the direction of the difference if airspeed off scale.

Figure 3-34: Airspeed Scale

The airspeed scale has a pilot-settable airspeed bug that is filled-white at all times and geometrically interacting with the airspeed box pointer, which is white.

The airspeed bug is annunciated above the airspeed scale with a resolution of one knot indicated airspeed used only as a visual reference and is mutually exclusive with the vertical speed bug.

When the airspeed bug setting differs from aircraft airspeed to the extent the airspeed bug is off-scale, the airspeed bug appears to be "parked" in the direction of the difference with half of the airspeed bug visible as seen in Figure 3-32.

3.5.10. Airspeed Display (Round Dials)

The PFD has an airspeed readout, dial, and pointer on the left side of the display. The airspeed readout digitally displays indicated airspeed in knots, miles per hour, or kilometers per hour depending upon the setting of the "Speed Units" system limits. The airspeed dial is scaled to show the entire operating range of the aircraft with clockwise pointer movement corresponding to increasing speed.

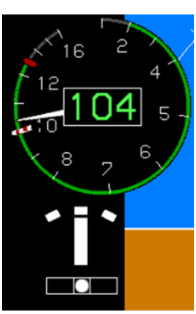
When the ADC sensor fails, a black circle with red "X" is shown instead of the airspeed readout, dial and pointer.

Figure 3-35: ADC Sensor Failed (Round Dials)

The airspeed dial for Part 27 and 29 rotorcraft has coloration conforming to FAR § 27.1545 and FAR § 29.1545 as follows:

A gray area from the bottom of the dial to $\mathbf{V}_{\mathbf{MIN}}$. The airspeed readout is gray at 0 (indicating "dead" airspeed) but otherwise green in this area.

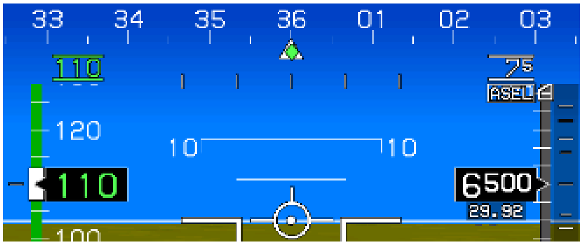
The airspeed markings are as described for the tapes airspeed indicator.



The airspeed dial has a pilot-settable triangular airspeed bug. The airspeed bug setting is limited to the higher of 60KIAS at the low end, and redline airspeed at the high end. The airspeed bug setting is as described for the tapes airspeed indicator.

Figure 3-36: Airspeed Dial (Round Dials) for Part 27 and 29 Rotorcraft

3.5.11. Airspeed Display (with EFIS-Coupled)



Airspeed descent to 7,500' with green color and filled airspeed

Figure 3-37: Airspeed Display (with EFIS-Coupled)

3.5.12. Heading Display (Tapes)

Figure 3-38: Heading Display (Tapes)

The PFD heading scale across the top of the display is aligned with magnetic North with graduations every 5° with major graduations and heading labels every 10°. These graduations and digits of the heading scale are equally spaced so, at an aircraft roll angle of zero, they approximately conform to the 3-D PFD background. The heading scale includes a triangular white heading pointer aligned with the longitudinal axis of the aircraft with a slip indicator.

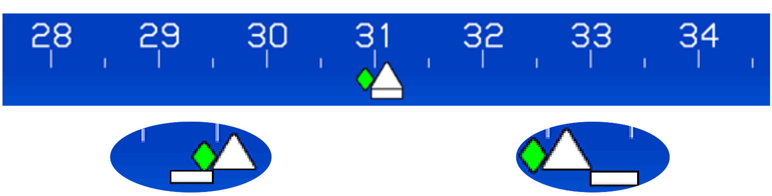
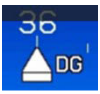


Figure 3-39: Slip/Skid Indicator (Tapes)

An integral slip indicator is provided and may replace the mechanical slip indicator mounted in the bezel. 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.

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.



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

Figure 3-40: DG Indicated when AHRS in DG Mode (Tapes)

The heading scale has a green, diamond-shaped track pointer aligned with the aircraft's track across the earth. When the aircraft's track is displaced from aircraft heading beyond the boundaries of the PFD screen, the track pointer is drawn at the limit of the heading scale in the direction of the displacement, and the aircraft track value is displayed in a solid green box above the track pointer. The track pointer is not displayed when indicated airspeed is in the noise range (indicated airspeed or groundspeed is less than 20 KIAS).

The heading scale has a pilot-settable heading bug symbol designed to geometrically interact with the heading pointer. When the heading bug is set, the value is displayed in a white bordered black box above the heading bug symbol for a period of five seconds. When the heading bug value is displaced from aircraft heading beyond the boundaries of the PFD screen, the heading bug symbol is drawn halved at the limit of the heading scale in the direction of the displacement, and the heading bug value is white with a black box above the heading bug symbol as in Figure 3-41.

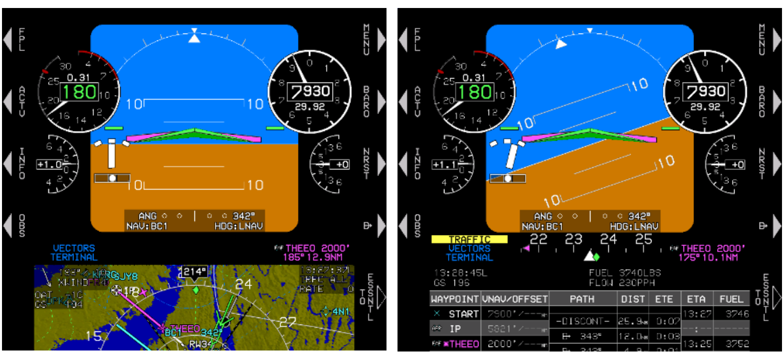
Figure 3-41: Heading Bug Displaced (Tapes)

When an active waypoint exists, the heading scale includes a magenta, star-shaped waypoint pointer (see Figure 3-38) at a point corresponding with the active waypoint. When the waypoint pointer is displaced from aircraft heading beyond the boundaries of the PFD screen, the waypoint pointer is replaced by a magenta, triangular arrow at either the far-right or far-left limit of the heading scale to indicate the shortest (not necessarily the safest) direction of turn to the active waypoint as seen in Figure 3-41. The waypoint pointer and shortest direction of turn indications turn amber (yellow) in the event of GPS Loss of Navigation caution.

In round dial mode, the heading display appears in a blacked-out area on the bottom to emulate a “Basic-T” and automatically declutters when a compass rose is detected in the bottom area.

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

Figure 3-42: Heading Indicator when AHRS in DG Mode (Round Dials)



Heading detected in bottom area

No heading detected in bottom area

Figure 3-43: Heading in Bottom Area (Round Dials)

3.5.13. Pitch Scale

Rotation of the background, pitch scale, and background oriented display elements occur relative to the location of the waterline symbol or Large Aircraft Reference Marks.

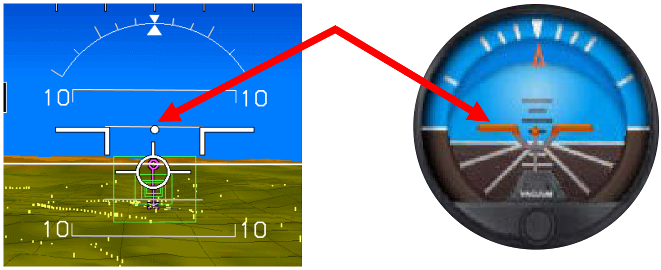


Figure 3-44: Pitch Scale (Tapes)

The pitch scale and double width horizon-line, which rotates in conjunction with the background according to the aircraft's roll angle, have 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 the 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°.

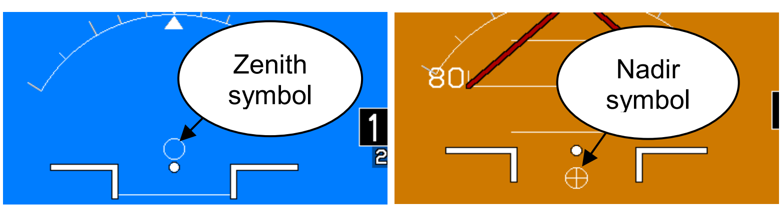


Figure 3-45: Pitch Scale Zenith and Nadir Symbol

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 Large Aircraft Symbol Reference Marks.

3.5.14. Turn Rate Indicator (Tapes)

A turn rate indicator is displayed in the upper center of the PFD just below the heading pointer, when selected, and has standard rate and half-standard rate graduations with a horizontal worm magnitude presentation. The full scale for the turn rate indicator worm is at least 20 pixels beyond the standard rate turn graduation allowing the pilot to fly a standard rate turn.

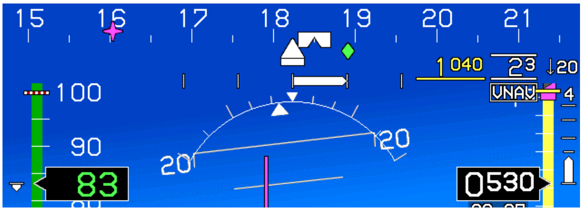
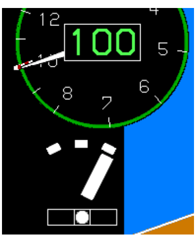


Figure 3-46: Turn Rate Indicator (Tapes)

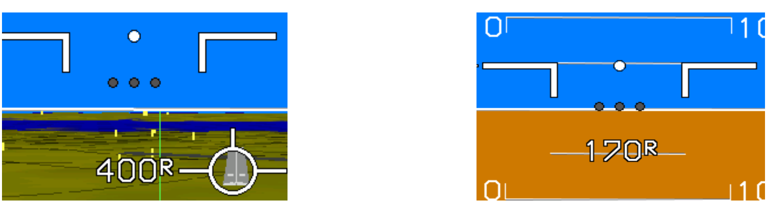
3.5.15. Turn Rate Indicator (Round Dials)



The turn rate indicator, a standard “turn needle” display with marks representing a standard rate turn, is displayed below the airspeed indicator. The full scale for the turn needle is beyond the standard rate turn mark. This allows the pilot to fly a standard rate turn and incorporates a standard “balance ball” display.

Figure 3-47: Turn Rate Indicator (Round Dials)

3.5.16. Landing Gear Indication (Tapes and Round Dials)



Normal Mode **Basic Mode**

Figure 3-48: Landing Gear Indication

3.5.17. Unusual Attitude Mode (Tapes)

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), appear to aid in unusual attitude recovery.

NOTE:

Recovery chevrons 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) Flight Path Marker
5) Highway in the Sky boxes
6) Atmospheric perspective
7) Analog and Digital AGL indication
8) Active waypoint symbology
9) Mini Map
10) Traffic thumbnail
11) If in Basic Mode, PFD reverts to Normal Mode (unless round dials selected)
12) If in Zoom mode FOV, PFD reverts to normal FOV
13) Runways

Figure 3-49: Unusual Attitude Mode (Tapes)

3.5.18. PFD Background (Tapes only)

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 (i.e., horizon (NM) = 1.17 x sq. root alt in feet). Thus, the relative elevation of terrain and obstructions with respect to aircraft altitude and performance is naturally observed by reference to the primary flight information pitch ladder and flight path marker.

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.

The terrain and obstruction rendering uses hidden surface removal techniques while terrain/sky rendering uses atmospheric perspective techniques. Terrain with obstruction rendering are 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.

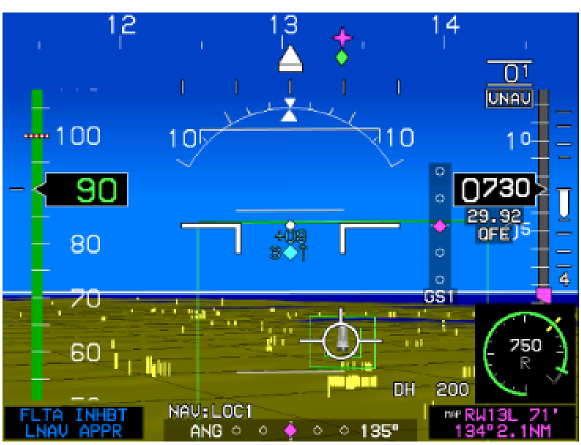


Figure 3-50: PFD Terrain and Obstructions (Tapes)

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 3-7.

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). This enhances the 3-D effect, improves distance judging, and eliminates foreground occlusion (object in the foreground that cannot be seen against a similar background). Furthermore, an actual horizon is depicted based upon an aircraft altitude like the real horizon. Distance varies to create a realistic depiction of the horizon.

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 3-7: 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 3-8: 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.
SVS TAWS	Shades of olive when at or below aircraft altitude. Shades of brown when above aircraft altitude. TAWS coloring of FLTA alert or warning cells.	Amber and red used for normal display of terrain. Amber and red are used to show terrain areas causing FLTA alerts.

Table 3-8: Terrain and Obstruction Rendering Levels		
Feature	**Coloring**	**Notes**
None	No terrain or Obstructions are shown. Neither, **SVS BASIC** or **SVS TAWS** are selected.	

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.

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.

WARNING:

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

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 as in Figure 3-51.

WARNING:

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

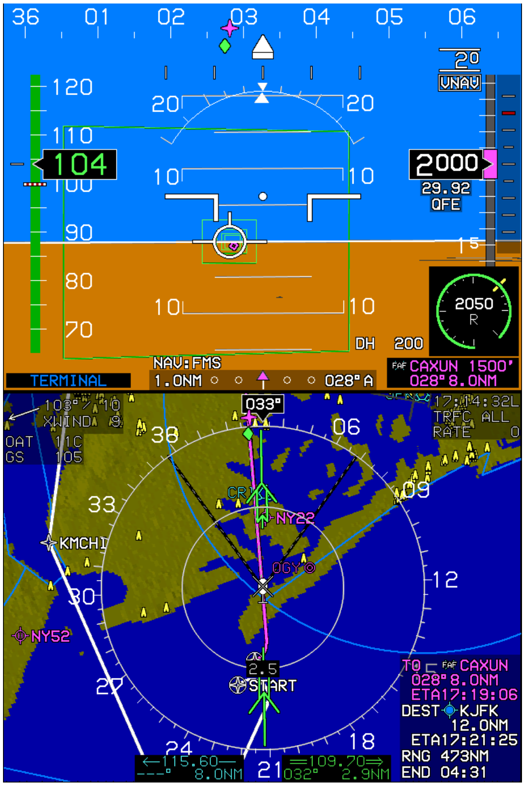
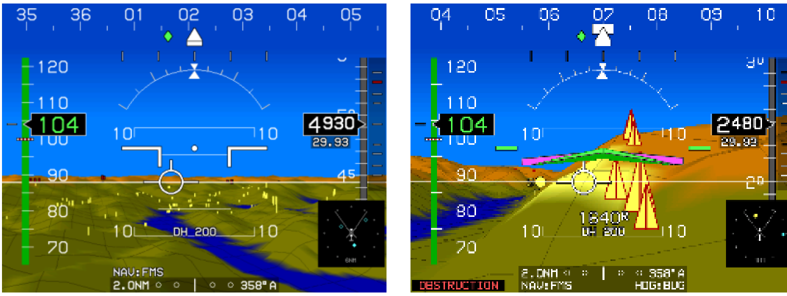


Figure 3-51: PFD with Terrain Deselected on PFD

Towers, antennas, and other obstructions such as buildings and manmade structures are shown on the PFD display as vertical amber (yellow) lines. All vertical amber (yellow) lines in Figure 3-52 are obstructions in the vicinity. Obstructions are conformal in both location and size and only shown in conjunction with terrain regardless of altitude. Obstructions representing a collision hazard are annunciated aurally and with a caution or warning flag.

Audible Annunciation

Towers, antennas, and obstructions representing a collision hazard cause an annunciation of “Obstruction” and aural annunciation of “Caution Obstruction.”



Obstructions without hazardous condition

Obstructions creating an OBSTRUCTION warning

Figure 3-52: PFD with Obstructions (Tapes)

NOTE:

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

3.5.19. Flight Path Marker (Velocity Vector) (Tapes only)

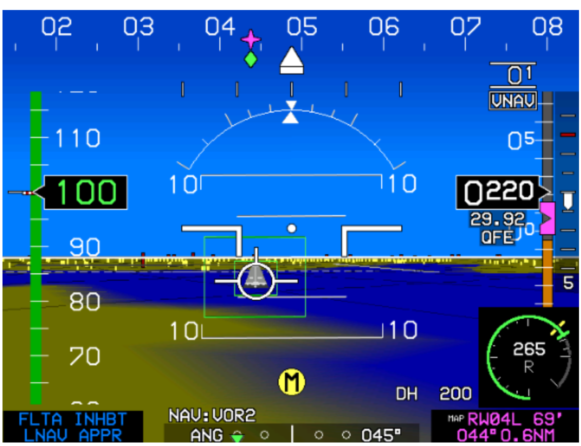
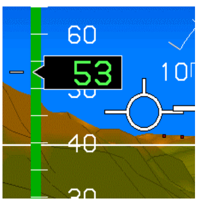
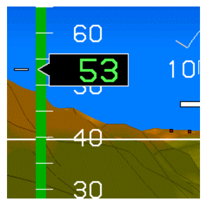


Figure 3-53: Flight Path Marker (Tapes)

The flight path marker appears at a location on the background to coincide with the aircraft's actual flight path as projected upon the outside world and is referenced to the Large Aircraft Symbol Reference Marks. The Reference Marks are centered on the display and 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 are vertically displaced perpendicular to the horizon to account for aircraft climb or descent angle. Because the flight path marker is used in conjunction with a 3-D background, the flight path marker utility normally associated with a HUD is achieved. When the location of the flight path marker is displaced to the extent it interferes with heading, altitude, or airspeed indications, it is removed from the display as seen in Figure 3-54 with increasing crosswind from the right side.



FPM nearing airspeed tape due to strong crosswind.



FPM removed due to excessive crosswinds from the right.

Figure 3-54: Flight Path Marker Views (Tapes)

Table 3-9: Flight Path Marker Behavior (Tapes only)

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

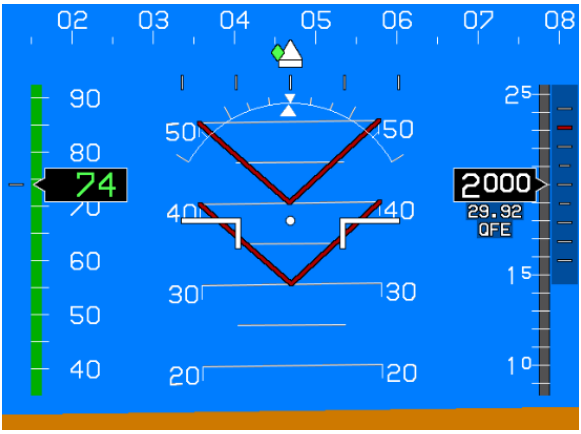


Figure 3-55: Flight Path Marker absent (Unusual Attitude Mode) (Tapes)

Flight path marker movement is dampened by reference to aircraft pitch and heading so not to deviate from pitch or heading at a rate greater than 1°/sec.

Figure 3-56: PFD with Flight Path Marker Removed (Tapes)

In Unusual Attitude Mode, the flight path marker disappears to allow the pilot to concentrate on the Large Aircraft Symbol Reference Marks for unusual attitude recovery. In reversionary mode 1 (GPS failure), the flight path marker changes to a light gray color after one minute to indicate degraded performance as seen Figure 3-57.

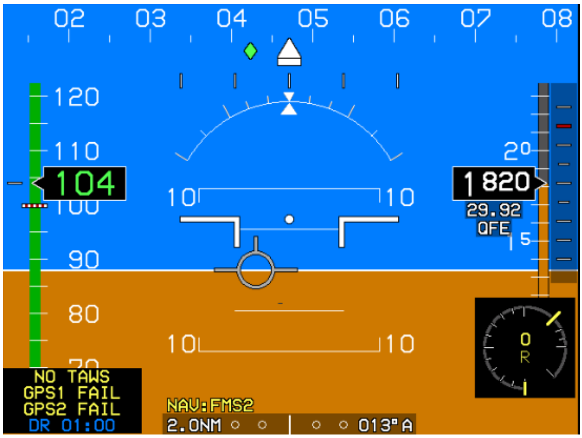
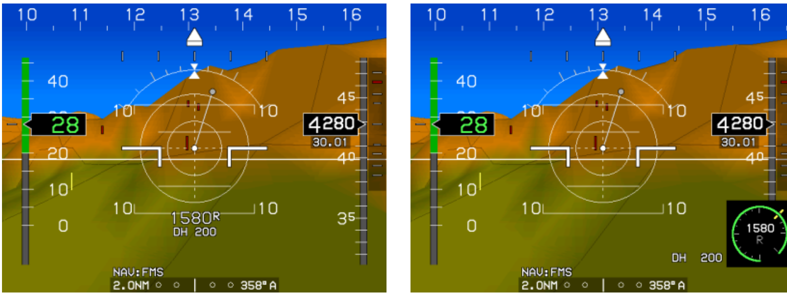


Figure 3-57: PFD with GPS Failure after 1 Minute (Tapes)

3.5.20. Hover Vector (Tapes only)

The hover vector indicates direction and groundspeed of drift at low groundspeeds (when lower than 30 IAS) 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. 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. Figure 3-57 shows drift, forward and slightly to the left (11 o'clock position) at 20 knots groundspeed. See § 3.17 for full Hover Vector symbology with Hover page on MFD.



AGL Indicator (Normal) **AGL Indicator (Analog)**

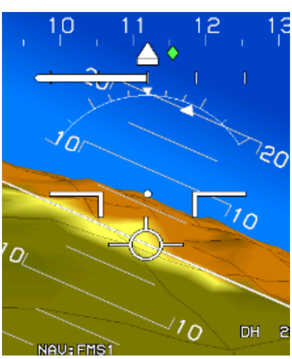
Figure 3-58: PFD Hover Vector Symbology (Tapes)

NOTE:

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

3.5.21. Bank Angle Scale (Tapes)

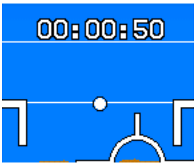
The bank scale and roll pointer are centered upon the Large Aircraft Symbol Reference Marks in Basic or Unusual Attitude Mode. When bank angle scale decluttering is selected (not in Basic Mode), the bank angle scale and sky pointer are displayed when the magnitude of bank angle exceeds 2.8°. With decluttering 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 3-59: PFD Bank Scale (Tapes)

3.5.22. Timer Indication



When selected, a countdown or count-up timer is displayed in hh:mm:ss above the Flight Path Marker or Large Aircraft Symbol Reference Marks.

Figure 3-60: Timer

3.5.23. Marker Beacon Symbology

Marker beacon 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 3-61).

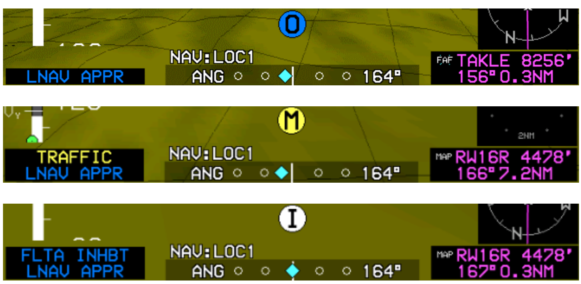


Figure 3-61: Marker Beacons

3.5.24. Flight Director Symbology (FD1 Single Cue) (Tapes)

The Flight Director symbology is controlled on the IDU or integrated autopilot/flight director equipment. When selected, Flight Director symbology and valid steering commands are received from the Flight Director 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 Reference Marks.

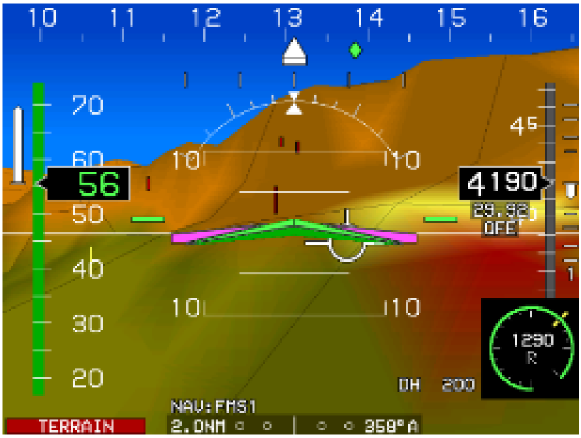


Figure 3-62: Flight Director FD1 Single Cue (Tapes)

Figure 3-63: Flight Director FD1 (Basic Mode) (Tapes)

3.5.25. Flight Director Symbology (FD2 Dual Cue) (Tapes)

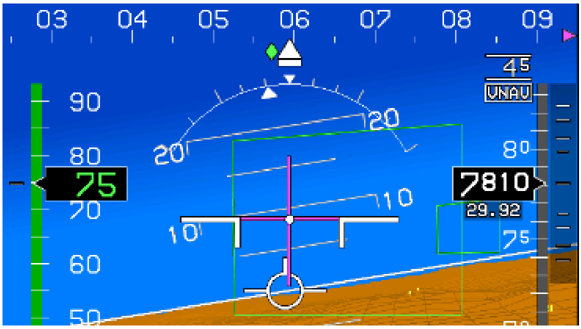


Figure 3-64: Flight Director FD2 (Normal Mode) (Tapes)

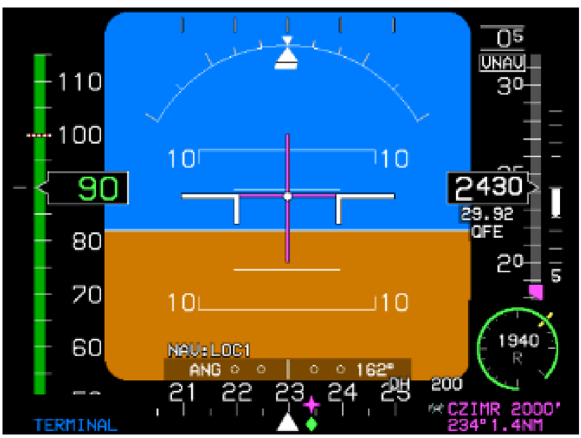


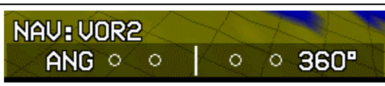
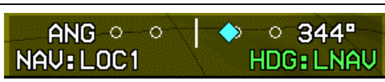
Figure 3-65: Flight Director FD2 (Basic Mode) (Tapes)

3.5.26. Course Deviation Indicator (Tapes)

Figure 3-66: Course Deviation Indicator (Tapes)

Table 3-10: CDI Behavior and Color	
CDI Pointer and Condition	**Color or Behavior**
Full Scale Deflection	Flash
When Slaved to GPS/SBAS	Scale is appropriate FSD value for mode of flight: **Enroute**: ±2NM **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.
When Slaved to GPS/SBAS (with GPS Loss of Navigation)	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
Navigation source is Localizer (Course error exceeds 105°)	Reverse sensing
When lateral deviations are in a failed state	Red “X” displayed over CDI
EFIS not coupled with autopilot	
	Selected NAV source FMS2
	Selected NAV source VOR1
	Selected NAV source VOR2
EFIS coupled system with autopilot	
	Holding the wings level*
	Tracking HDG BUG**
	LNAV in ARM mode**
	LNAV captured**

Notes: *No positive autopilot feedback

**Positive autopilot feedback

3.5.27. OBS Setting of CDI

In automatic mode, the system automatically controls the scale and OBS setting according to the requirements of GPS/SBAS (TSO-C-146C). The currently selected navigation source is annunciated immediately below the CDI as follows:

1) NAV: **FMS1**

2) NAV: **FMS2**

3) NAV: **VOR1**

4) NAV: **LOC1**

5) NAV: **BC1** (annunciated instead of LOC1 when course error exceeds 105°)

6) NAV: **VOR2**

7) NAV: **LOC2**

8) NAV: **BC2** (annunciated instead of LOC2 when course error exceeds 105°)

3.5.28. Heading/Roll-Steering Sub-Mode

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

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)

3.5.29. 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.

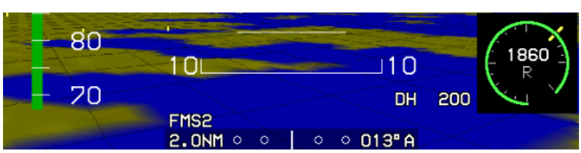


Figure 3-67: Course Deviation Indicator No Autopilot or Fully-Integrated Autopilot

3.5.30. Vertical Deviation Indicator

The PFD has a vertical deviation indicator on the right side to display vertical deviation for the currently selected vertical navigation source for displaying descent profile. When the selected vertical navigation source is FMS, the vertical deviation indicator conforms to the vertical deviation display requirements of the GPS/SBAS requirements. The vertical deviation indicator only appears when the source of vertical navigation is valid, and the source of vertical navigation is FMS (either LPV or VNAV modes).

Table 3-11: Vertical Deviation Indicator Behavior

Source (Below VDI)	Behavior/Condition	Pointer Color
FMS	Conforms to the VDI display GPS/SBAS requirements (TSO-C-146C) when source is valid	Magenta
Glideslope	The source must be valid when a valid glideslope is received.	Magenta
LPV or VNAV mode	Source is valid if: On VNAV descent segments when approaching the Top of Descent point to provide descent anticipation as long as the following are true: 1) On VNAV descent segments; or 2) If the vertical deviations on VNAV level segments option 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: 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	Magenta

Table 3-11: Vertical Deviation Indicator Behavior		
Source (Below VDI)	**Behavior/Condition**	**Pointer Color**
	3) If on the final approach segment, the aircraft is within a 35° lateral wedge of the azimuth reference point (either the GARP or MAWPT + 10,000 ft.).	
LPV,VNV-G	During GPS Loss of Navigation or GPS Vertical Loss of Navigation	Pointer and Text Color Amber (Yellow)

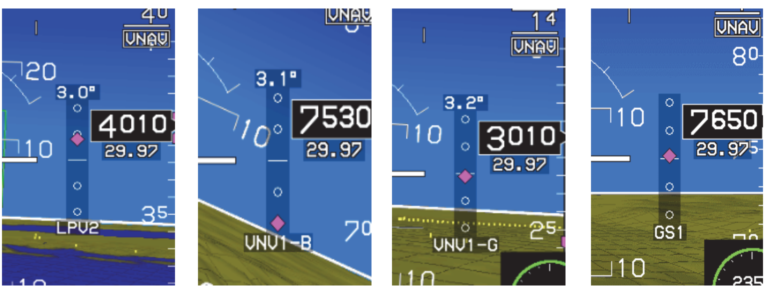


Figure 3-68: Vertical Deviation Indicator (Tapes)

Vertical deviation indicator 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 3-69: Vertical Deviation Indicator Color during GPS/SBAS LON or VLON (Tapes)

3.5.31. Vertical Deviation Indicator (EFIS Coupled) (Tapes)

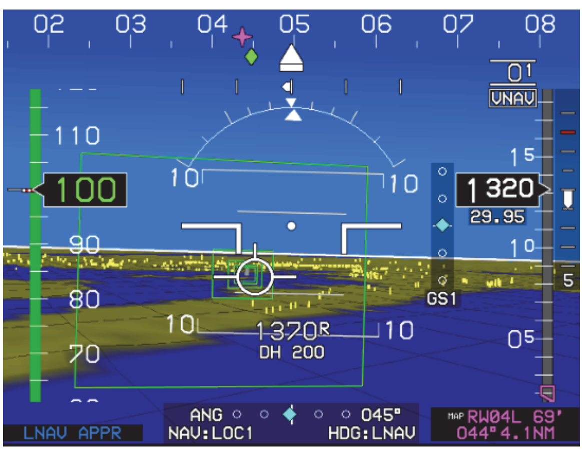


Figure 3-70: EFIS Coupled Vertically with Glideslope Mode Engaged (Tapes)

When vertically integrated with an autopilot (either fully integrated or partially integrated) through use of the 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.

3.5.32. Active Waypoint and Waypoint Identifier (Tapes)

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 Loss of Navigation caution.

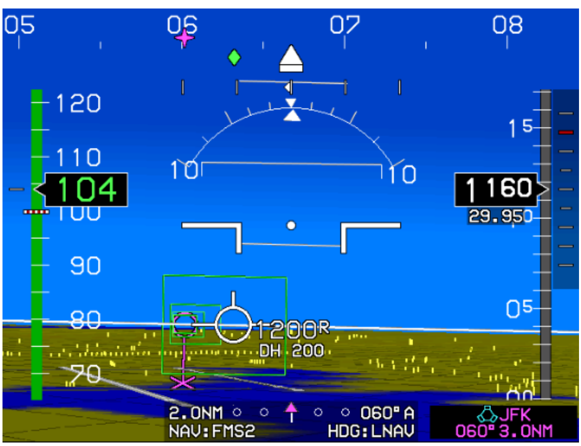


Figure 3-71: Active Waypoint (Tapes)

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 3-71, 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.

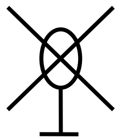
If the active waypoint is beyond the lateral limits of the screen, the magenta waypoint direction pointer (i.e., magenta triangle) on the directional scale indicates shortest direction of turn to the waypoint.

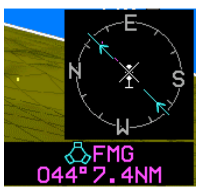
If the waypoint is only a hoop hanging in space, it is a fix and not directly associated with a NAVAID on the ground (such as a VOR, NDB, user waypoint, or airport). If the waypoint X disappears behind terrain on the PFD display, there is terrain between the aircraft present position and the waypoint.

3.5.33. Mini Map (Tapes only)

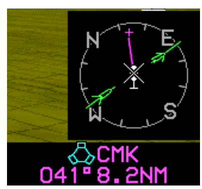
Figure 3-72: Mini Map

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 (GPS/SBAS normal)	Magenta	
Active Leg (GPS/SBAS LON condition)	Amber (Yellow)	

Table 3-12: Mini-Map Behavior (When Not Decluttered)		
VOR Pointer, Active Leg, Ownship Symbol	**Color**	**Condition**
Ownship Symbol — Rotorcraft 	White	
Mutually exclusive with the Analog AGL Indicator		
Mini-Map disappears in Unusual Attitude Mode		
Mutually exclusive with Traffic Thumbnail		



VOR #1



VOR #2

Figure 3-73: Mini Map VOR Symbology

3.5.34. Runways (Tapes only)

Figure 3-74: 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.	

The PFD displays airport runways in a 3-D manner. Immediately upon a system startup on the ground, runways for the nearest airport are displayed. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, runways for the airport associated with the procedure are also displayed. In addition, runways associated with the three nearest airports (as computed by the

TAWS algorithms) are displayed. Runways are drawn using the hidden surface removal techniques of the terrain and obstruction rendering so runways behind terrain appear to be so. Runways are dark gray according to characteristics contained in the navigation database, including elevation, position, orientation, length, and width. The landing portion of the selected runway, taking into account displaced threshold data, is shown in light gray. When the depiction of a runway is wide enough, runway markings, including aiming point markings, centerline, designation, and displaced threshold arrows appear.

3.5.35. Heliports (Tapes only)

Heliports appear as distinguishable 150’ x 150’ helipads with applicable markings as shown in Figure 3-75.

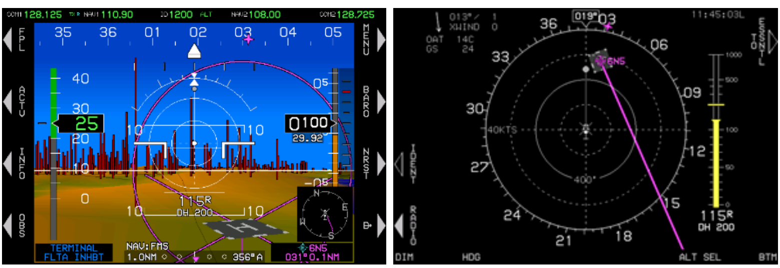


Figure 3-75: Heliports

3.6. MFD Symbology

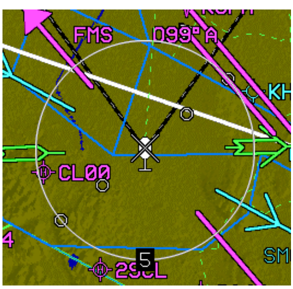
The Navigation Display is presented in a variety of formats:

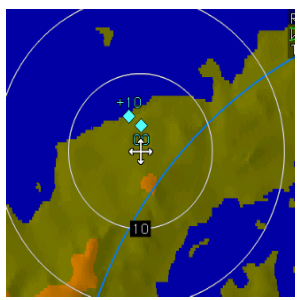
1) Moving Map
2) Conventional HSI
3) Navigation Log
4) Strikes
5) Traffic
6) Datalink
7) WX RDR
8) Video
9) EICAS
10) Radio page

3.6.1. Basic Moving Map

Figure 3-76: Basic Moving Map

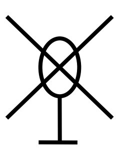
3.6.2. Ownship Symbology





Rotorcraft

Pan Mode



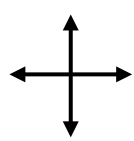


Figure 3-77: Ownship Symbology

3.6.3. Moving Map with Instrument Approach

Figure 3-78: Moving Map with Instrument Approach

3.6.4. North-Up Arc Mode

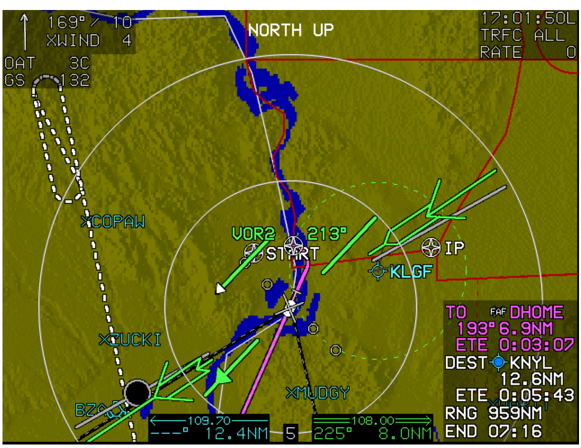


Figure 3-79: North-Up Arc Mode

3.6.5. North-Up Centered Mode

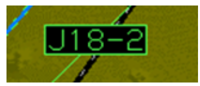
Figure 3-80: North-Up Centered Mode

3.6.6. Heading-Up Centered Mode

Figure 3-81: Heading-Up Centered Mode

3.6.7. Waypoint Symbology

The ND displays navigation symbology in its correct relationship to the ownship symbol and includes the following symbols.

Table 3-14: Navigation Symbology			
	IFR Airport		NDB
	VFR Airport		FIX
	VORTAC		High Altitude Airway
	DME only or TACAN		Low Altitude Airway
	VOR		User Waypoint

3.6.8. Conventional HSI/PTR Format

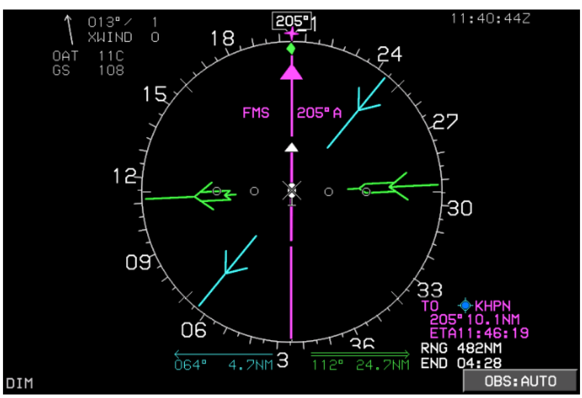


Figure 3-82: Conventional HSI/PTR Format

The ownship symbol (Figure 3-77) 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.

3.6.9. Compass Rose Symbols

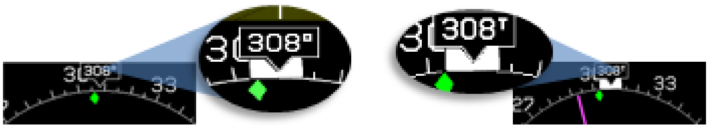


Figure 3-83: Compass Rose

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 Loss of Navigation 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

3.6.10. Fuel Totalizer/Waypoint Bearing and Distance Functions

Figure 3-84: Fuel Totalizer/Waypoint Bearing and Distance

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

Function	Conditions	Type Symbols Options
TO Waypoint	If there is an active flight plan, waypoint type, identifier, range, bearing, and estimated time enroute/estimated time of arrival for the active waypoint (TO waypoint) are shown. Waypoint information is magenta but turns amber (yellow) in the event of a GPS Loss of Navigation caution.	ETA or ETE Degree (°) symbol or True North (^{T}) symbol
DEST Waypoint	If there is an active flight plan, waypoint type, identifier, range, and estimated time enroute/ estimated time of arrival for the last waypoint (“DEST” waypoint) are shown. Range and time to destination waypoint are based upon the flight plan route if the active waypoint is not the last waypoint; otherwise, range and time to the destination waypoint are based upon a direct geodetic path. DEST Waypoint information is white but turns amber (yellow) in the event of a GPS Loss of Navigation caution.	ETA or ETE Degree (°) symbol or True North (^{T}) symbol
Range	Aircraft range based upon instantaneous fuel flow, fuel remaining, and groundspeed are shown immediately below DEST waypoint information for easy comparison.	

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

Function	Conditions	Type Symbols Options
Endurance	Aircraft endurance based upon instantaneous fuel flow and fuel remaining is shown.	

3.6.11. Clock Options

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

Zulu Time

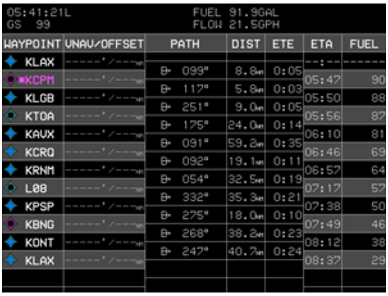
Local Offset Time

Figure 3-85: Clock Options

Table 3-16: Clock Options

Feature	Options	Notes
Zulu Time or Local Offset	Zulu or Local	Shown in **hh:mm:ss** and synchronized with the GPS/SBAS constellation.
Timer	**COUNT UP** **COUNT DN..** **FLT TIME**	Countdown or count-up timer is displayed when selected and matches timer shown on the PFD.
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.

3.7. Navigation Log



With Fuel Enabled **Without Fuel Enabled**

Figure 3-86: Navigation Log

3.7.1. 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 § 3.6.11.

2) **Groundspeed**: Displayed digitally in knots

3.7.2. 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.

3.7.3. 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 is magenta and indicated with an asterisk but turns amber (yellow) in the event of a GPS Loss of Navigation 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, small procedure legends are drawn on top of the navigation data symbol to easily distinguish procedure waypoints. The following legends are used:

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, or 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.

3.7.4. 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.

NOTE:

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

3.7.5. Path Column

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

1) 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 with the legend “-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 applies to the leg between waypoints.

3.7.6. Distance Column

Distance between waypoints is displayed immediately to the right of the Path column. Distance between waypoints 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.

3.7.7. Estimated Time Enroute Column

ETE between waypoints is displayed immediately to the right of the Distance column. ETE 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.

3.7.8. Estimated Time of Arrival Column

ETA at the active waypoint and all subsequent waypoints are displayed immediately to the right of the ETE column. 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.

3.7.9. 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:

The absence of the following are associated with a suppressed waypoint, as a suppressed waypoint is not actually part of the active flight plan:

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

3.8. Start Point

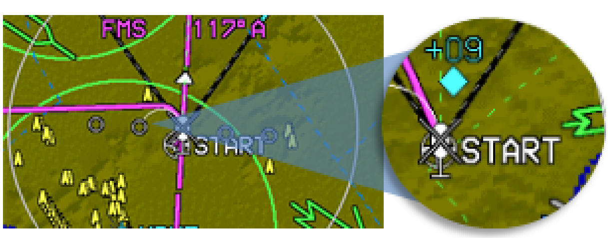
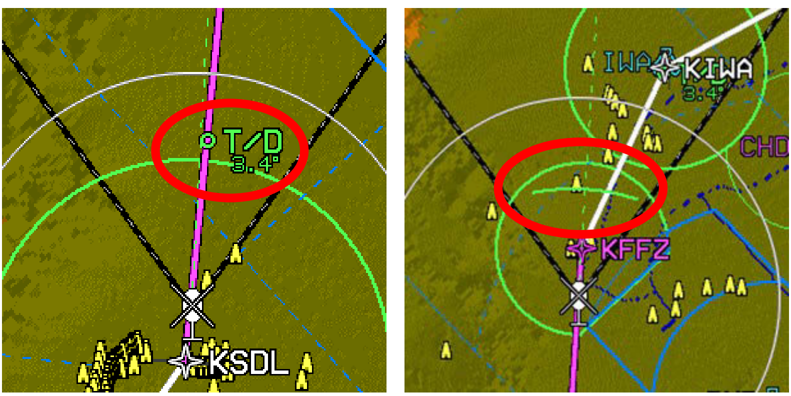


Figure 3-87: Start Point

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.

3.9. Altitude Capture Predictor/Top of Descent

When a selected altitude or VNAV is specified on the PFD, the point at which a descent commence is marked with T/D in the correct location on the flight plan path and contains location on the flight plan path with an indication of the glidepath angle used to calculate position. The altitude is captured and shown as a green arc located ahead of the aircraft after passing the Top of Descent along the lubber line. The arc marks the bottom-of-descent or top-of-climb point.



Top of Descent **Top of Climb**

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

3.10. Projected Path

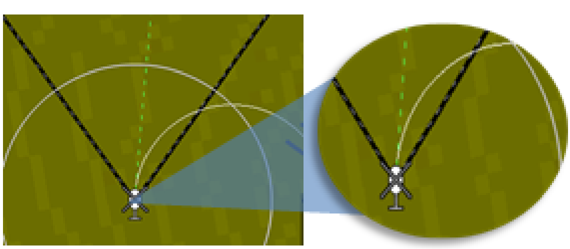


Figure 3-89: Projected Path

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 to a maximum of 180° of turn. The projected path or “Noodle” effectively assists in course interception and making small adjustments to bank angle for proper roll out.

3.11. Active Flight Plan Path/Manual Course/Runways

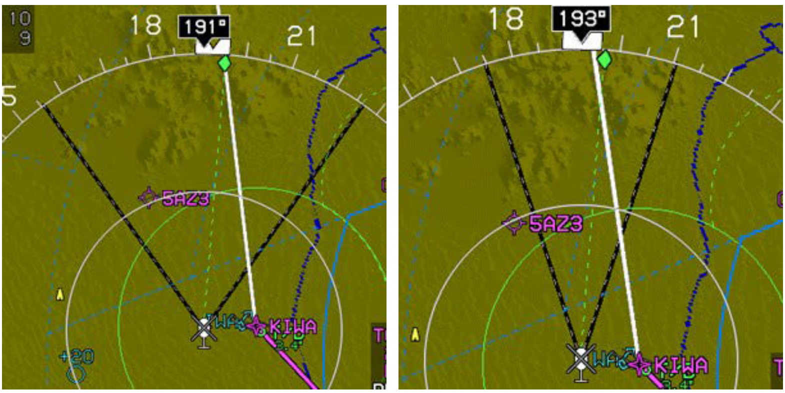
When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path is shown on the ND in correct relationship to the ownship symbol. The active flight plan path depiction meets all requirements of GPS/SBAS path definition and matches lateral navigation guidance given on the PFD (GPS/SBAS CDI in automatic OBS mode, skyway boxes, and mini-map). The symbol 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. Top of descent symbols with an indication of glidepath angle are shown where VNAV descents are predicted to commence.

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 Loss of Navigation caution.

The ND displays airport runways in correct relationship and scale to the ownship symbol. Immediately upon a system startup on the ground, the runways for the nearest airport are displayed. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, runways for the airport associated with the procedure are displayed. In addition, the runways associated with the three nearest airports (as computed by the TAWS algorithms) are displayed in dark gray according to characteristics contained in the navigation database, including position, orientation, length, and width.

3.12. FOV 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.



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

Figure 3-90: Field of View

3.13. Range

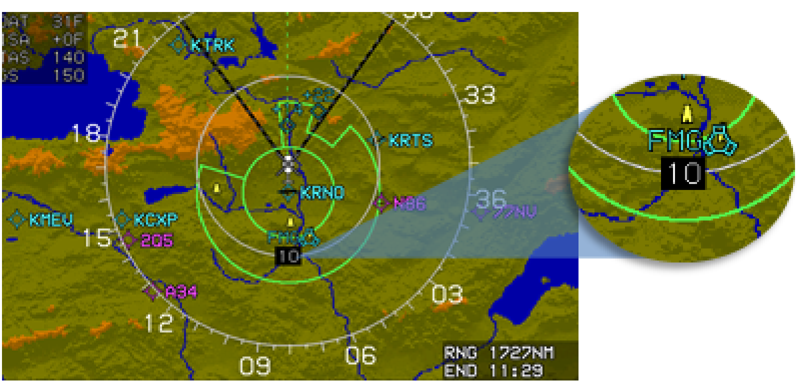


Figure 3-91: Range

The white range ring is centered on the aircraft's position to quickly estimate distances. Distance (in nautical miles) from the aircraft to the ring is a white figure, 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 ❶ or ❷ to set the overall map scale ranges to .5, 1, 2.5, 5, 10, 25, 50, 100, and 200NM as appropriate.

3.14. Navigation Data

Figure 3-92: Navigation Data and Airspace Depiction

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.

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.

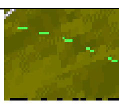
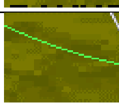
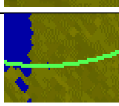
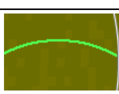
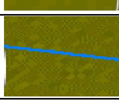
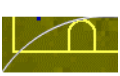
3) **NDBs**: Manually or automatically decluttered. In automatic declutter mode, NDBs are shown in levels 1 and 2. Both enroute and terminal NDBs are shown.

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

Type of ARINC 424 Airspace		Vertical Limits
	Single pixel, dashed lines	More than ±500’
	Single pixel solid lines	Within ±500’
	Double pixel solid lines	Within airspace vertical limits
		Color of Airspace
	Class C, Control Area, TRSAs, Class D	Green
	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

3.14.1. Air Data and Groundspeed

True North Mode

Normal Mode

Figure 3-93: 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 aircraft is in the ground mode, or when the AHRS is in DG mode.

If referenced to magnetic North, the direction readout uses the degree (°) symbol. Otherwise, a stylized True North (^{T}) symbol is used. Outside Air Temperature: Digitally in Degrees C or F (as configured).

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.

3.14.2. Analog Navigation Symbology

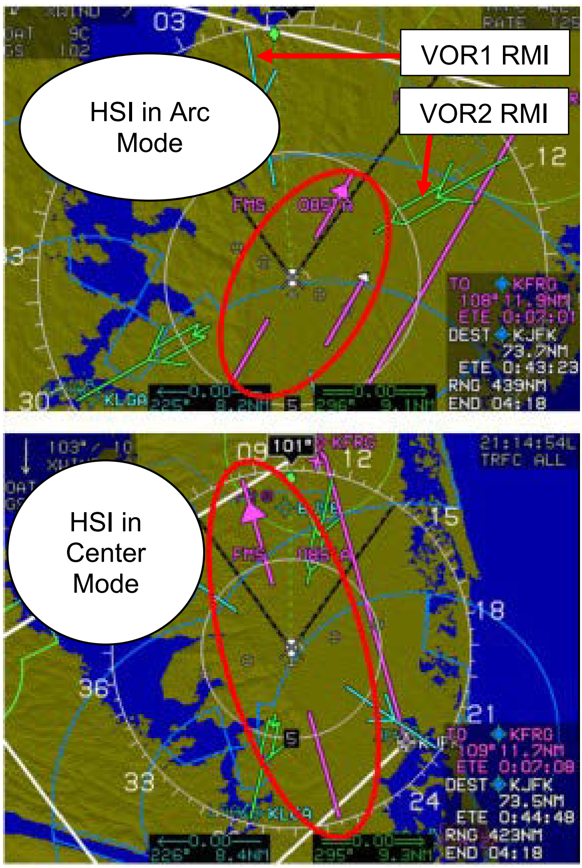


Figure 3-94: Analog Navigation Symbology

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 above the distance readout. If a bearing or distance are not valid, the respective field is filled with dashes.

3.14.3. 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 3-95: Borders

3.14.4. 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 Display on Navigation Display Color Relationship to Aircraft Altitude

Based on Aircraft Altitude	Color	Notes #
Terrain when at or below 100 feet less than aircraft altitude	Shades of Olive	#1
Terrain when above 100 feet less than aircraft altitude	Shades of Brown	#1
FLTA alerts	Amber and Red	#2
Water at all altitudes	Deep Blue	#3

Note #1 Slope between adjacent terrain pixels in an increasing longitude direction determines shade.

Note #2 See Section 8 TAWS for terrain elements causing FLTA alerts.

Note #3 Areas of water and 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.

Table 3-19: Obstructions

Lateral Distance Away	8.5 NM or greater	Not depicted on the ND
	8.5 NM or less	As described below
Vertical Criteria	More than 2000’ below the 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 3-96: Obstructions

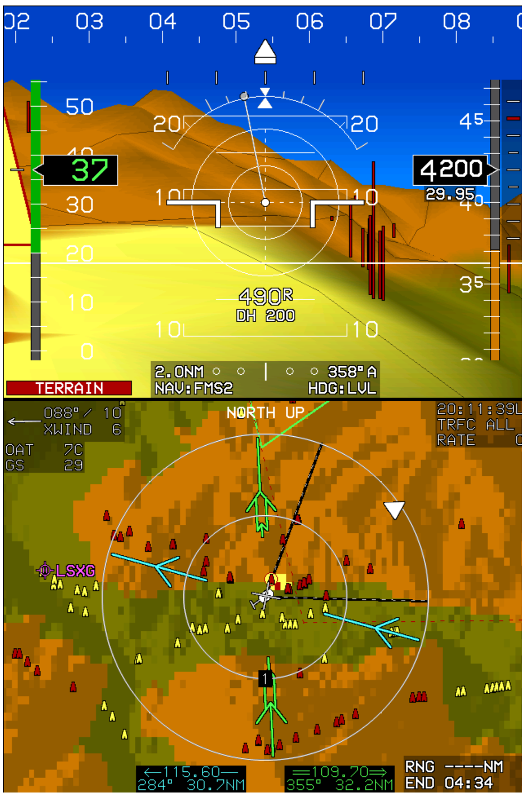


Figure 3-97: Terrain/Obstructions

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

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

See Section 8 Terrain Awareness Warning System for obstructions causing TAWS alarms and depiction of separate symbology.

3.15. Pan Mode

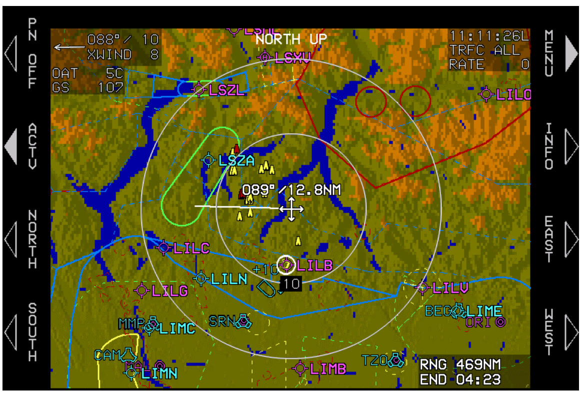


Figure 3-98: Pan Mode

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

Figure 3-98 shows the line with bearing and distance from the map center to the aircraft's current position in white whenever the aircraft is more than 0.5 NM away. If referenced to magnetic North, the bearing uses the degree (°) symbol. Otherwise, a stylized True North (^{T}) symbol is used. When panning, the nearest displayed airport, VOR, NDB, or fix within the inner range ring are highlighted with a flashing circle as seen in Figure 3-98. Buttons allow for viewing or hiding waypoint information (including datalink weather information associated with that point). When exiting the pan mode, all previous settings in place before the pan mode was enabled are restored.

3.16. HSI Screen

3.16.1. Ownship Symbol and Compass Rose

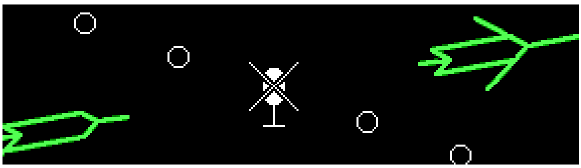
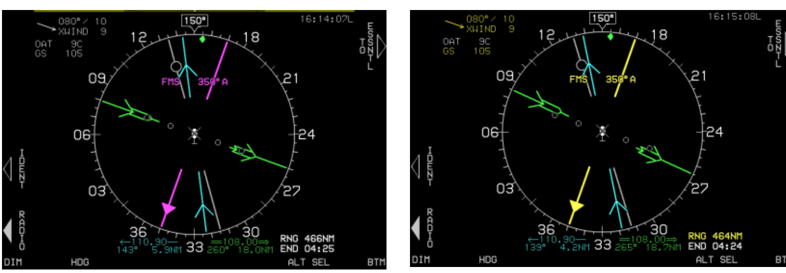


Figure 3-99: Rotorcraft Ownship Symbol

The ownship symbol is in the center of the HSI. The HSI has a compass rose aligned with either magnetic North or True North depending on the status of the True North input. The ownship symbol points straight up, and when the HSI NAV source fails (FMS, VOR1 or VOR2), a red “X” is displayed in place of the HSI deviations. When the AHRS is in DG mode, “DG” appears to the right of the ownship symbol.



Normal Magenta Pointer

GPS Loss of Navigation Amber (Yellow) Pointer

Figure 3-100: HSI Pointer Color

When selected, the ND displays conventional HSI symbology including a selected course needle, a lateral deviation indicator, and a “TO-FROM” indicator. When the HSI is slaved to GPS/SBAS during a GPS Loss of Navigation condition, the HSI pointer color is amber (yellow), otherwise it remains magenta as in Figure 3-100.

3.16.2. HSI Screen VDI

A vertical deviation indicator appears (Figure 3-100) 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 § 3.5.30.

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

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

3) GS1: Glideslope #1

4) GS2: Glideslope #2

3.16.3. Analog Navigation Symbology

Figure 3-101: Analog Navigation Display VOR1 and VOR2 and VDI

When selected, the HSI displays analog (VOR1 [cyan] and VOR2 [green]) navigation symbology 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 as shown in Figure 3-101.

The Audio-Radio page of the EFIS may be used to handle radio tuning. If a NAV receiver is interfaced for frequency tuning by the EFIS, when the VOR1 pointer is selected for display, the NAV1 frequency (unless an Identifier is decoded) is displayed in cyan over the VOR1 pointer in the bearing/distance display. If a NAV receiver is interfaced for frequency tuning by the EFIS, when the VOR2 pointer is selected for display, the NAV2 frequency (unless an identifier is decoded) is displayed in green over the VOR2 pointer in the bearing/distance display (Figure 3-102).

Figure 3-102: HSI Bearing Distance Readout without DME in HOLD

If a DME receiver is interfaced for frequency tuning by the EFIS and a DME channel is in hold mode, the DME's channel hold frequency is also amber (yellow) (Figure 3-103). When the hold function for the associated DME channel is enabled, **HOLD (L5)** sets the hold frequency of the DME channel associated with the current NAV receiver equal to the current NAV receiver active frequency. Appearance of "HOLD" requires the selected navigation receiver be interfaced with a DME channel outputting a valid signal. If the VHF NAV or DME receiver fails, HOLD button appearance and operation are inhibited. If the frequency is subsequently changed, the DME is still in HOLD mode on the original nav frequency until the HOLD mode is cleared. If the DME fails while in hold mode (signal is invalid), the DME radio remains in hold mode and the menu option is still available. Once the pilot disables the hold mode from the DME, it is no longer available for enabling the DME hold mode.

NOTE:

This prevents a weak DME signal from disengaging the DME hold mode.

When a DME channel is in hold mode, the tuned DME frequency is displayed in amber (yellow) over the associated VOR pointer in the bearing/distance display.

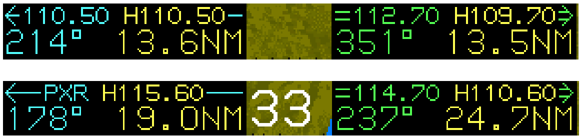


Figure 3-103: HSI Bearing Distance Readout with DME in HOLD

Valid Marker Beacon discretes are displayed as indicators on the PFD and ND HSI display as seen Figure 3-104 with appropriate coloring markings. Only during a built-in-test, more than one marker beacon may be active. The display of marker beacons is disabled when the NAV source is FMS.

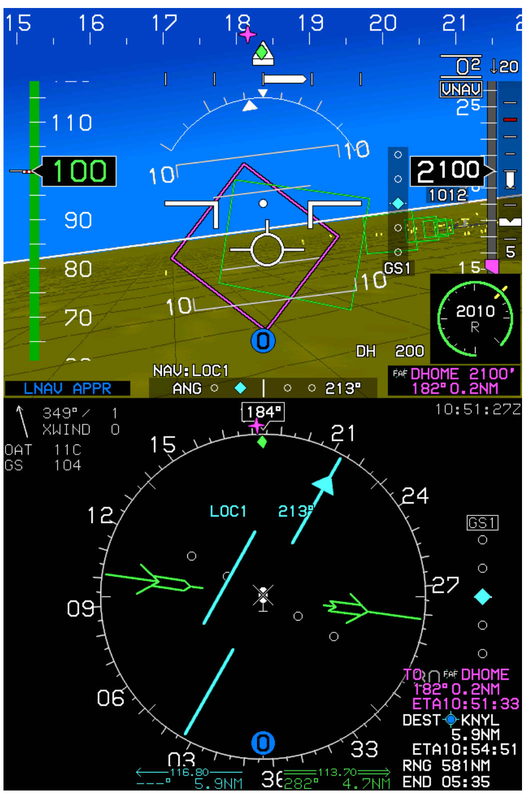
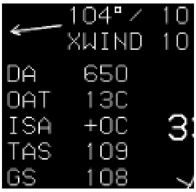


Figure 3-104: HSI with Marker Beacon Displayed

3.16.4. Air Data and Groundspeed



Air data and groundspeed are displayed as explained as specified in § 3.14.1.

Figure 3-105: HSI Display Air Data and Groundspeed

3.16.5. Clock/Options

Figure 3-106: HSI Clock

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

1) **Zulu Time or LCL Time**: As specified in § 3.6.11

2) **HSI Source**: Shown when HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation, HSI source is amber (yellow); otherwise, it is white.

3) **OBS**: Setting associated with HSI source shown. When HSI source is FMS, FMS OBS setting matches OBS setting shown on PFD FMS CDI. FMS OBS setting is labeled “A” (automatic) or “M” (manual). When HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition, OBS setting is amber (yellow); otherwise, it is white.

4) **CDI Scale**: Current CDI scale is shown and matches the CDI scale shown on the PFD course deviation. When the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition, the CDI scale is amber (yellow); otherwise, it is white.

3.16.6. Fuel Totalizer/Waypoint Bearing and Distance Functions

Fuel totalizer, waypoint bearing, and waypoint distance are displayed in the lower right corner of the HSI as specified in § 3.6.10.

Figure 3-107: HSI Fuel Totalizer/Waypoint Bearing

3.17. Hover Screen

The hover screen has the following elements.

3.17.1. Ownship Symbol

Hover screen ownship symbology is as in Figure 3-77.

3.17.2. Hover Screen Orientation

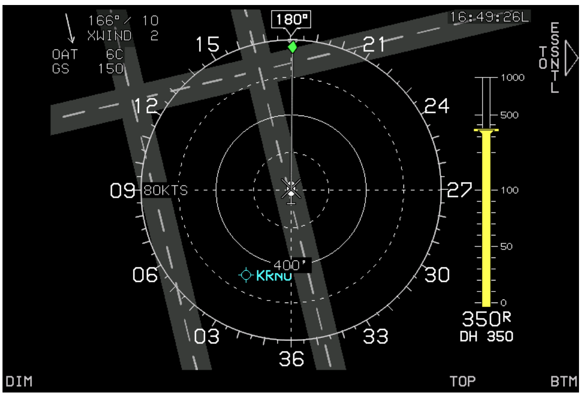


Figure 3-108: ND (Hover Vector Screen)

3.17.3. Hover Screen Range

The following selectable hover screen ranges are available (all distances represent the distance 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 the pilot to judge range to displayed symbols. A 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).

3.17.4. 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 automatically changes based upon current groundspeed. Available speed ranges are (all speeds represent the speed indicated at the compass rose): 20KTS, 40KTS, and 80KTS 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.

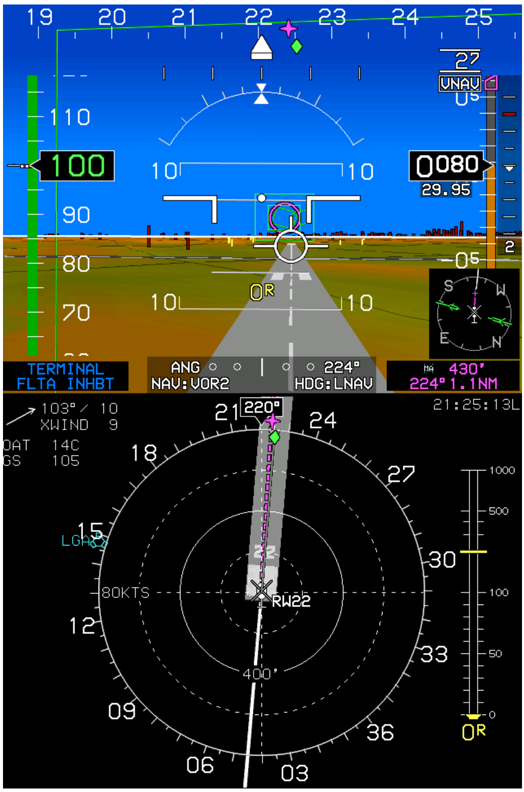


Figure 3-109: Hover Vector Symbology

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. The 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, a "DG" indication appears to the right of the ownship symbol.

3.17.5. Compass Rose Symbols

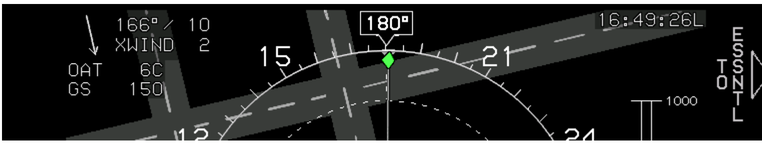


Figure 3-110: ND (Hover Vector Compass Rose)

A digital magnetic heading readout and pointer aligned with the longitudinal axis of the ownship symbol appears 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 Loss of Navigation caution.

3.17.6. Active Flight Plan Path/Manual Course

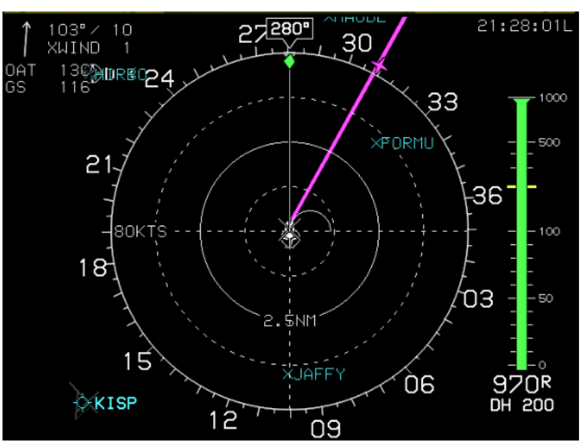


Figure 3-111: ND (Hover Vector Active Flight Plan Path/Manual Course)

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.

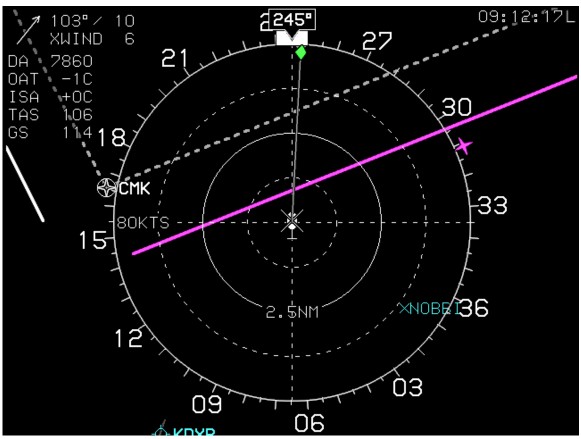


Figure 3-112: ND (Hover Vector Active Flight Plan Path/Parallel Course)

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).

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 Loss of Navigation caution.

3.17.7. Navigation Data

The hover screen displays navigation data in correct relationship to the ownship symbol. Navigation data symbols include airport symbols, VORs, NDBs, fixes, and user waypoints. The user waypoint symbol on the hover screen includes an outlining box sized so it cannot be obscured by the ownship symbol allowing 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. Immediately upon a system startup on the ground, the runways for the nearest airport are displayed. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, the runways for the airport associated with the procedure are displayed. In addition, the runways associated with the three nearest airports are also displayed. 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.

3.17.8. Projected Path

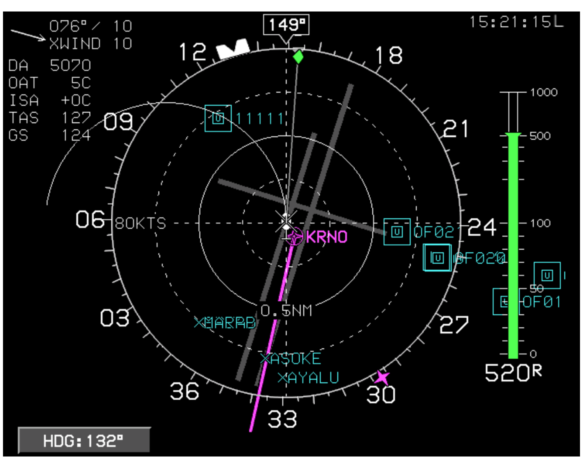


Figure 3-113: ND (Hover Vector Projected Path)

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.

3.17.9. Air Data and Groundspeed

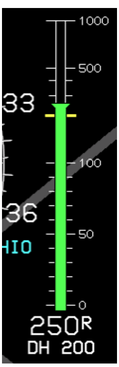
Air data and groundspeed are displayed in the upper left corner of the hover screen as specified in § 3.14.1.

3.17.10. Clock

The following are displayed in upper right corner of the hover screen:

Zulu Time or LCL Time: As specified in § 3.6.11.

3.17.11. 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 whatever 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: ND (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 jumpiness (Table 3-2).

Table 3-20: Analog AGL Indication Designed Parameters		
Range of Altitude	**Markings**	**Notes**
0-1000’	Green color-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	
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 the 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.		

3.17.12. Decision Height Indication

The AGL indication includes a display of the currently set decision height altitude as described in § 3.5.6.

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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. Examples of when the limits were configured for “Show Full MFD Status Flag” are noted; otherwise, display examples may appear without showing full sensor status flags on the ND.

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

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.

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.

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 crewmember 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 on the IDU-680 is as follows:

When an MFD (IDU #2, 3, or 4) becomes the “transmit-enabled” IDU, the MFD automatically switches to Essential Mode. Essential Mode shows a PFI screen in the top area. In addition, if an EICAS is defined, Essential Mode shows the Essential Mode 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 NORMAL/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.

Press **TO NORMAL/TO ESSNTL (R5)** to alternate between Normal and Essential Modes on all displays. Essential Mode consists of a PFD screen in the top area and, if configured, an Essential Mode EICAS screen in the bottom area. On a PFD (IDU #1), there is only a distinction between Normal and Essential Modes when an EICAS is configured, and the display of **To NORMAL/TO ESSNTL (R5)** is inhibited when an EICAS is not configured. Because switching between Normal and Essential Modes is an alternating action of pressing **To NORMAL/TO ESSNTL (R5)**, access to an EICAS display on any IDU only requires a single pilot action.

4.1.5. GPS Failure

GPS degrades or fails as a result of loss of satellite information or GPS equipment failure. When the integrity is provided by SBAS, the IDU provides a Loss of Integrity (LOI) monitoring caution within two seconds if the current Horizontal Protection Level (HPL) exceeds the Horizontal Alert Level (HAL). GPS LON appears when there is no integrity monitoring and disappears when integrity monitoring is restored.

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) GPS 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) GPS LON (Loss of Navigation) displayed with no time delay of the onset of the following:

    a) The absence of power;

    b) Equipment malfunction or failure;

    c) The presence of a condition lasting five seconds or more where there are an inadequate number of satellites to compute position solution;

    d) Fault detects a position failure that cannot be excluded within time-to-alert when integrity is provided by FDE;

    e) HPL > HAL on the final approach segment: 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.

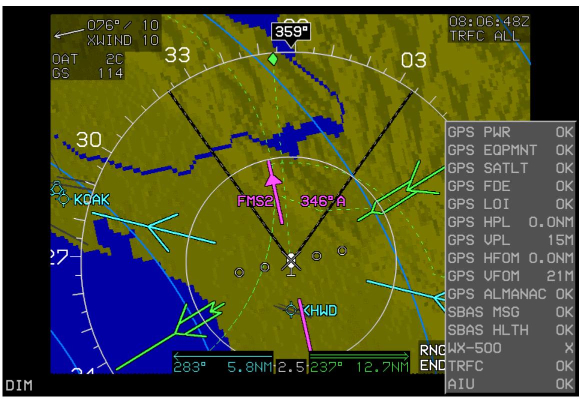


Figure 4-1: FAULTS Page on MFD

1) **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.

b) NO POSITION, no position available from the GPS and the EFIS cannot DR due to a second failure.

2) **VERT LON** (Loss of Vertical Navigation)

In the event the navigation equipment is no longer adequate to conduct or continue the LNAV/VNAV approach, VERT LON appears within one second of the onset of any of the following conditions:

a) The absence of power;

b) Equipment malfunction or failure;

c) The presence of a condition where fault detection detects a position failure that cannot be excluded;

d) There are an insufficient number of SBAS HEALTY 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.

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.

4.2. PFD Failure Mode 0 (Normal Mode) (Tapes)

Figure 4-2: PFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS Normal (Tapes)

4.2.1. PFD Failure Mode 0 (Normal Mode) (Round Dials)

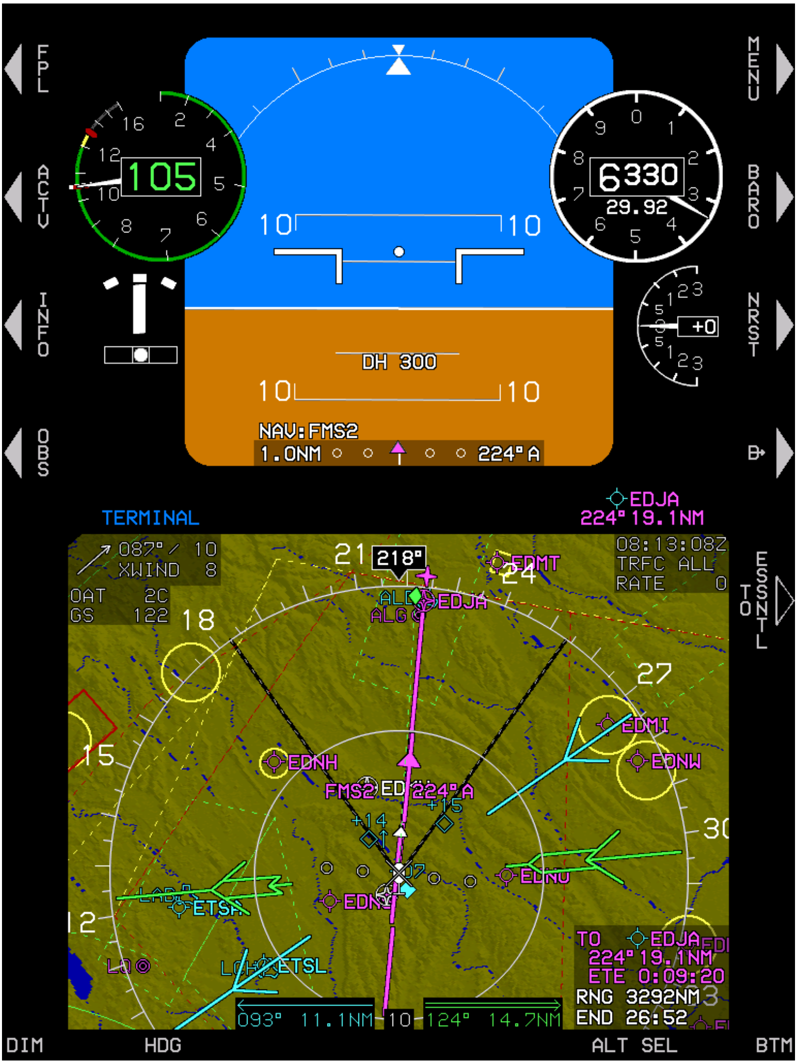


Figure 4-3: PFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS Normal (Round Dials)

4.2.2. MFD Failure Mode 0 (Normal Mode)

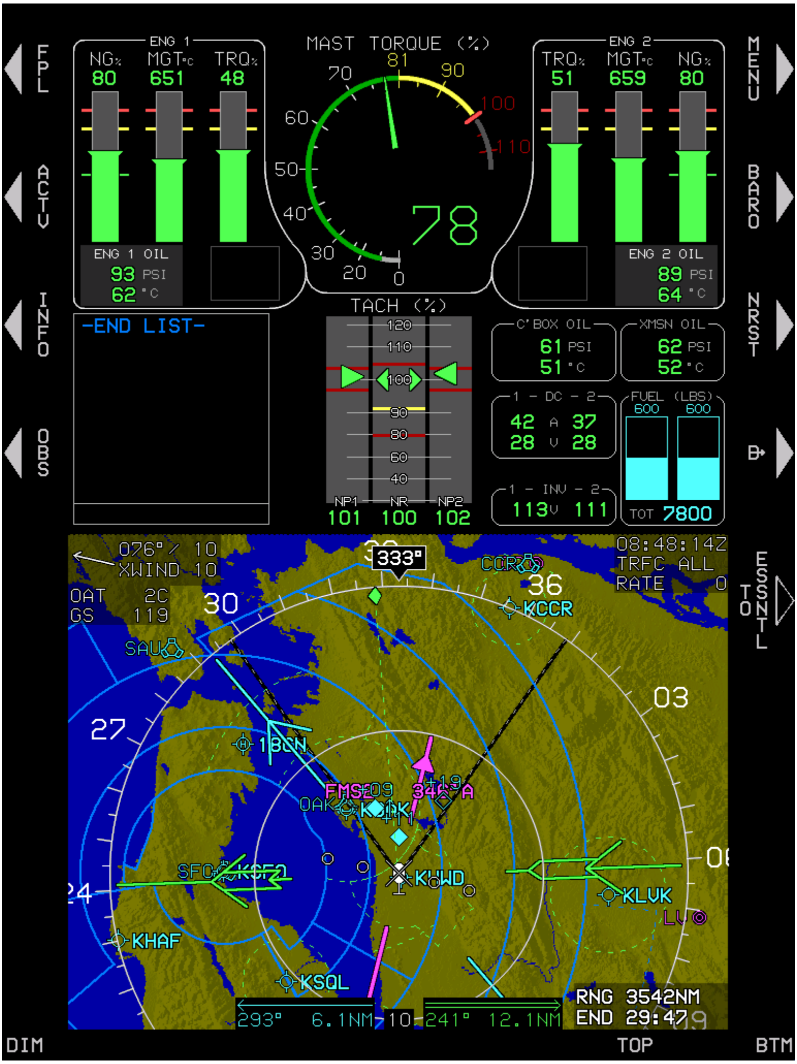


Figure 4-4: MFD Failure Mode 0 (Normal Mode)
GPS, ADC and AHRS Normal

4.3. PFD Failure Mode 1 (Normal Mode) (Tapes)

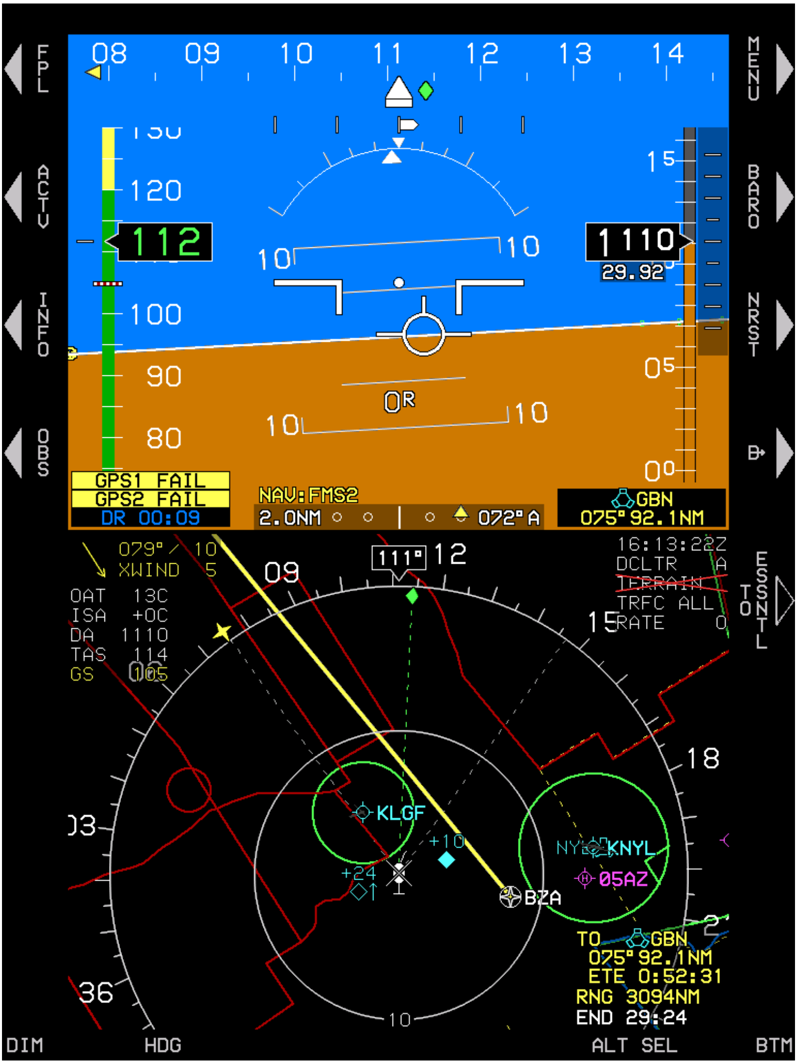


Figure 4-5: PFD Failure Mode 1 (Normal Mode) GPS/SBAS Failed, (Show Full MFD Status Flag) ADC and AHRS Normal (Tapes)

4.3.1. PFD Failure Mode 1 (Normal Mode) (Round Dials)

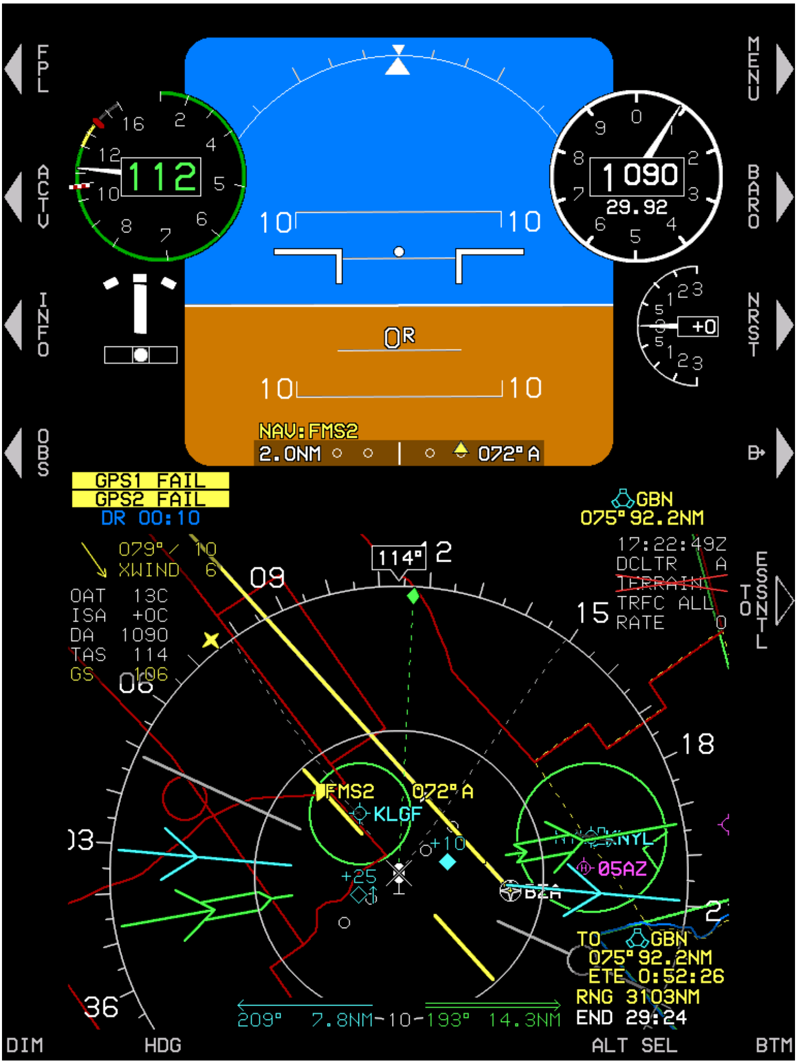


Figure 4-6: PFD Failure Mode 1 (Normal Mode)
GPS/SBAS Failed, ADC and AHRS Normal (Round Dials)

4.3.2. PFD Failure Mode 1 (Essential Mode) (Tapes)

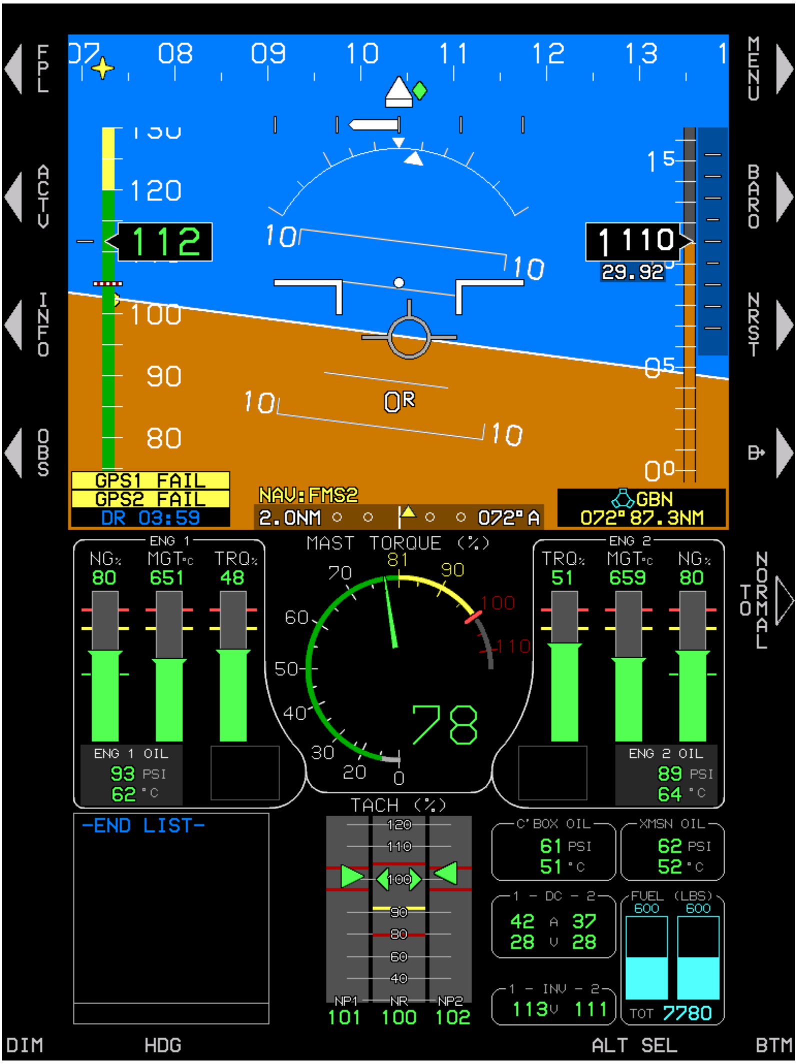


Figure 4-7: PFD Failure Mode 1 (Essential Mode)
GPS/SBAS Failed, ADC and AHRS Normal (Tapes)

4.3.3. MFD Failure Mode 1 (Normal Mode)

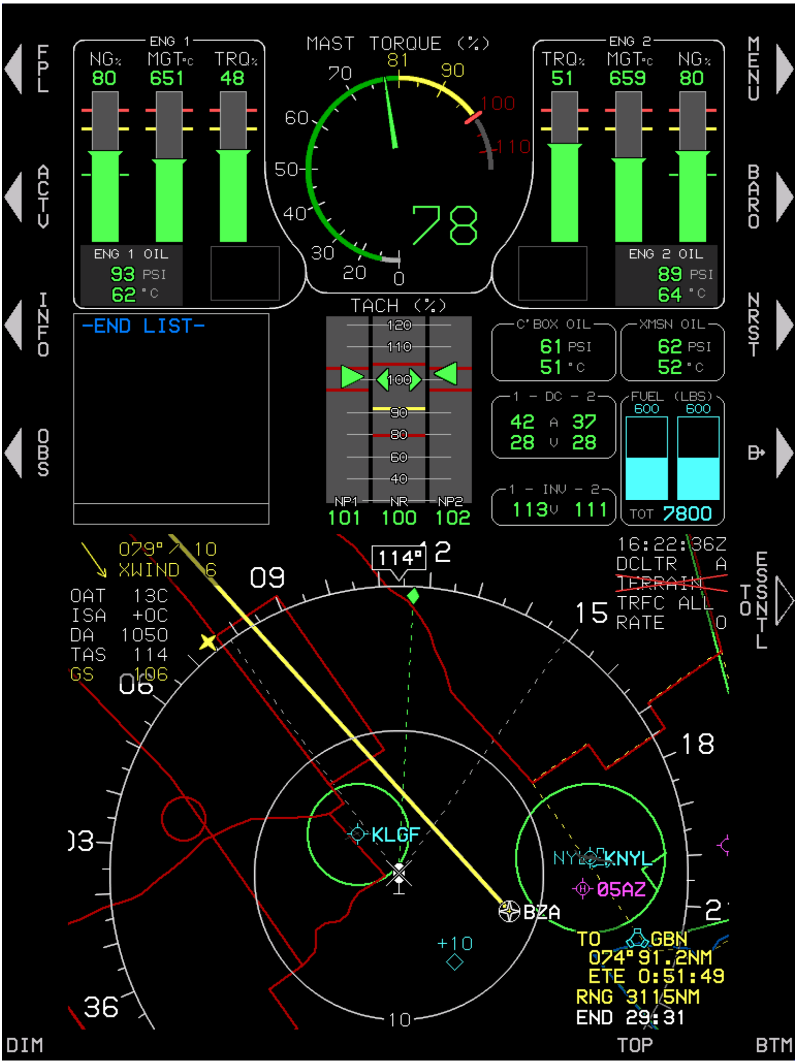


Figure 4-8: MFD Failure Mode 1 (Normal Mode) GPS/SBAS Failed, (Full MFD Status Flag) ADC and AHRS Normal

4.4. PFD Failure Mode 2 (Normal Mode) (Tapes)

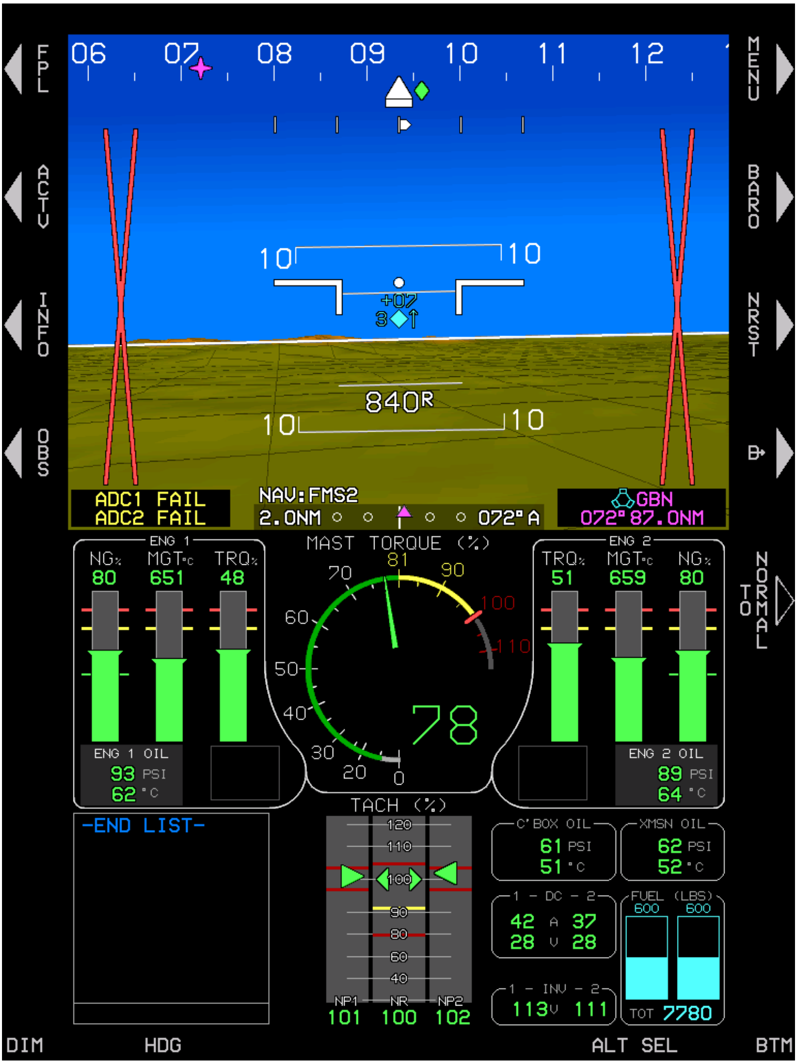


Figure 4-9: PFD Mode 2 (Normal Mode)
ADC Failed, GPS/SBAS and AHRS Normal (Tapes)

4.4.1. PFD Failure Mode 2 (Normal Mode) (Round Dials)

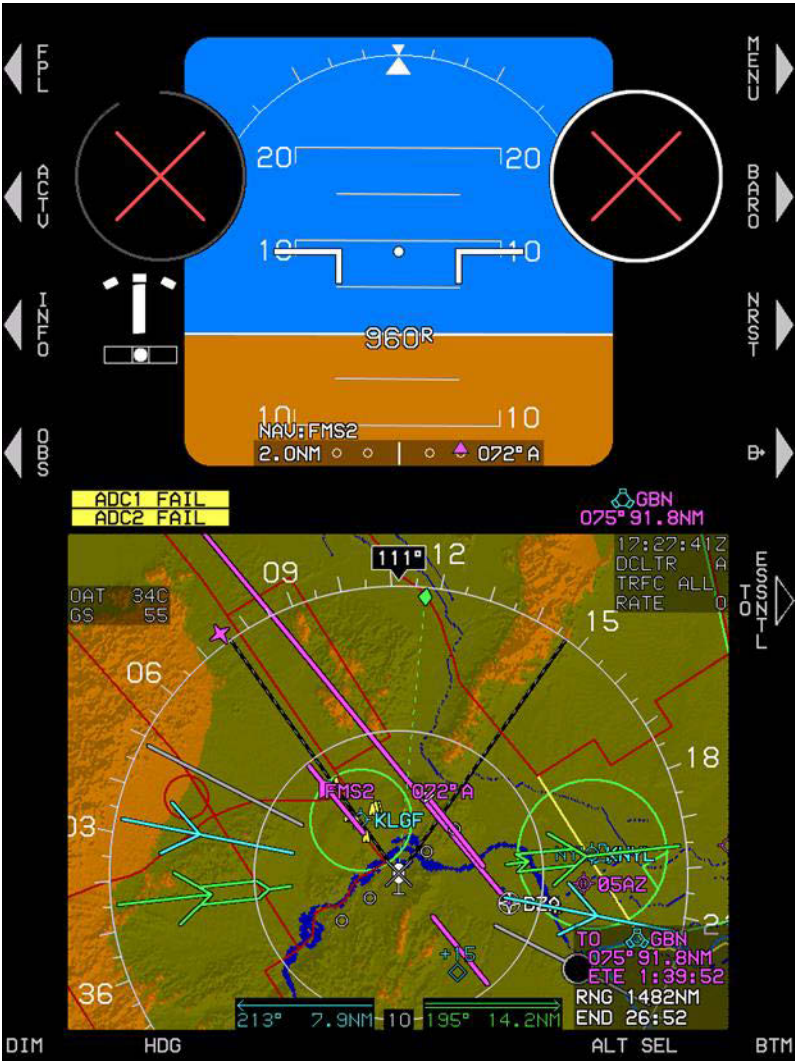


Figure 4-10: PFD Mode 2 (Normal Mode)
ADC Failed, GPS/SBAS and AHRS Normal (Round Dials)

4.4.2. MFD Failure Mode 2 (Normal Mode)

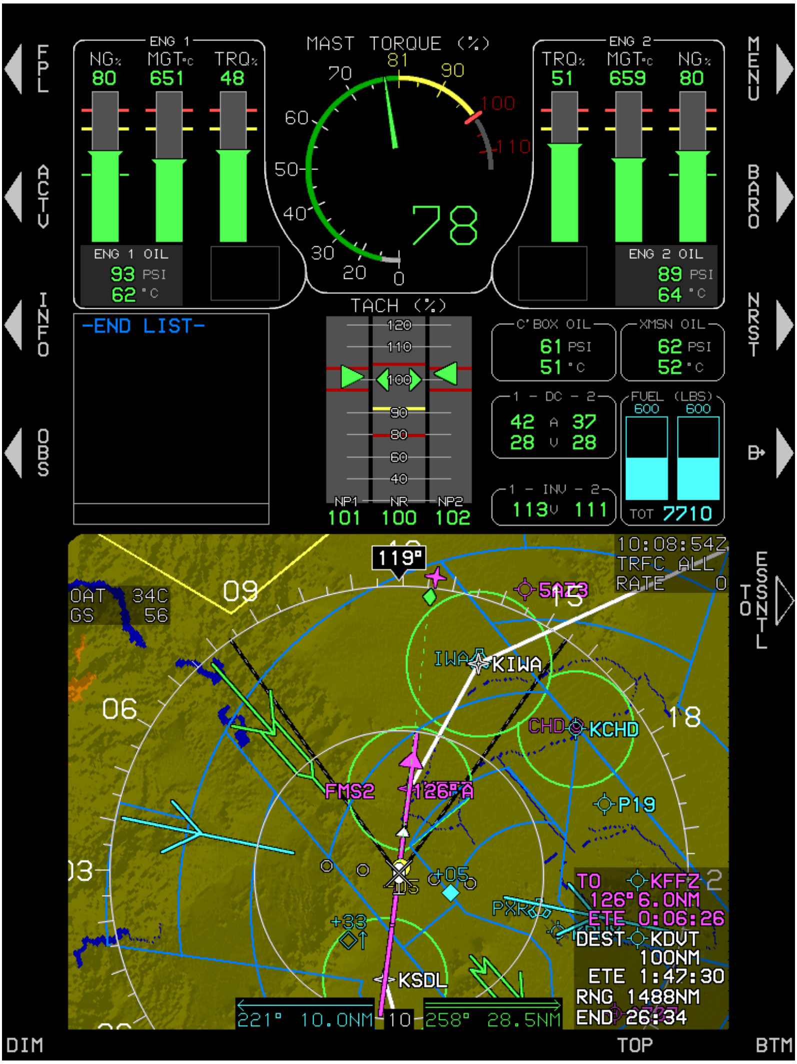


Figure 4-11: MFD Failure Mode 2, (Normal Mode)
ADC Failed, GPS/SBAS and AHRS Normal

4.4.3. MFD Failure Mode 2 (Essential Mode) (Tapes)

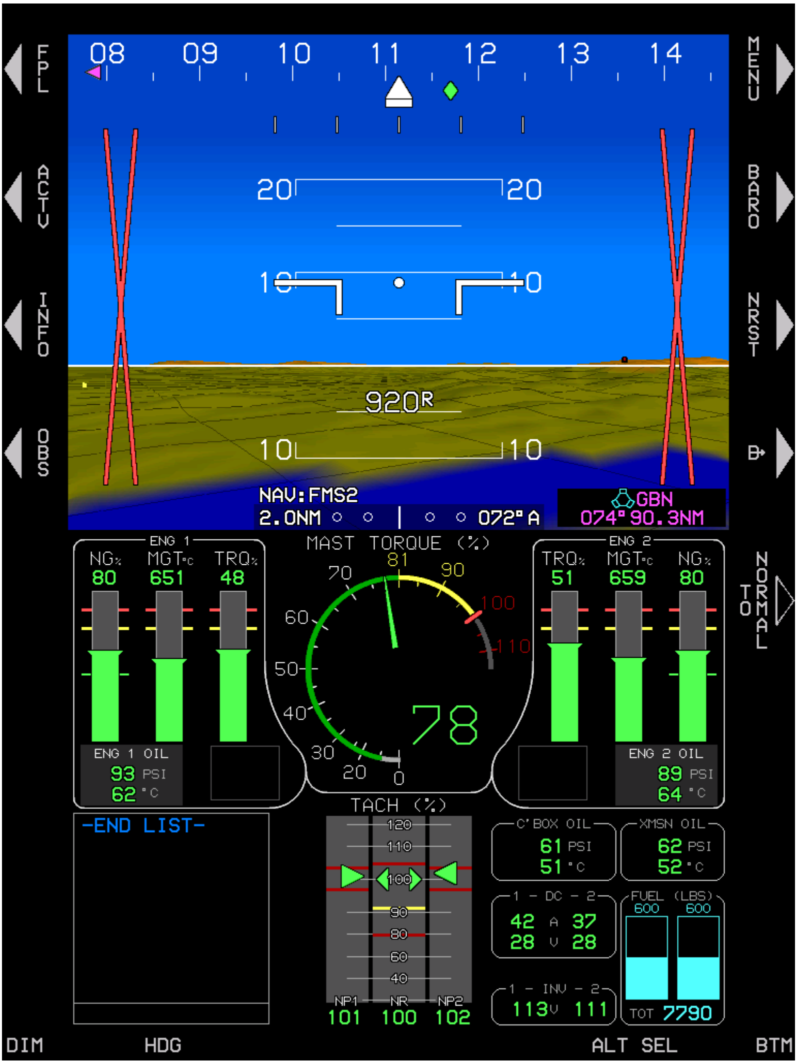


Figure 4-12: MFD Failure Mode 2 (Essential Mode) ADC Failed, GPS/SBAS and AHRS Normal (Tapes)

4.5. PFD Failure Mode 3 (Normal Mode) (Tapes)

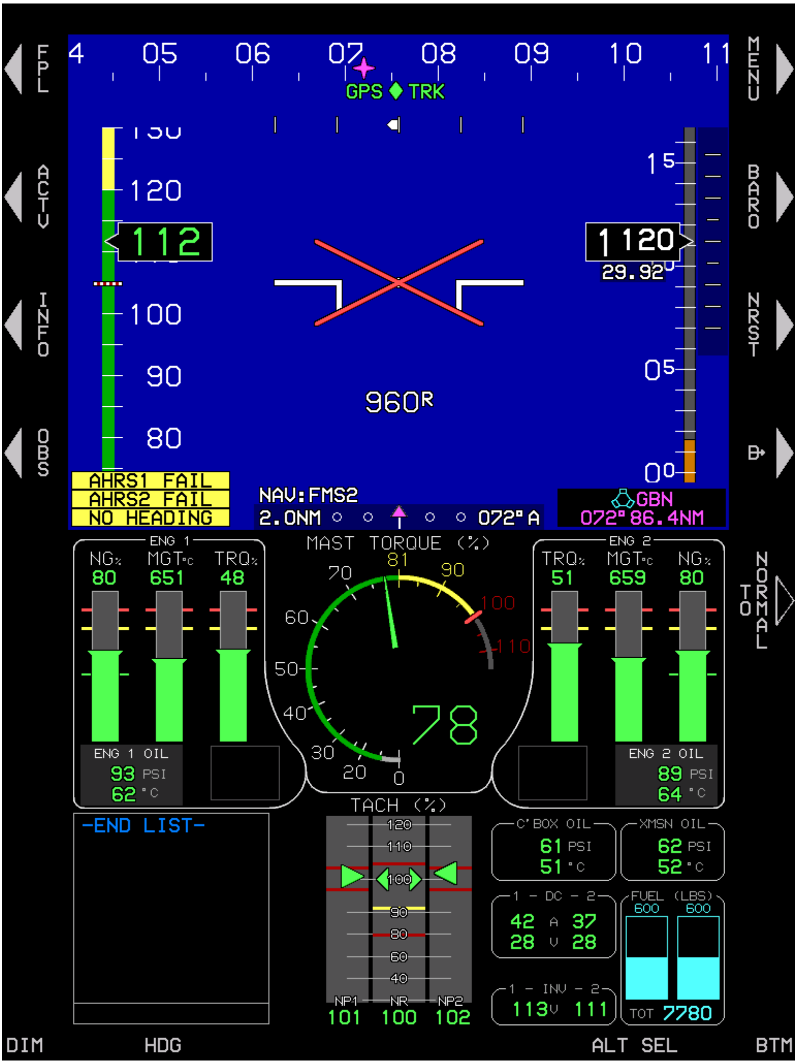


**Figure 4-13: PFD Failure Mode 3 (Normal Mode)
AHRS Failed, GPS/SBAS and ADC Normal (Tapes)**

4.5.1. PFD Failure Mode 3 (Normal Mode) (Round Dials)

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

4.5.2. MFD Failure Mode 3 (Normal Mode)

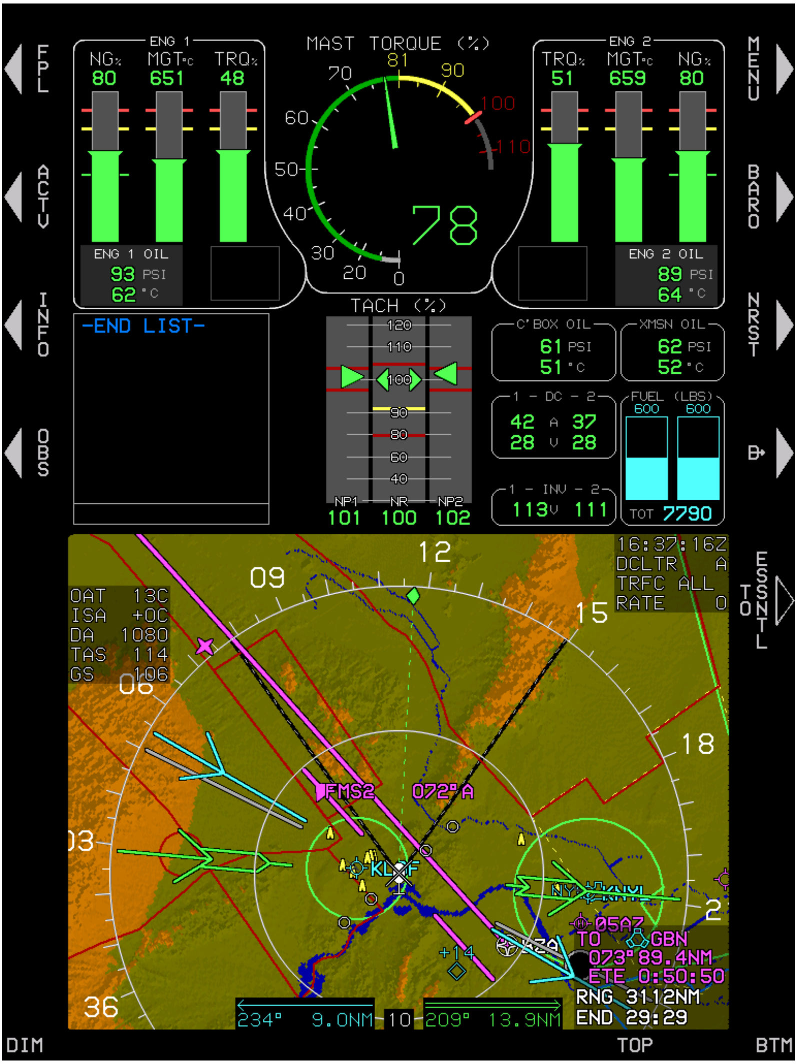


Figure 4-15: MFD Failure Mode 3 (Normal Mode)
AHRS Failed, GPS/SBAS and ADC Normal

4.6. PFD Failure Mode 4 (Normal Mode) (Tapes)

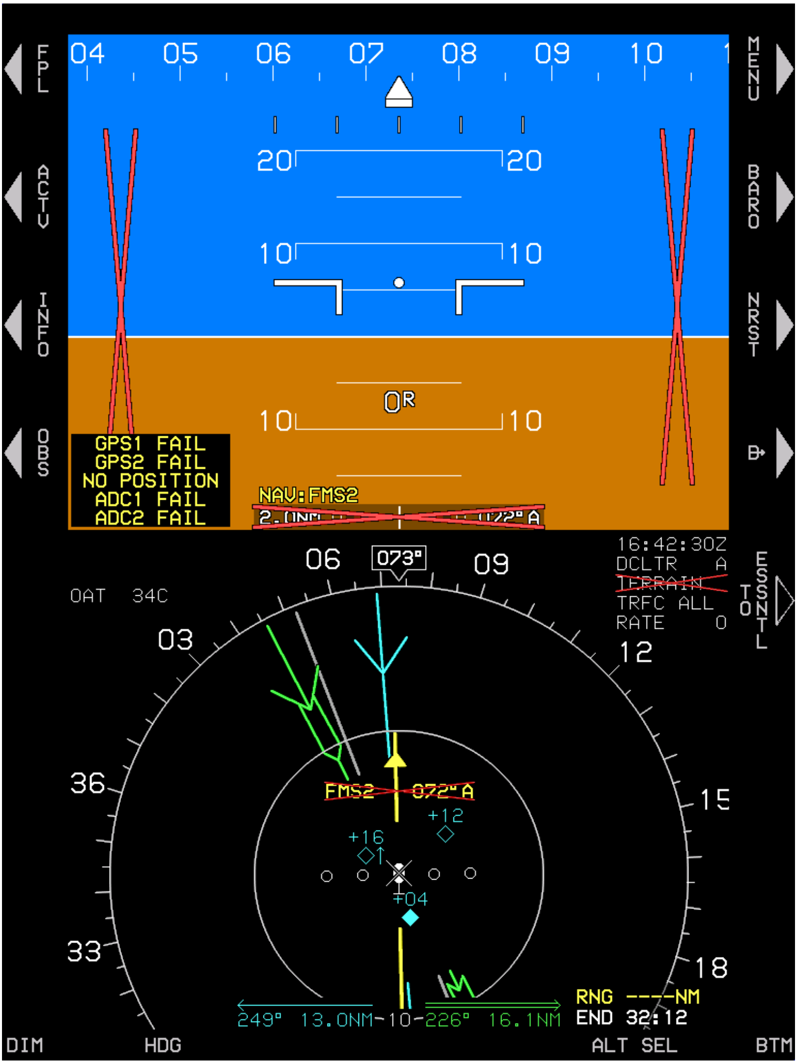


Figure 4-16: PFD Failure Mode 4 (Normal Mode)
GPS/SBAS and ADC Failed, AHRS Normal (Tapes)

4.6.1. PFD Failure Mode 4 (Normal Mode) (Round Dials)

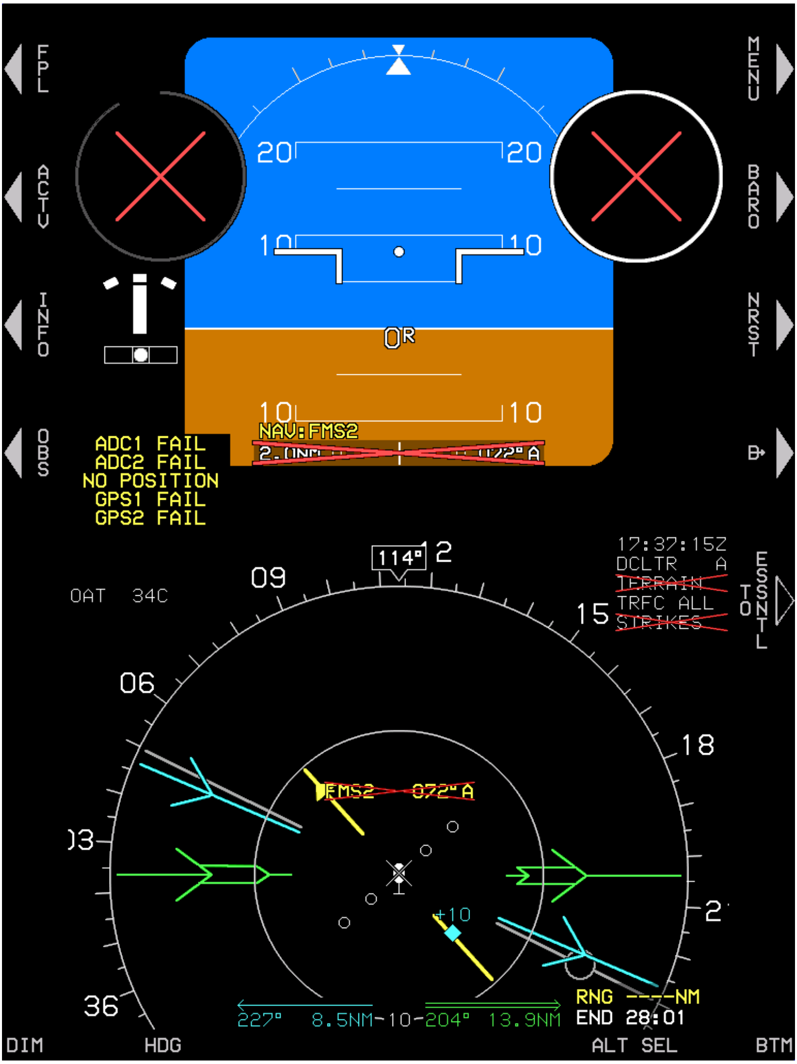


Figure 4-17: PFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC Failed, AHRS Normal (Round Dials)

4.6.2. MFD Failure Mode 4 (Normal Mode)

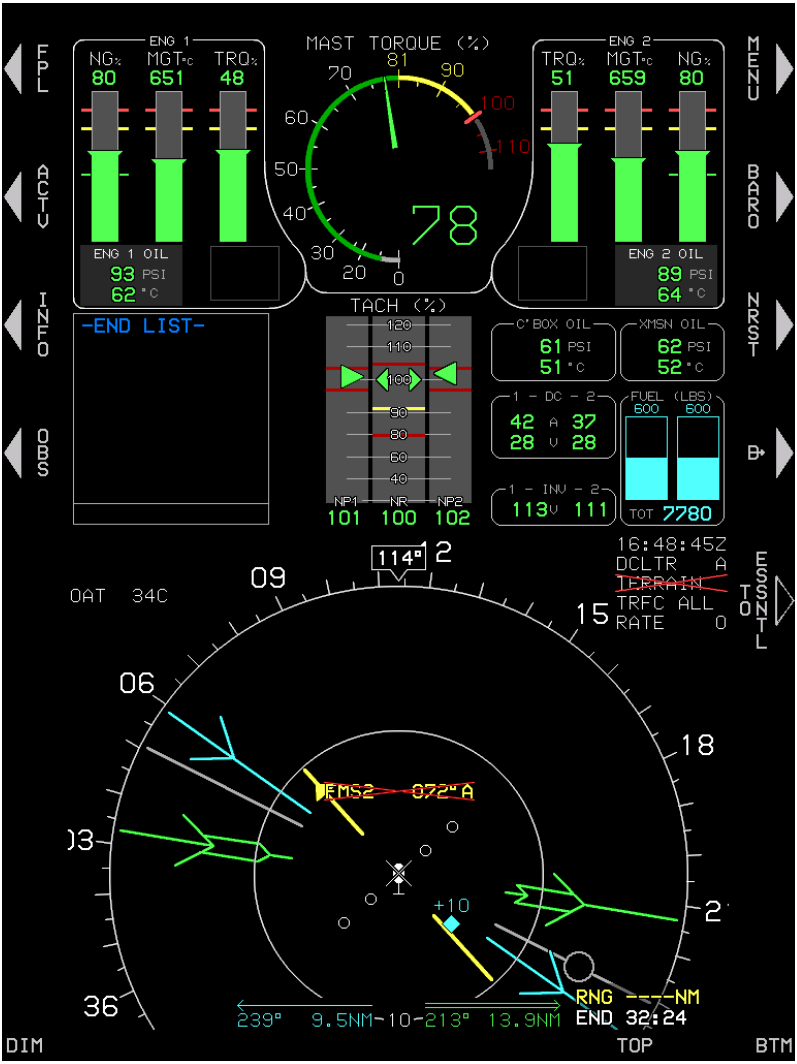


Figure 4-18: MFD Failure Mode 4 (Normal Mode)
GPS/SBAS and ADC Failed, AHRS Normal

4.6.3. MFD Failure Mode 4 (Essential Mode) (Tapes)

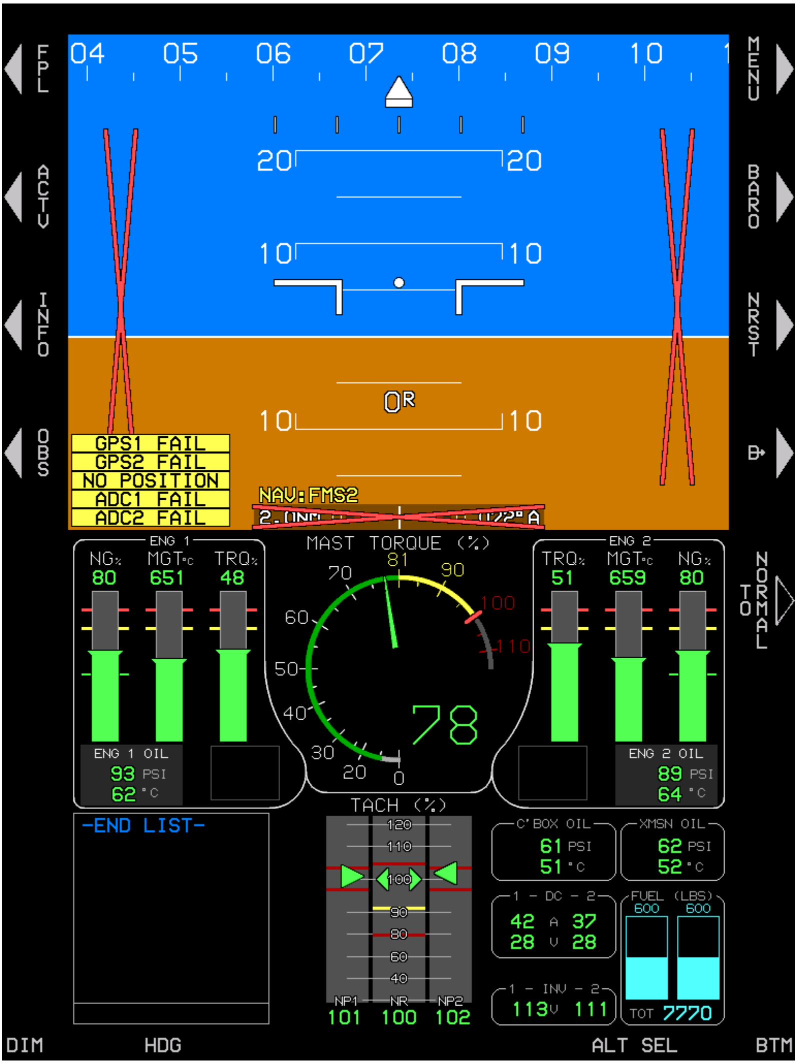


Figure 4-19: MFD Failure Mode 4 (Essential Mode) GPS/SBAS and ADC Failed, AHRS Normal (Tapes)

4.7. PFD Failure Mode 5 (Normal Mode) (Tapes)

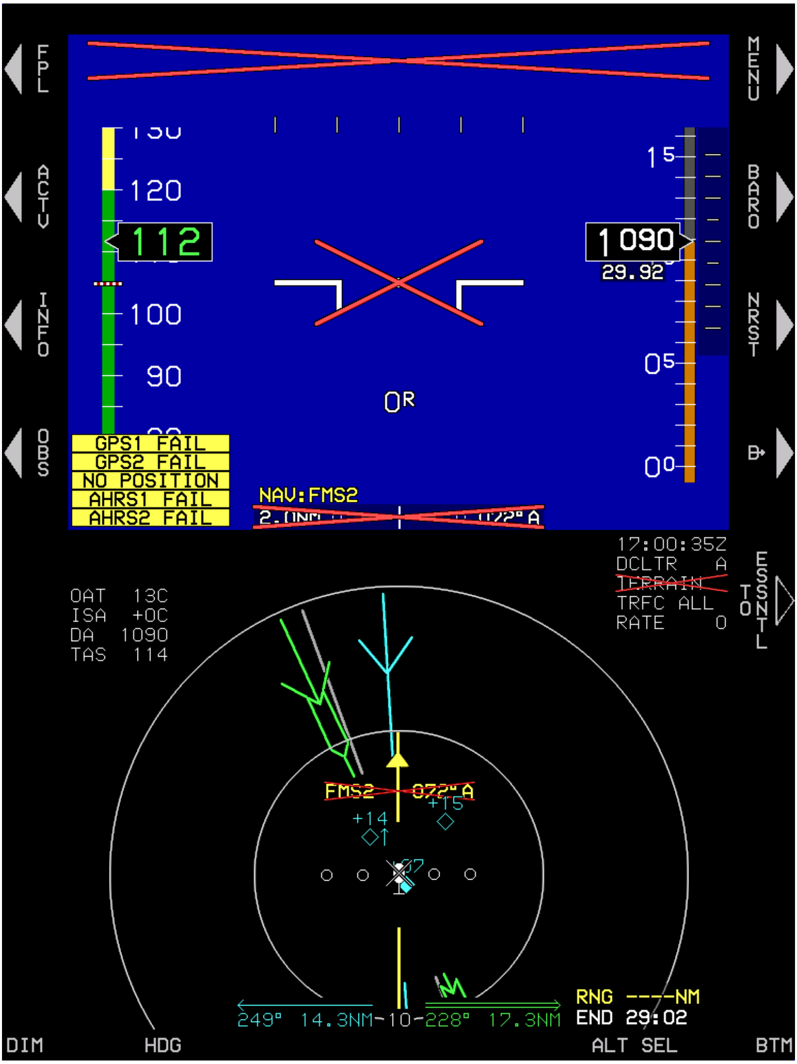


Figure 4-20: PFD Failure Mode 5 (Normal Mode)
GPS/SBAS and AHRS Failed, ADC Normal (Tapes)

4.7.1. MFD Failure Mode 5 (Normal Mode) (Round Dials)

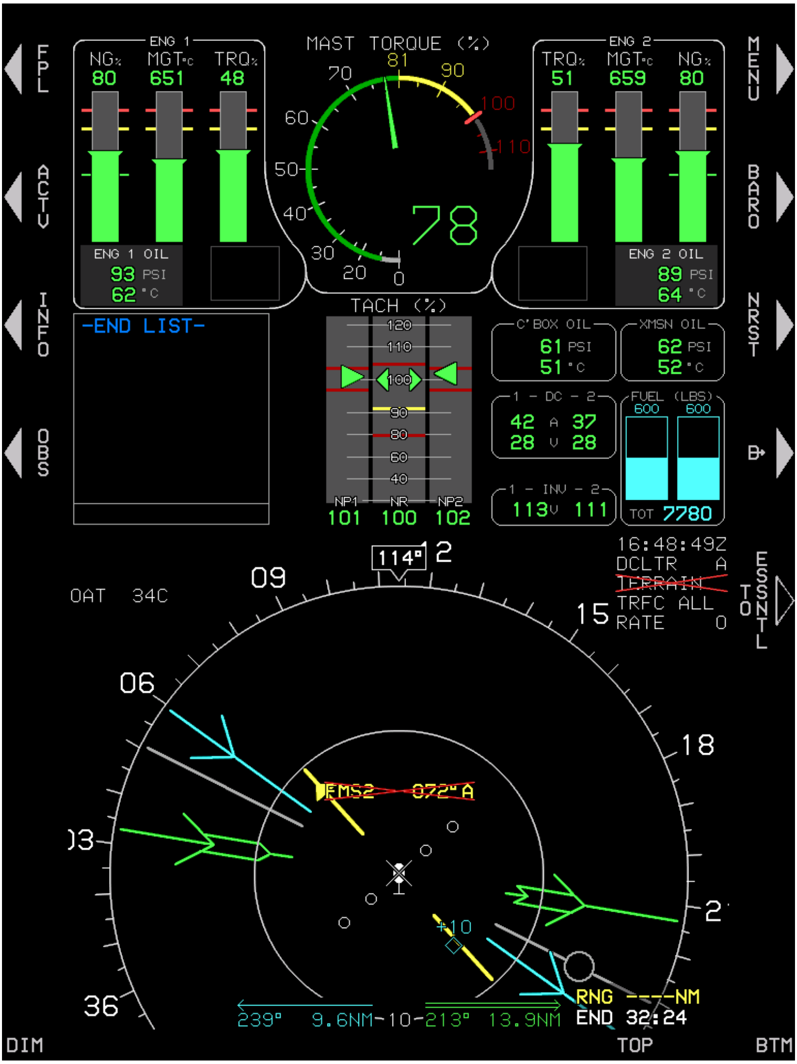


Figure 4-21: MFD Failure Mode 5 (Normal Mode) GPS/SBAS and AHRS Failed, ADC Normal (Round dials)

4.7.2. MFD Failure Mode 5 (Normal Mode)

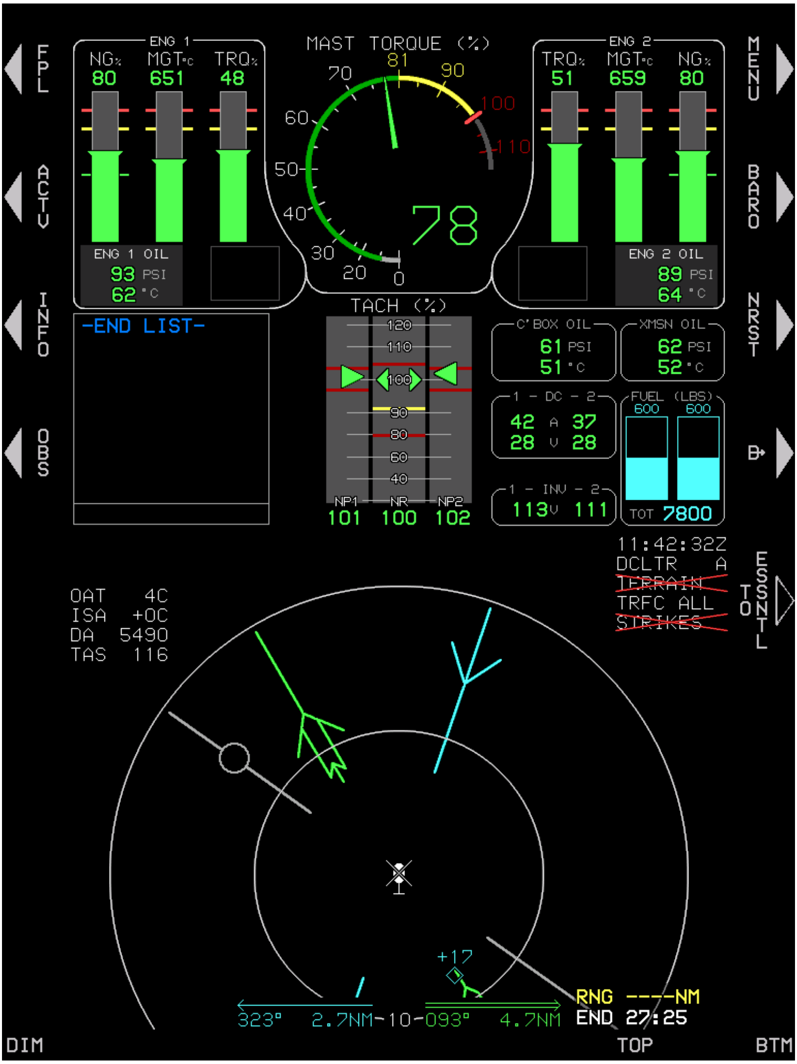


Figure 4-22: MFD Failure Mode 5 (Normal Mode)
GPS/SBAS and AHRS Failed, ADC Normal

4.7.3. MFD Failure Mode 5 (Essential Mode) (Tapes)

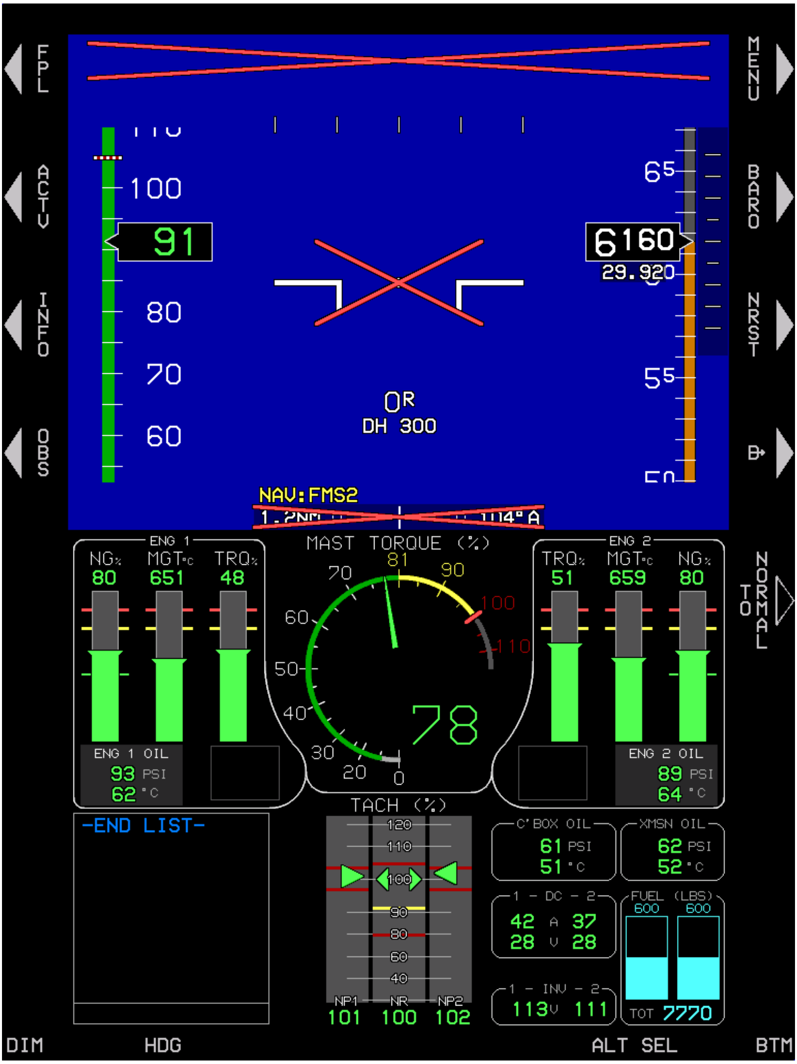


Figure 4-23: MFD Failure Mode 5 (Essential Mode) GPS/SBAS and AHRS Failed, ADC Normal (Tapes)

4.8. PFD Failure Mode 6 (Normal Mode) (Tapes)

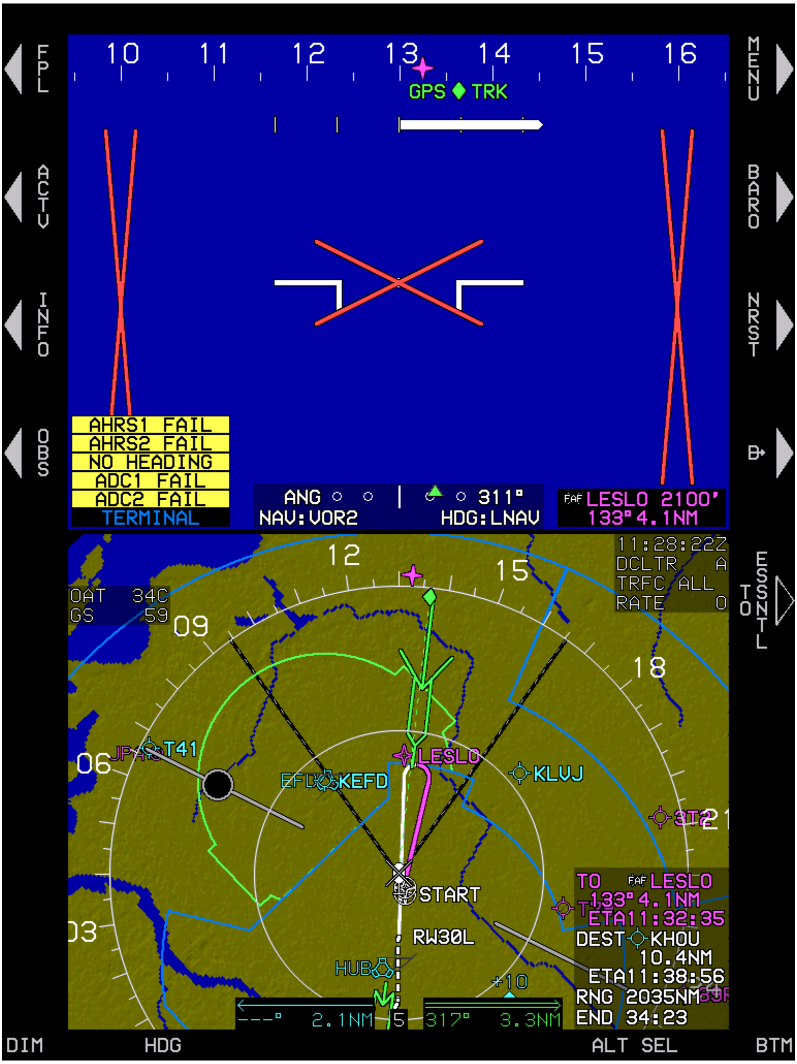


**Figure 4-24: PFD Failure Mode 6 (Normal Mode)
ADC and AHRS Failed, GPS/SBAS Normal (Tapes)**

4.8.1. PFD Failure Mode 6 (Normal Mode) (Round Dials)

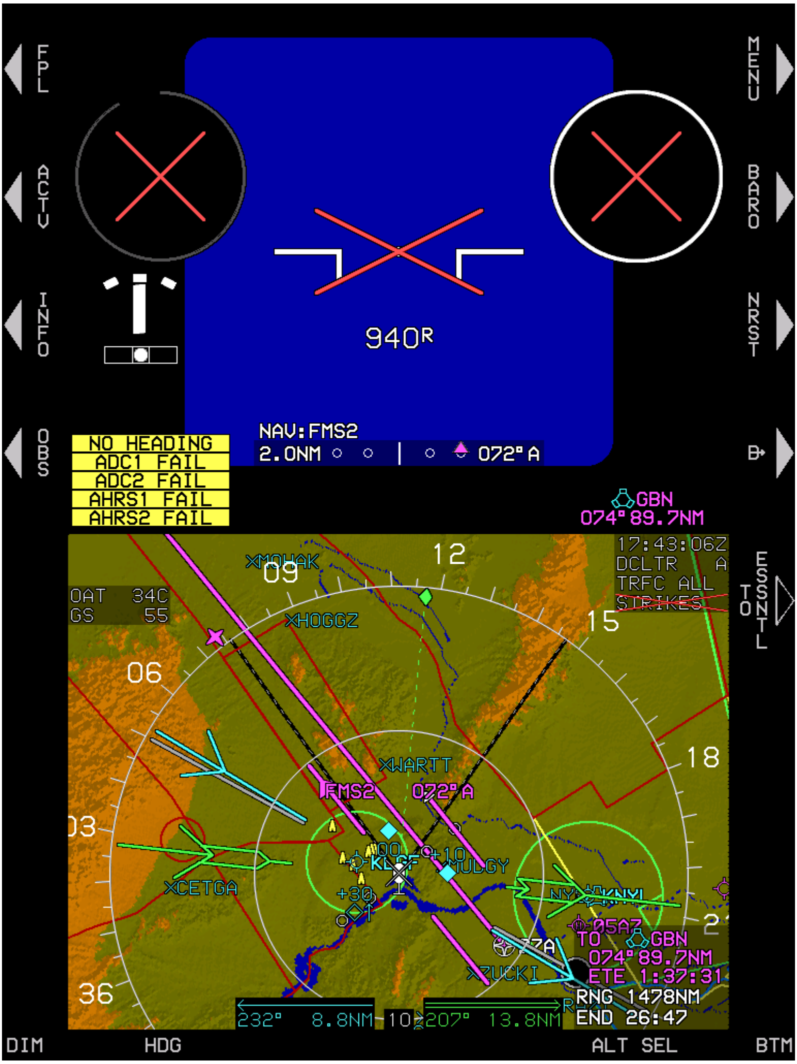


Figure 4-25: PFD Failure Mode 6 (Normal Mode)
ADC and AHRS Failed, GPS/SBAS Normal (Round Dials)

4.8.2. MFD Failure Mode 6 (Normal Mode)

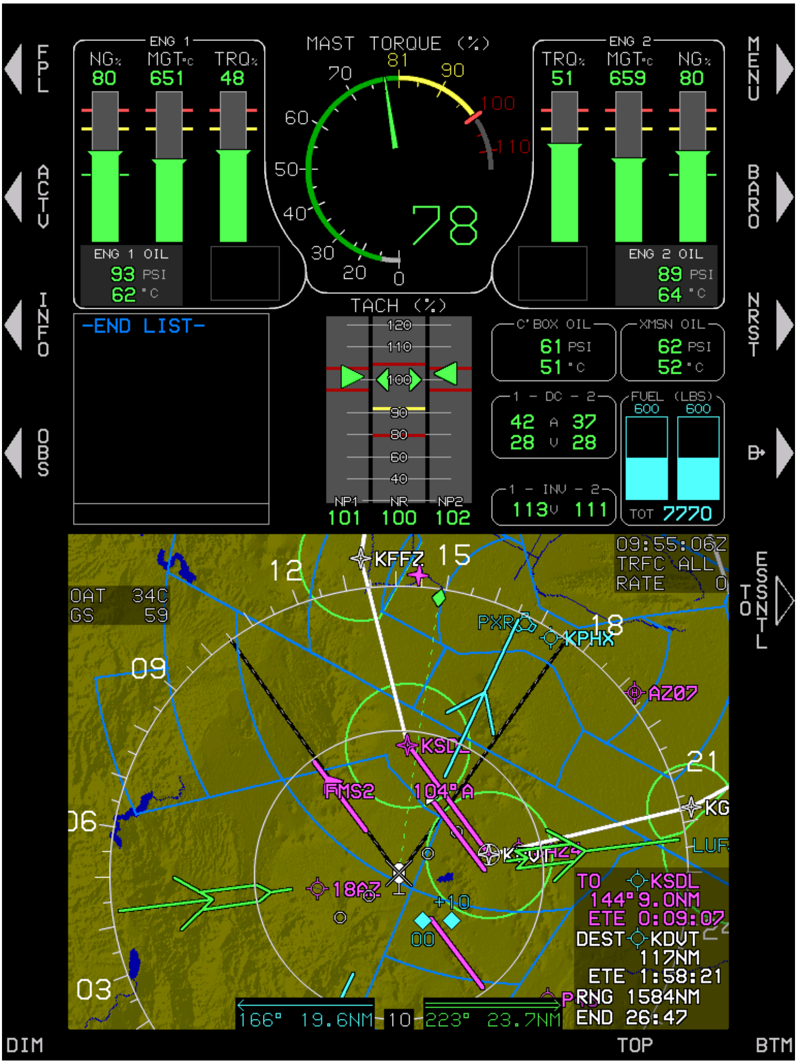


Figure 4-26: MFD Failure Mode 6 (Normal Mode)
ADC and AHRS Failed, GPS/SBAS Normal

4.8.3. MFD Failure Mode 6 (Essential Mode) (Tapes)

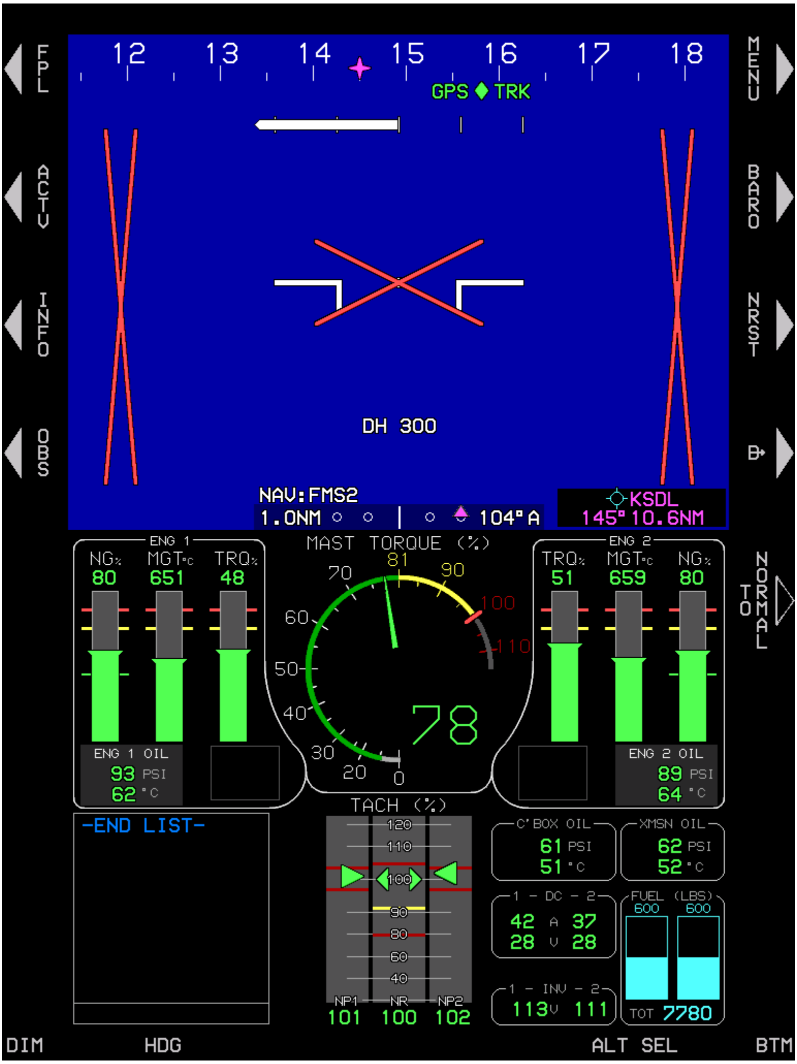


Figure 4-27: MFD Failure Mode 6 (Essential Mode) ADC and AHRS Failed, GPS/SBAS Normal (Tapes)

4.9. PFD Failure Mode 7 (Normal Mode) (Tapes)

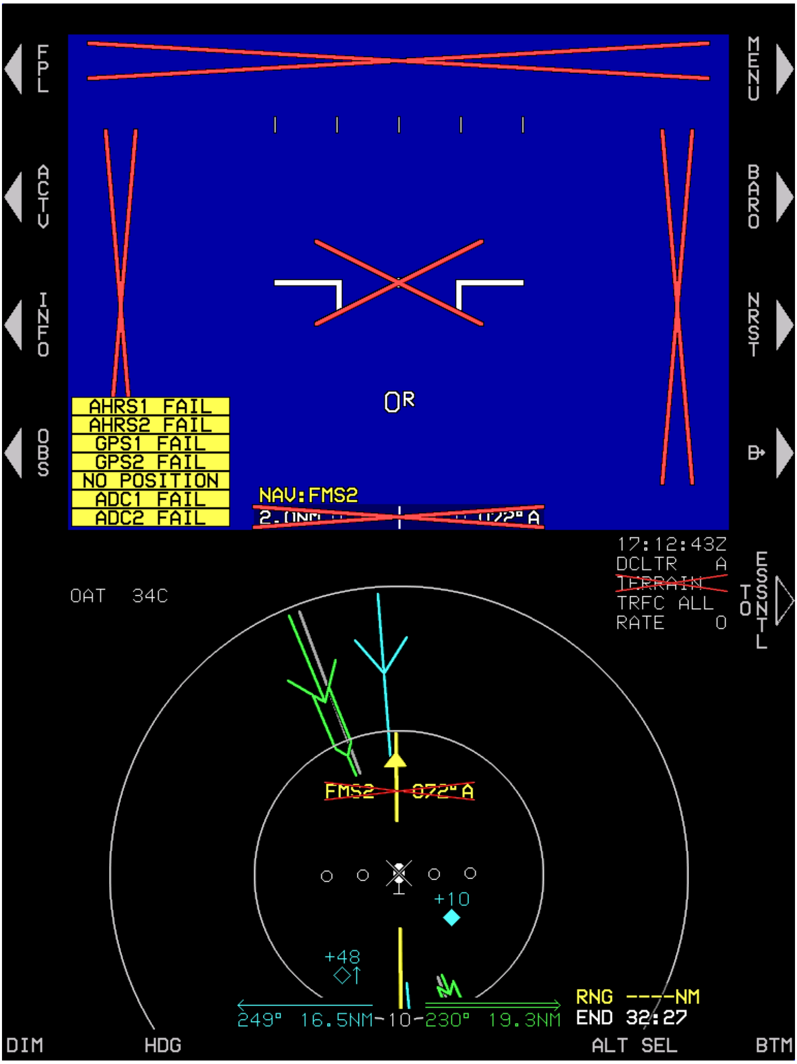


Figure 4-28: PFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS Failed (Tapes)

4.9.1. PFD Failure Mode 7 (Normal Mode) (Round Dials)

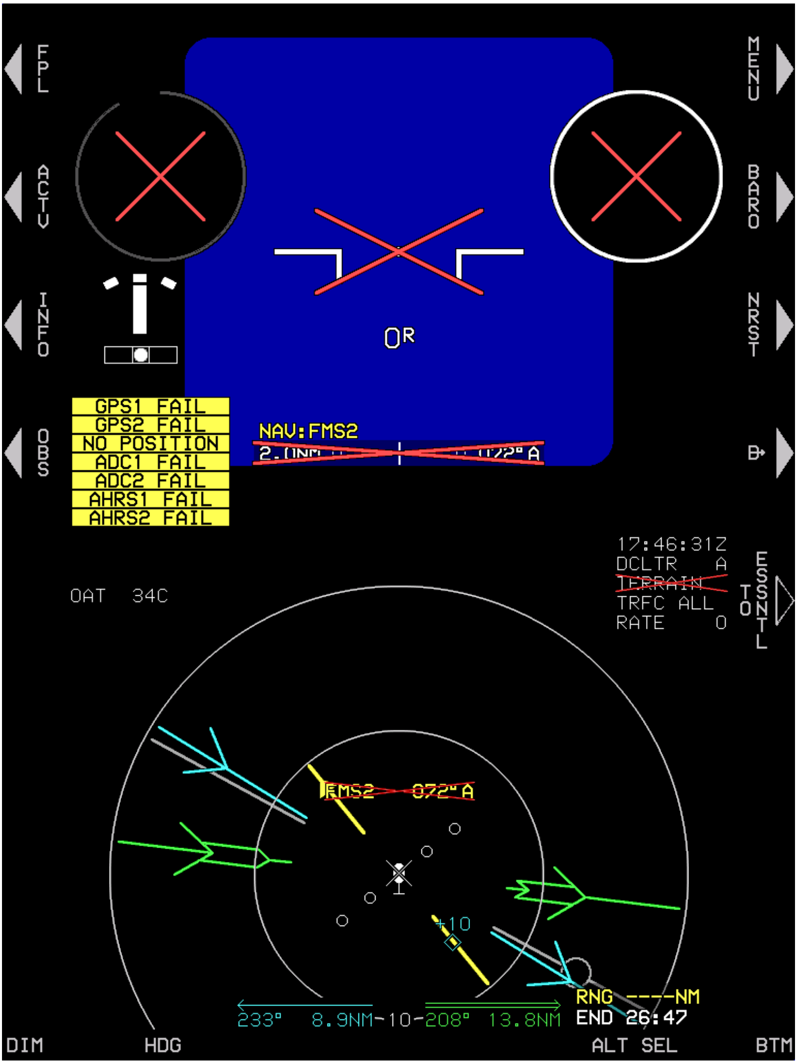


Figure 4-29: PFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS Failed (Round Dials)

4.9.2. MFD Failure Mode 7 (Normal Mode)

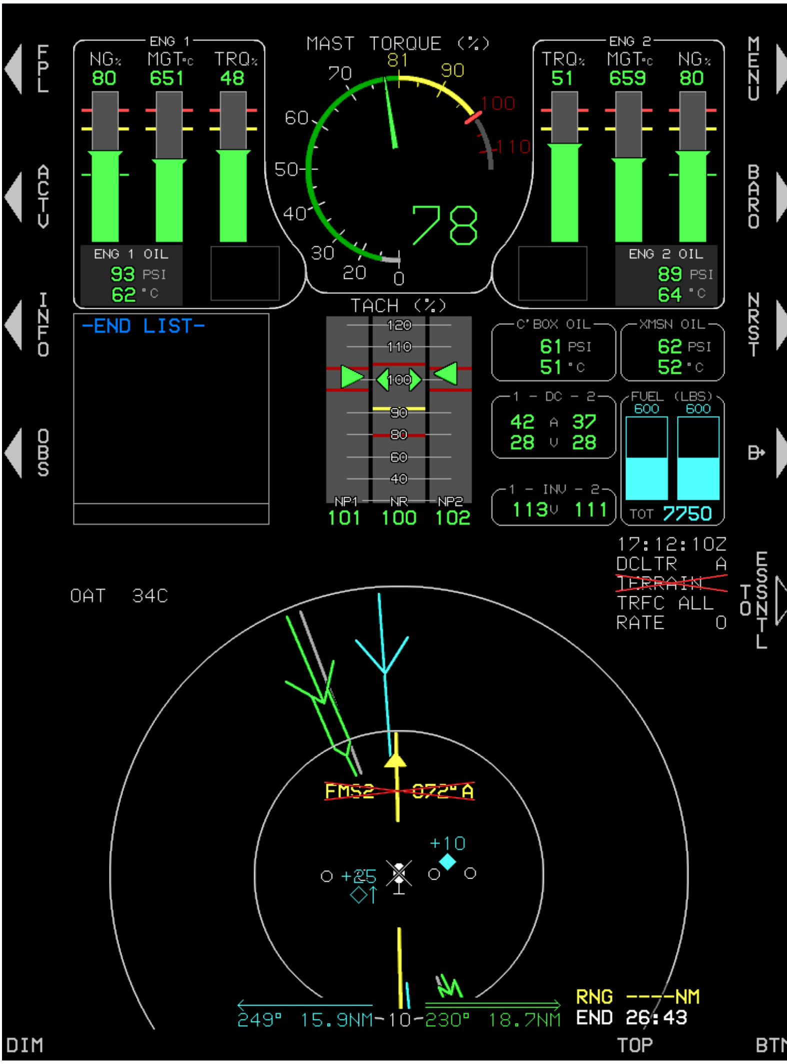
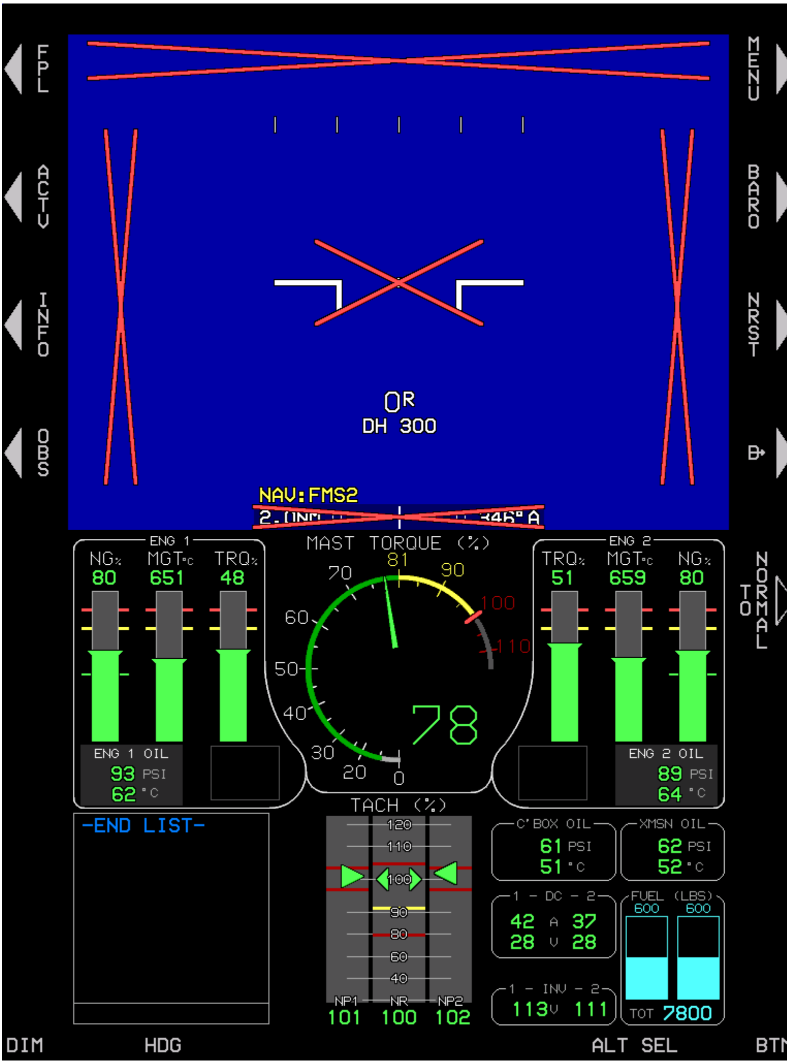


Figure 4-30: MFD Failure Mode 7 (Normal Mode)
GPS/SBAS, ADC and AHRS Failed

4.9.3. MFD Failure Mode 7 (Essential Mode) (Tapes)



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Section 5 Menu Functions and Step-By-Step Procedures

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5.1. Menu Functions

Navigate menu functions with the 16 peripheral buttons and three rotary encoders (❸, ❷, and ❶). The encoder in the lower left corner 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

5.2. 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 according to 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
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
AHRS 1 and 2 mode and slewing values	
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" is false.
Emergency and Minimum Fuel Settings	
Heading Bug	
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	
Audio-Radio device parameters	
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.	
Active Flight Plan Parameters	
Runway Display Parameters	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Decision Height Setting	Used when “Dual Decision Height Flag” is true.
Navigation Source	
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 Skyway Show Flag	
PFD Terrain Show Flag	
PFD Traffic Show Flag	
Weather Radar Scale	Onside because range is controlled by the weather radar.
Audio-Radio device parameters	
Rate of turn indication flag	
WX RDR 2XXX Radar Control Menu parameters	
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	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
of these parameters are also independent between top and bottom 680 MFD areas as specified in the notes.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.
MFD Map and HSI Page Pointer Settings	Independent between top and bottom 680 MFD areas
MFD Map Function Declutter Settings	Independent between top and bottom 680 MFD areas
MFD Show ETA Flag	
MFD Map NavData Symbol Declutter Settings	Independent between top and bottom 680 MFD areas

5.3. Menu Function Types

On the IDU-680, only soft menu functions are used (even at the top-level) and are annunciated in a dedicated, blacked-out area in the screen margins. Soft menu function tiles indicate further menu levels with a filled triangle (with further levels) or hollow triangle (without further levels) pointing to the associated button. Soft menu function tiles appear next to the appropriate IDU button or one of the rotary encoders when appropriate. Menus adjacent to rotary encoders are frequently a selection list format. Within selection lists, the indication of further menu levels consists of a two-dot trailer. Selection lists too long to be presented in the space available provide an indication of location within the list. When the menu system is beyond the top-level, **EXIT (R1)** provides a one-touch escape to the top level. When a soft menu level is deeper than the first level, **BACK (L1)** regresses through the menu system by one level.

5.4. Top-Level Menu

On the IDU-680, the top-level menu consists of soft menu options along with option labels for the rotary encoders.

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

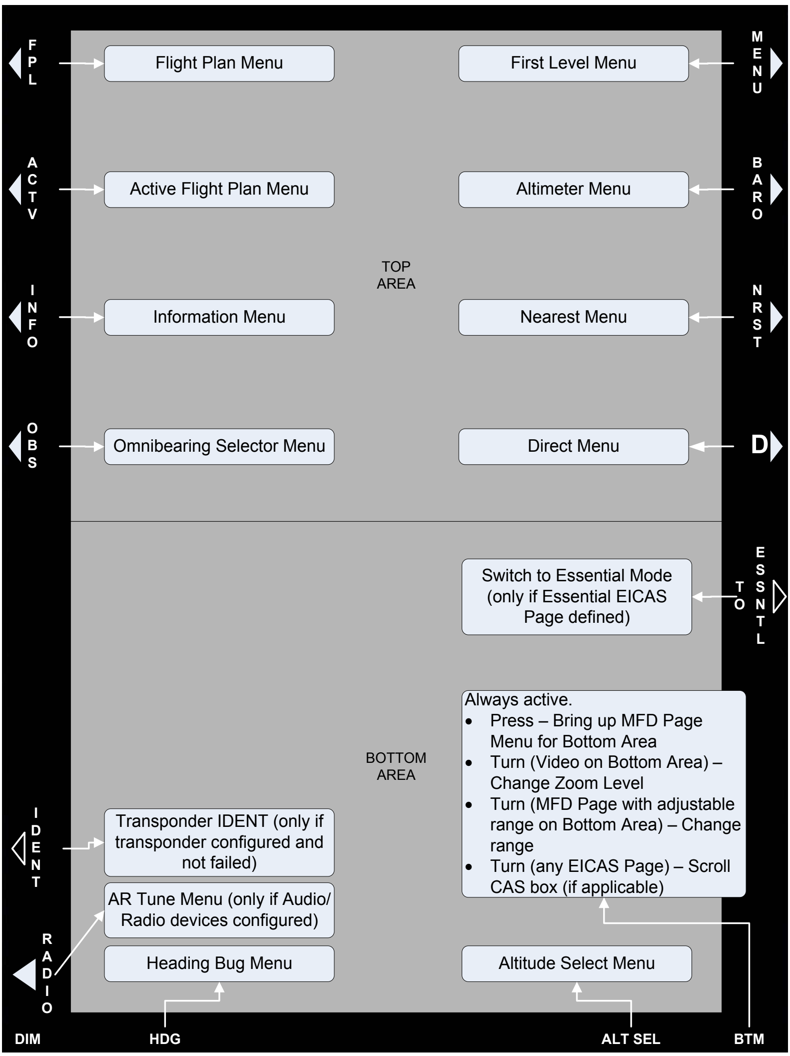


Figure 5-2: PFD Normal Mode Top-Level Menu

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

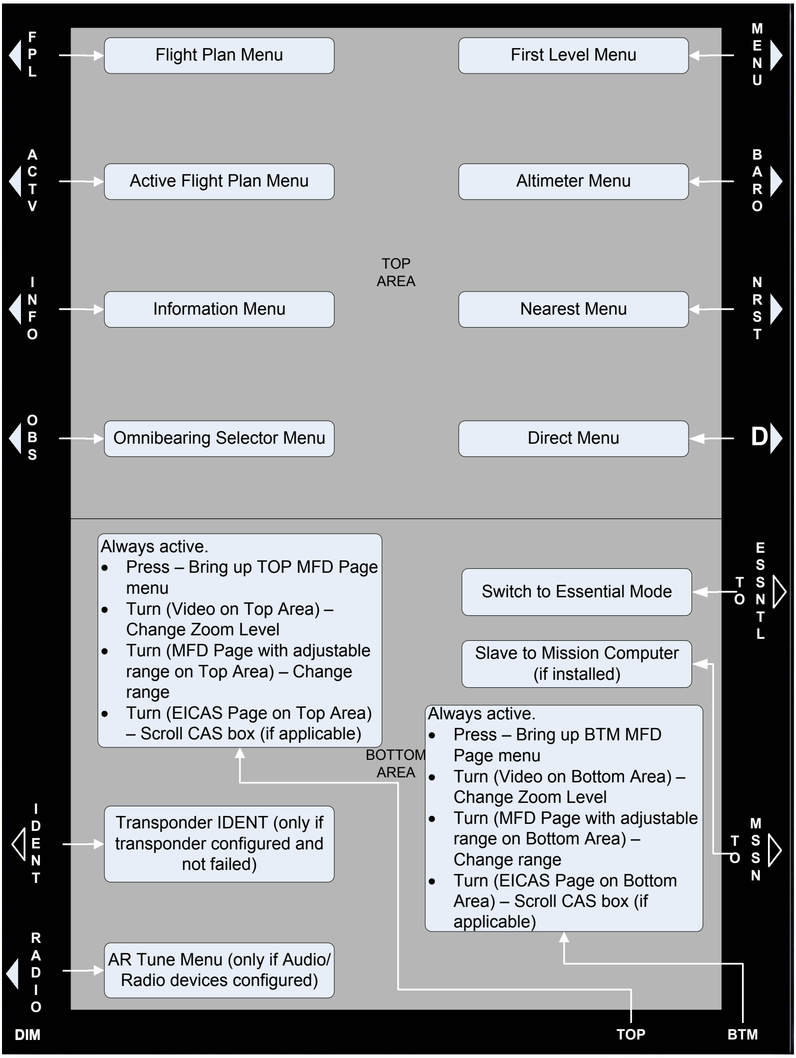


Figure 5-3: IDU-680 MFD Normal Mode Top-Level Menu

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

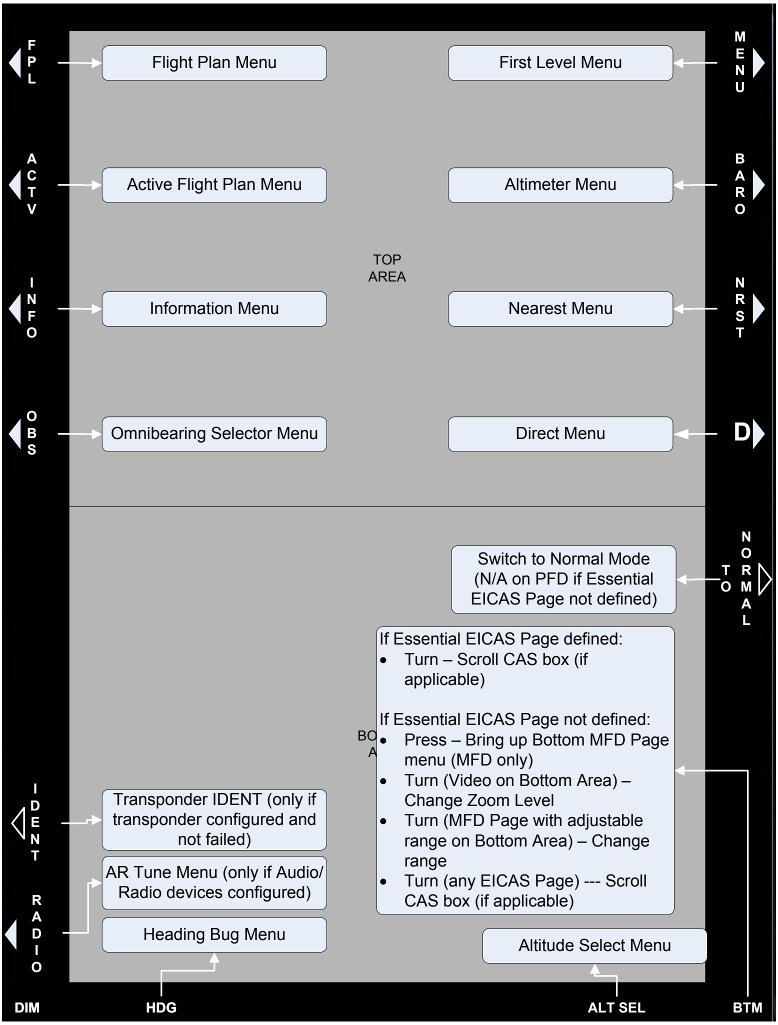


Figure 5-4: IDU-680 PFD or MFD Essential Mode Top-Level Menu

5.4.4. 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) **MENU (R1)**: First-level associated with the current display page and automatically times out after ten seconds if there are no subsequent pilot actions.

6) **BARO (R2)**: Altimeter menu option.

7) **NRST (R3)**: Nearest menu option.

8) **(R4)**: Direct menu option.

9) **TO ESSNTL/TO NORMAL (R5)**: Switches between Normal and Essential modes.

10) **TO MSSN (R7)**: Switches control of the screen to an external DVI source if configured and there is no discrete input configured to perform this function.

11) **#3 Encoder (❸)**: Function depends upon IDU number and mode (Normal vs. Essential) as follows:

    a) On a PFD (IDU #1), push ❸ to sync current heading and scroll to activate the Heading menu.

    b) On an MFD (IDUs other than #1) operating in Essential Mode, push ❸ to sync current heading and scroll to the Heading menu.

12) **#2 Encoder (❷)**:

    a) On a PFD (IDU #1), any encoder action activates the target altitude selection function of the PFD Bugs menu. The encoder is labeled **ALT SEL**.

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

    c) On an MFD (IDUs other than #1) operating in Normal Mode, if the top area is showing a video page, scroll the encoder to change the zoom level (CW to increase zoom, CCW to decrease zoom).

d) On an MFD (IDUs other than #1) operating in Normal Mode, if the top area is showing an EICAS with a CAS box, scroll the encoder to progress the CAS box.

e) On an MFD (IDUs other than #1) operating in Normal Mode, press the encoder to activate the TOP MFD Page Menu as described in the MFD Page Menu section. The TOP MFD Page Menu is drawn above ❷, 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.

f) On an MFD (IDUs other than #1) operating in Essential Mode, the encoder is labeled TOP when either an encoder scroll or press has an effect.

g) On an MFD (IDUs other than #1) operating in Essential Mode, any encoder action activates the target altitude selection function of the PFD Bugs menu. The encoder is labeled ALT SEL.

5.4.5. #1 Encoder (❶)

1) 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, or Weather Radar), scroll the encoder to change the display scale (clockwise = increase scale, counterclockwise = decrease scale).

2) On a PFD or MFD operating in Normal Mode, if the bottom area is showing a video page, scroll the encoder to change the zoom level (clockwise = increase zoom, counterclockwise = decrease zoom).

3) 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 the encoder to progress the CAS box.

4) On a PFD or MFD operating in Normal Mode, if the bottom area is showing an Audio/Radio page, scroll the encoder to change

the selected Audio/Radio device volume and or mute function if applicable.

5) On a PFD or MFD operating in Essential Mode with an EICAS configured, if the EICAS includes a CAS box, scroll the encoder to progress the CAS box.

6) In Normal Mode or Essential Mode without an Essential EICAS page configured, push the encoder to activate the MFD bottom page menu option as described in the MFD Page menu section. The pilot may have selected a full screen EICAS page in the top area consuming both the top and bottom areas. In this case, completion of the MFD Page menu action automatically switches the EICAS page in the top area to its related "backup" displays.

   a) ❶ is labeled **BTM** but is not labeled in Essential Mode with an Essential EICAS page configured, and the EICAS page does not include a CAS box.

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

Under certain conditions, soft menu tiles automatically appear at the top-level to provide single-touch access to needed functions. The following soft menu tiles appear adjacent to the specified pushbutton under the specified conditions.

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

Note 1	Note 2	Precedence, Tile Legend, and Action
L1	**L5**	1) As specified in Section 8 TAWS, **RESET** appears when a terrain popup occurs during a TAWS FLTA alert. 2) When showing 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," **LNAV** appears when there is an active flight plan, heading bug sub-mode is active, and the system is integrated with

Table 5-2: Top-Level Auto Pop-Up Function Descriptions		
Note 1	**Note 2**	**Precedence, Tile Legend, and Action**
		an analog autopilot. Press to deactivate heading bug sub-mode and resume guidance to active flight plan path. **RESET** and **PN OFF** have precedence over **LNAV**. 4) When display is "transmit enabled," **MISS** appears upon transitioning the Final Approach Fix. Press to activate missed approach procedure. **RESET**, **PN OFF**, and **LNAV** have precedence over the **MISS**. 5) When display is "transmit enabled," **CONT** appears when in a holding pattern with further active flight plan legs after the holding pattern. Press to re-enable automatic waypoint sequencing to allow normal sequencing to leg after the holding pattern. **RESET, PN OFF** and **MISS** have precedence over **CONT**.
L2	**L6**	1) When showing 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** allows display of textual METAR and TAF data for the airport. 2) When display is "transmit enabled," **ARM** appears when on Final Approach Segment (between Final Approach Fix and Missed Approach Point). Press to arm missed approach procedure to automatically activate upon sequencing Missed Approach Point. **UP**, **WX**, and **VNAV** have precedence over **ARM**. 3) When display is "transmit enabled," **VNAV** appears when VNAV guidance is valid, selected altitude sub-mode is

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

Note 1	Note 2	Precedence, Tile Legend, and Action
		active, and the system is integrated with an analog autopilot. Press to deactivate selected altitude sub-mode and resume guidance to VNAV path. **UP** and **WX** have precedence over **VNAV**.
L3	**L7**	When showing ND Page with Pan Mode enabled, **NORTH** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.
L4	**L8**	When showing ND Page with Pan Mode enabled, **SOUTH** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.
R2	**R6**	When showing ND Page with Pan Mode enabled, **INFO** or **HIDE** appears. Press to toggle information for nearest highlighted waypoint. Refer to INFO menu requirements for amount and type of information presented.
R3	**R7**	When showing ND Page with Pan Mode enabled, **EAST** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.
R4	**R8**	When showing ND Page with Pan Mode enabled, **WEST** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.

Note 1: Designated buttons used when the function is tied to a page in the top area.

Note 2: Designated buttons used when the function is tied to a page in the bottom area or tied to being “Transmit Enabled.”

5.5. First Page (PFD)

The 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.

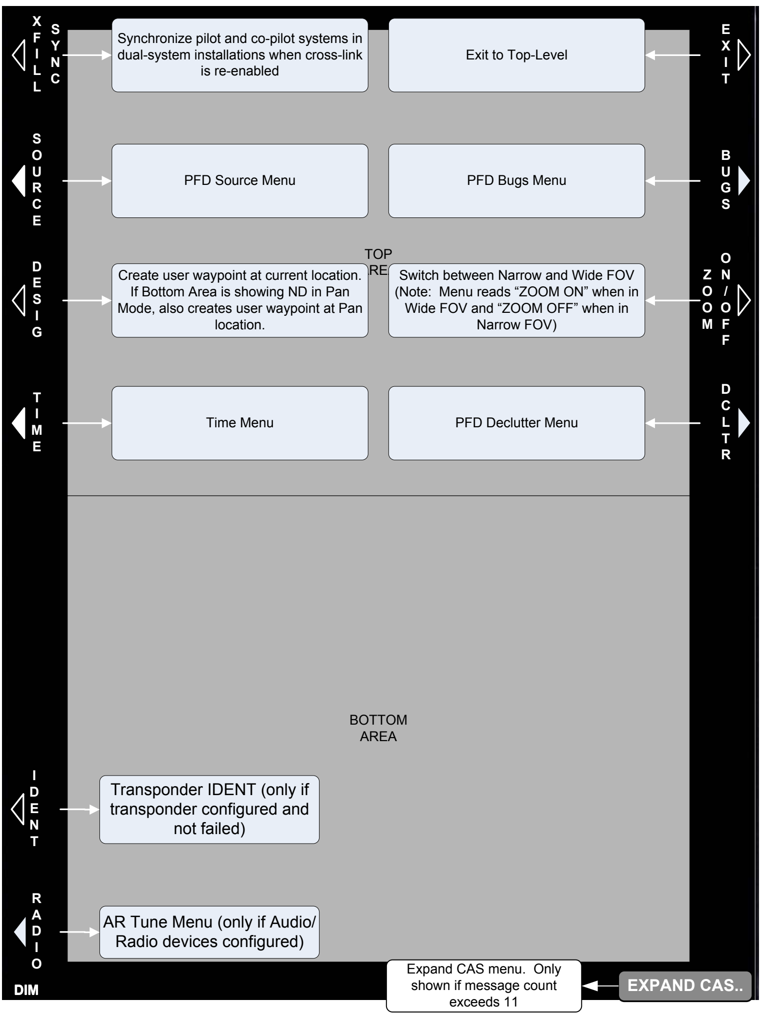


Figure 5-5: First Page PFD

5.5.1. First Level (PFD IDU#1) Normal Mode

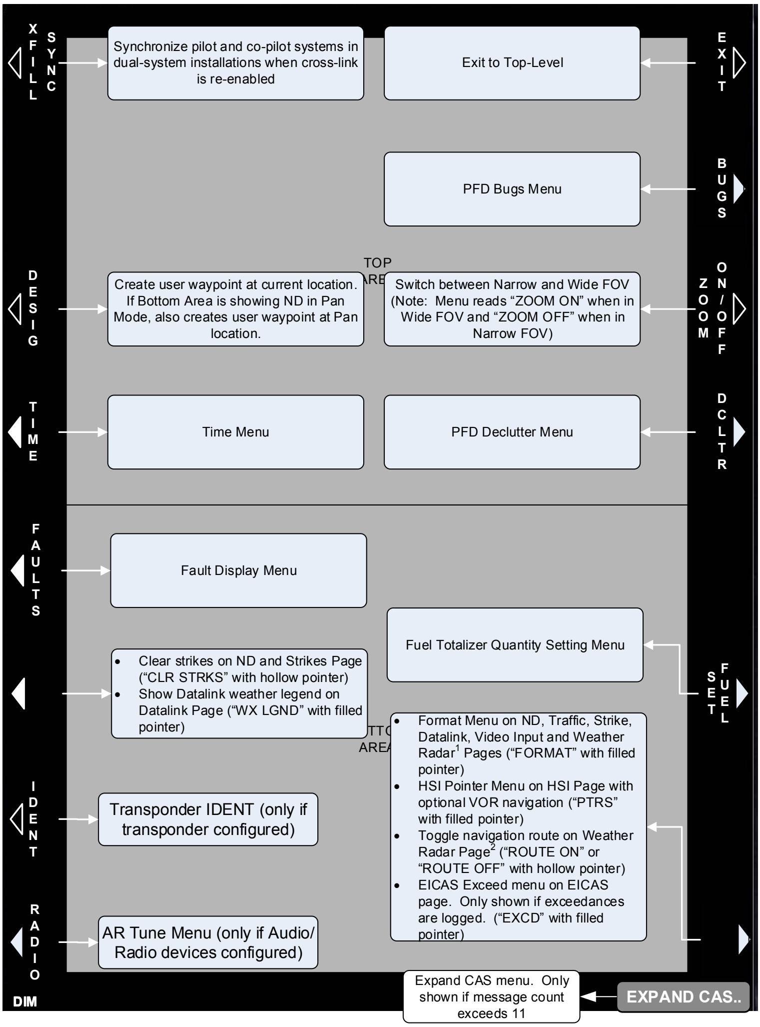


Figure 5-6: First Level PFD

5.5.2. PFD Page First-Level Option Descriptions

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 other system from where the button press occurred as described in Table 5-3.

Table 5-3: Crossfill Inhibit/Arm/Sync Function

Crossfill (1)	Flight Plan	Indication (Pilot and Co-pilot)	Action to Synchronize Flight Plans: Pilot	Action to Synchronize Flight Plans: Co-pilot	Result
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

Table 5-3: Crossfill Inhibit/Arm/Sync Function
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)**: Activates PFD source selection menu option.

3) **DESIG (L3)**: Creates a user waypoint at current aircraft location. In addition, if pressed on an IDU-680 with an ND page operating in panning mode, creates a user waypoint at the panning location. User waypoint is automatically be named “OF###,” where ‘###’ is the next available over-fly user waypoint number. When pressed and the number of user waypoint count is more than 998, the IDU displays "**USER WPTS FULL**" message.

4) **TIME (L4)**: Activates the timer menu option.

5) **BUGS (R2)**: Activates the PFD bug set menu option.

6) **ZOOM ON/ZOOM OFF (R3)**: Toggles between wide FOV mode and narrow FOV mode. **ZOOM ON** appears when the mode is wide FOV. **ZOOM OFF** appears when the mode is narrow FOV.

7) **DCLTR (R4)**: Activates the PFD declutter menu option.

8) **EXPAND CAS (➊)**: Activates the Expand CAS menu option only when there are more than 11 active CAS messages.

5.6. First Level (MFD)

The bottom area of all IDUs always shows the MFD Page in all modes (Essential EICAS page is considered an 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 area, the option is only shown adjacent to the top area. (Options spelled the same but affect different areas of the screen are not identical.)

NOTE:

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

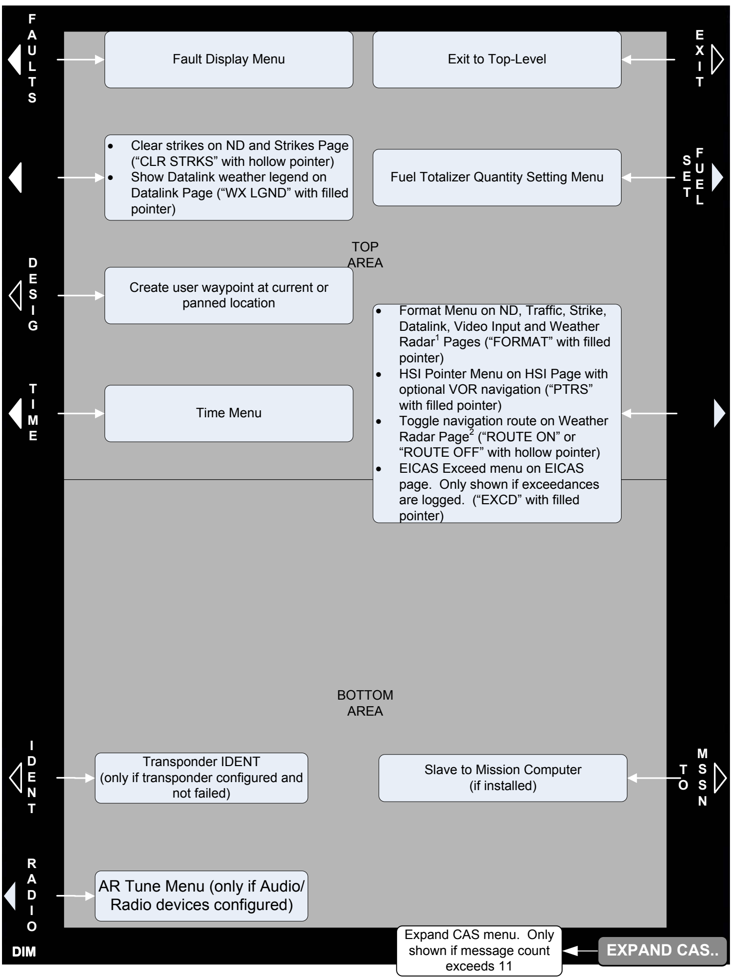


Figure 5-7: First Level MFD

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

MFD Page in both areas.

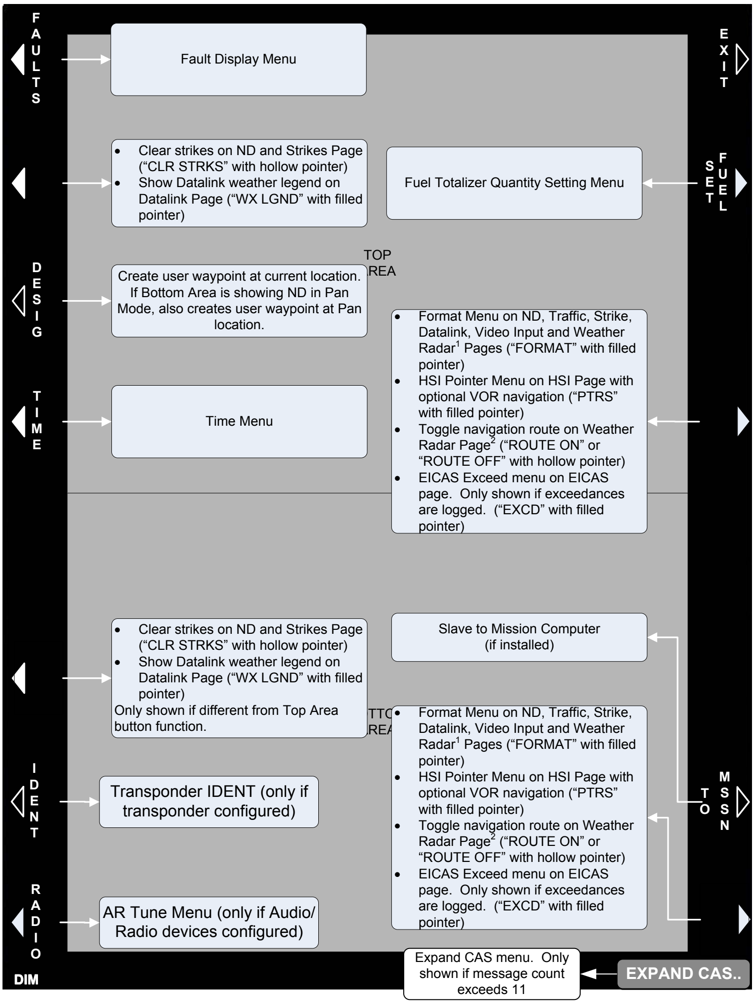


Figure 5-8: First Level (MFD IDU other than #1) Normal Mode

5.6.2. 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) **SET FUEL (R2)**: Activate fuel totalizer set menu option.

5) **PAGE**: On MFD, press ❶ and ❷ to perform function at the top-level.

6) **FORMAT: PTRS (R8)**, **ROUTE ON/ROUTE OFF (R8)**, or **EXCD (R8)**: On the ND, **FORMAT** activates the appropriate page format menu option.

    a) **PTRS**: On HSI page with optional VOR or ADF symbology enabled, activates HSI RMI pointer menu option.

    b) **ROUTE ON/ROUTE OFF**: On the Weather Radar page, **ROUTE ON/OFF** toggles the display of the active flight plan on the horizontal weather radar display. **ROUTE ON** appears when the display of the active flight plan is disabled. **ROUTE OFF** appears when display of the active flight plan is enabled.

    c) **EXCD**: On a generic EICAS page of type EICAS, **EXCD** activates the EICAS Exceedance menu option. **EXCD** only appears if exceedances are logged.

7) **TO MSSN (R7)**: (With DVI input only) Switch control of the screen to an external DVI source. If the discrete input is configured to perform this function this menu option does not appear.

8) **EXPAND CAS** (❶): Activates the Expand CAS menu option only when there are more than 11 active CAS messages.

5.6.3. 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.

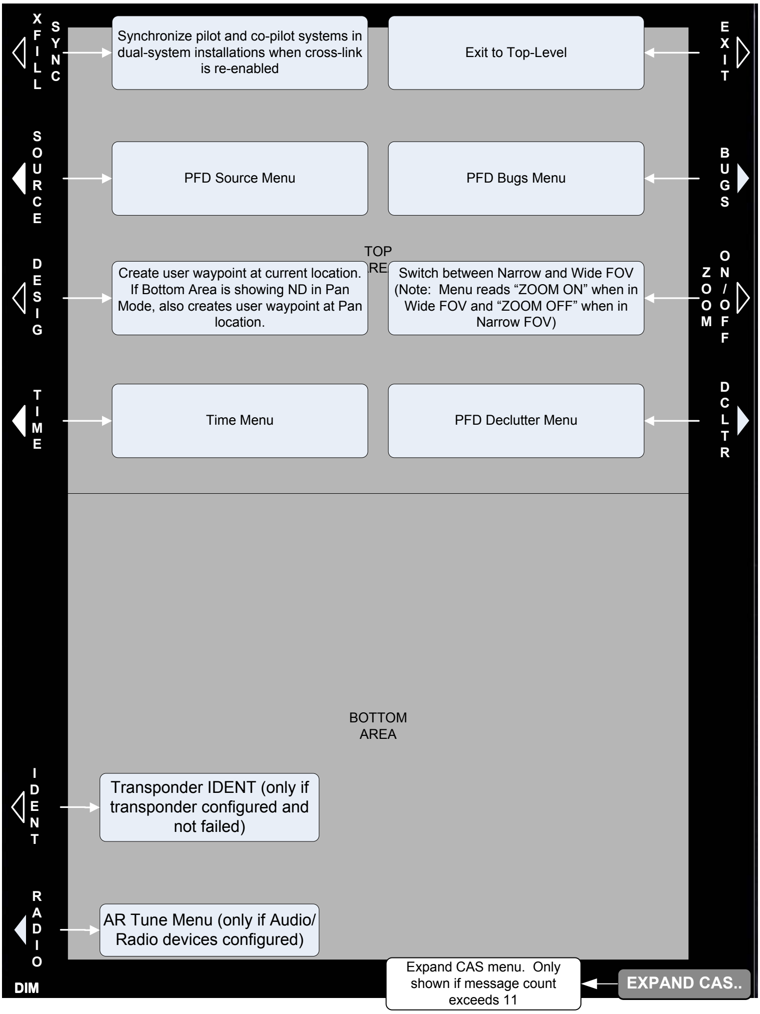


Figure 5-9: PFD Page in Top Area and Essential Mode EICAS Page in Bottom Area

5.6.4. EICAS Page First-Level Option Descriptions

1) **SET FUEL**: Same function as MFD Page First-level.

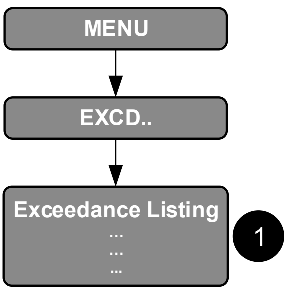
2) **PAGE 1 through PAGE 5** (only applicable in Normal Mode): Allows selection of optionally configured EICAS pages. Menu

tile text is as configured in the EICAS configuration file. Options are only shown if more than one EICAS page is configured and only shown for configured EICAS pages.

3) **EXPAND CAS (❶)**: Activates the Expand CAS menu option only when there are more than 11 active CAS messages.

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

5.7. EICAS Exceedance Menu



EICAS Exceedance menu presents a listing of logged EICAS exceedances. Scroll ❶ to view each line. The format for each exceedance line is the following:

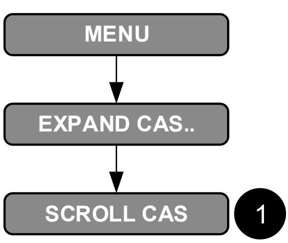
1) Exceedance element name;

2) Logged peak value in element units; and

3) Logged duration in hh:mm:ss format.

Figure 5-10: EICAS Exceedance Menu

5.8. Expand CAS Menu



Expand CAS menu changes the display of CAS messages from a stacked presentation to a CAS display box view off-screen messages when the message count exceeds 11. In the Expand CAS menu, ❶ is dedicated to scroll the CAS display box.

Figure 5-11: Expand CAS Menu

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

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

2) Scroll ❶ to view additional CAS messages.

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

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

5.9. Lower-Level Menus (Below First-Level)

The 16 pushbuttons and rotary encoders on IDU-680, which control the top-level and first-level menus, called lower-level menus, are described in this section. In the following diagrams, button and encoder numbers are interpreted according to the following view.

Figure 5-12: IDU-680 Input Controls Flight Plan (FPL) Menu

5.10. Flight Plan (FPL) Menu

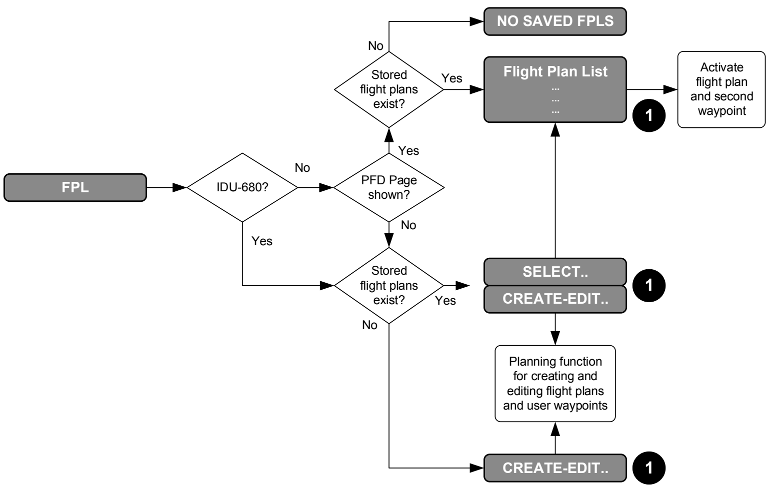


Figure 5-13: Flight Plan Menu

5.10.1. Flight Planner Page

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.

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:

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 takes over the IDU's controls and disables the menu operations described in this document (other than the automatic

IDU-680 EICAS page reversions described above). 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. Automatic reversion exits the Flight Planner Page and wipes out any changes being performed.

Because the Flight Planner page takes over the IDU's controls, limitations are placed upon access and display of the Flight Planner page as follows. When the Flight Planner page is accessed, the Flight Planner page only appears in the bottom area.

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 640x480 EICAS page.

5.10.2. PFD Page Shown on IDU

Upon activation of the flight plan menu, the application checks for the existence of saved flight plans. If there are no saved flight plans, **NO SAVED FPLS** encoder message is issued. Otherwise, a selection list of saved flight plans is presented. Upon selection of a saved flight plan, the second waypoint in the flight plan is activated.

5.10.3. No PFD Page Shown on IDU

Upon activation of the flight plan menu, the application checks for the existence of saved flight plans. If there are no saved flight plans, the Flight Planner page is activated. Otherwise, an option list is presented for the pilot to either select a saved flight plan or enter the flight planning page. Choose the saved flight plan select option for a list of saved flight plans. Upon selection of a saved flight plan, the second waypoint in the flight plan is activated.

5.10.4. 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 in sequence overfly user waypoint number available.

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.

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

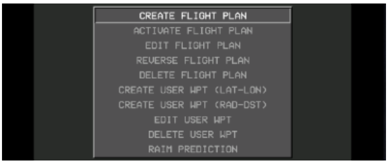
1) Press **FPL (L1)**.

2) Scroll ❶ to desired flight plan and push to enter.

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

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

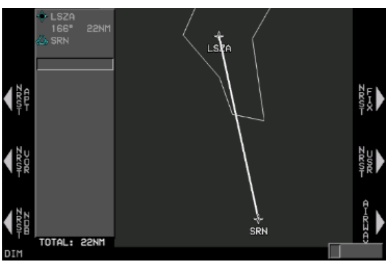
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.



3) Push ❶ to enter.

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

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



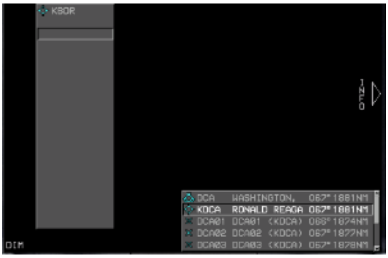
1) Press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, **NRST USR (R7)**, or **AIRWAY (R8)** to view applicable list, scroll ❶ to desired selection. Push to insert into flight plan.

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

3) If necessary scroll up to KBDR.

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

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



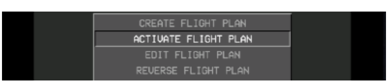
1) Scroll ❶ to next space and add another waypoint. Push to enter waypoint.

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

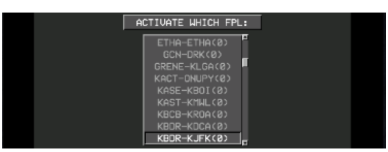
5.10.9. Activate Flight Plan (Step-By-Step)

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

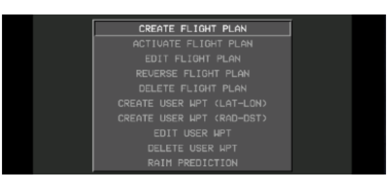
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.



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



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

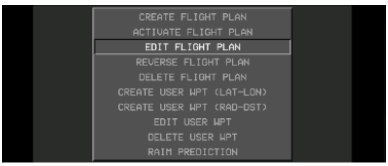


5) Press **EXIT (R1)** if no other action is necessary.

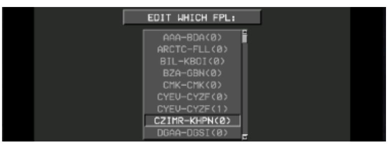
5.10.10. Edit Flight Plan (MFD only) (Step-By-Step)

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

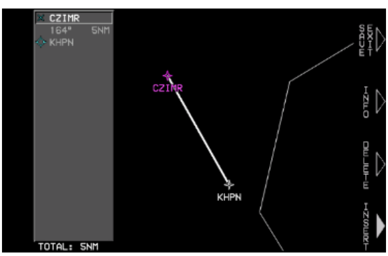
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.



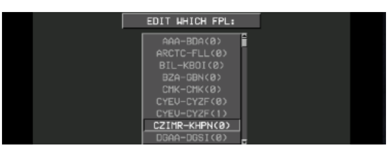
3) Scroll ❶ to **EDIT FLIGHT PLAN** and push to enter.



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



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



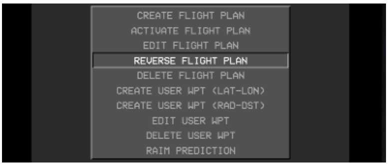
6) Press **SAVE (R8)** to save and exit to **EDIT WHICH FPL:** list.

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

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

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

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



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

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

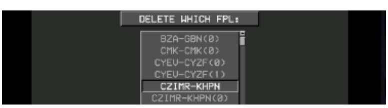
5) If no other flight plan to reverse, press **EXIT (R1)**.

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

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

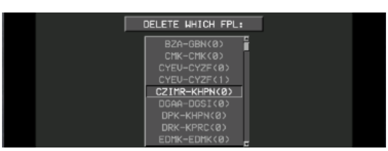
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.

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



4) Scroll ❶ to desired flight plan to delete. Push to enter.

5) Push ❶ to **CONFIRM DELETE FPL**.



6) The next flight plan is highlighted.

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

5.10.13. 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 ❶ to **CREATE-EDIT..** and push to enter.

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

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

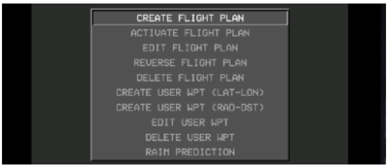
5) With new name created for user waypoint, continue to push ❶ to proceed through all fields as necessary.

Preloading of the approach bearing is dependent upon mode of flight as follows:

On Ground: Preloaded with current heading

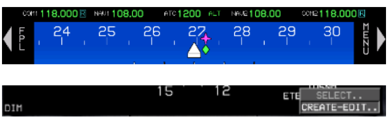
In Flight: Preloaded with "OFF" value.

If desired, specify the approach bearing to the user waypoint in degrees 1°-360°. "OFF" value disables VFR approaches to the user waypoint.



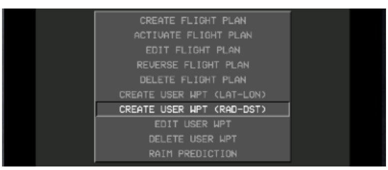
6) Once all fields are entered, push ❶ to save the user waypoint and return to editing screen.

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

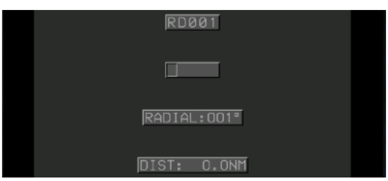


1) Press **FPL (L1)**.

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

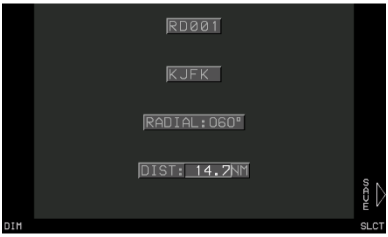


3) Scroll ❶ to **CREATE USER WPT (RAD-DST)** and push to enter



4) Identifier is automatically named **RD###** where **###** is the next available radial distance waypoint number.

5) To enter identifier for reference waypoint, scroll ❶ in same manner as waypoint for flight plan. If a single result from the search the menu advances to the radial entry box. If multiple results appear from the search, a selection list appears. **INFO (R6)** appears to verify each waypoint information.



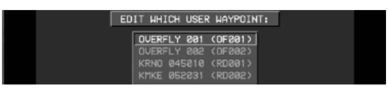
6) Scroll ❶ to enter the radial entry and distance as the 060° at 14.7 NM from KJFK.

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

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

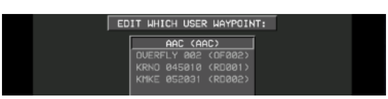
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.

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



4) Scroll ❶ to waypoint to be edited.

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



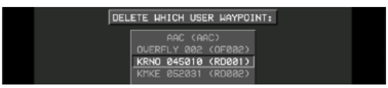
6) Select another USR WPT to edit or press **EXIT (R1)** to save changes.

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

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

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

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



4) Scroll ❶ to desired waypoint to be deleted.

5) Push ❶ 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:

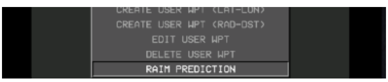
1) EDIT the user waypoint as described above.
2) Open a flight plan, which uses the user waypoint.
3) Delete the existing waypoint from the flight plan.
4) Save and exit.
5) Reload the flight plan if it were in use.

5.10.17. 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.

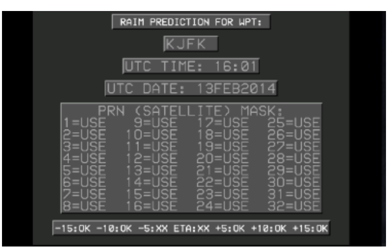
1) Press **FPL (L1)**.

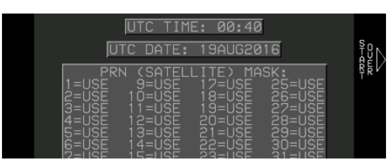
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.



3) Scroll ❶ 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 RAIM Prediction screen allows the pilot to perform RAIM Prediction at a designated waypoint. The screen has various data entry boxes as follows:

Designated Waypoint: The default entry is the current active flight plan destination; otherwise, the pilot is prompted to enter an identifier for the designated waypoint. If there is a single result from the search, the pilot is advanced to the UTC time entry box. If there is no result from the search, the pilot is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented and upon selection, the pilot is advanced to the UTC time entry box. **INFO (R6)** appears at this level to give access to information and aid in selection.

UTC Time Entry: Allows entry of the 24-Hour UTC estimated time of arrival at the designated waypoint.

UTC Date Entry: Allows entry of the UTC estimated date of arrival at the designated waypoint.

PRN Mask Entry: Allows the pilot to specify the PRN number of satellites expected to be unavailable at the destination.

EXIT: Allows pilot to exit the RAIM prediction screen at any time.

Once a designated waypoint and UTC estimated time of arrival are entered, **CALC** appears to allow the pilot 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 ±in 5-minute increments. Once a prediction is complete, **START OVER (L1)** allows the pilot to perform another prediction without having to exit the RAIM Prediction screen.

5.11. Active Flight Plan (ACTV) Menu

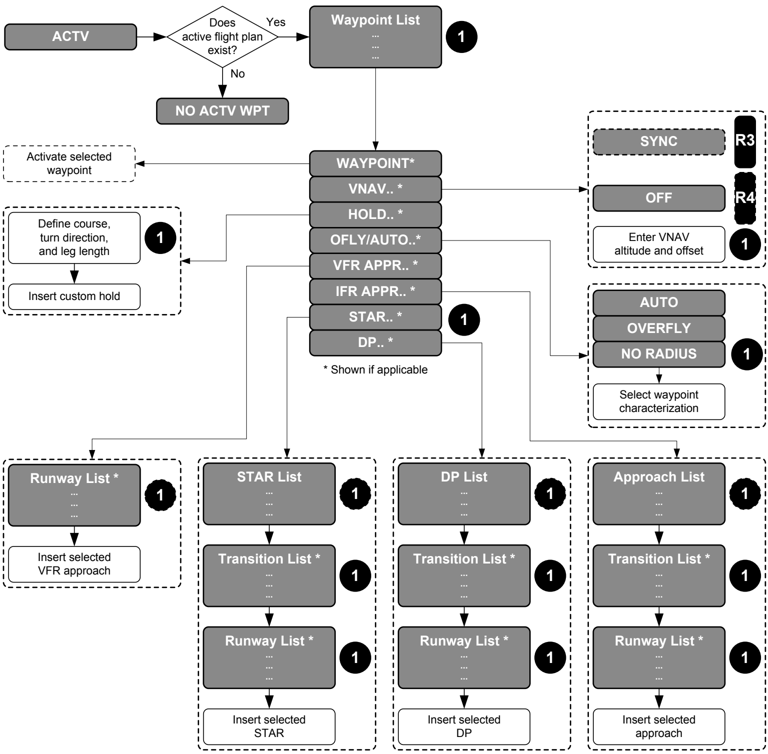


Figure 5-14: Active Flight Plan Main Menu

See Section 7 IFR Procedures for Active Flight Plan description.

5.11.1. Active Flight Plan (ACTV) Menu Options

Various options appear at the same menu level as the nav log selection list. These options allow various modifications to be made to the active flight plan as follows:

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. Highlighted result information includes datalinked weather information when available.

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.

9) **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.

10) **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. This tile 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. The tile 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.

11) **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. This tile 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.

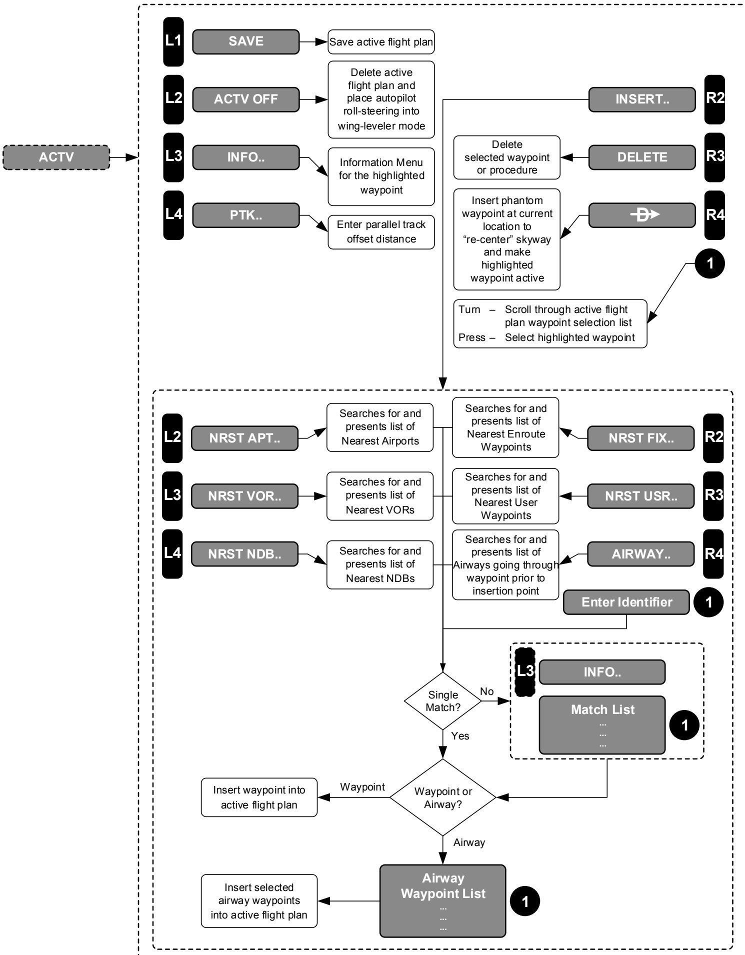


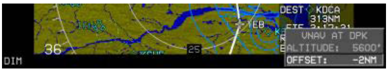
Figure 5-15: Active Flight Plan Menu Options

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

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

2) Scroll ❶ to desired waypoint and push to enter.

3) Scroll ❶ to desired option (**WAYPOINT**, **VNAV..**, **HOLD..**, or **OFLY/AUTO..**) 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).

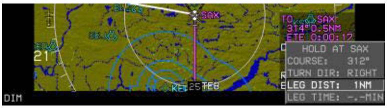
6) Push ❶ to **CONFIRM DEL WPT**.

5.11.3. 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 ❶ to desired waypoint option and push to enter.

3) If a HOLD is desired, scroll ❶ to **HOLD** and push to enter.



4) Scroll ❶ to set inbound course and push to enter. Then set leg distance or leg time. Push to enter.

5) View active flight plan with holding pattern indicated.

5.11.4. 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 **AIRWAY (R4)** to view applicable list, scroll ❶ to desired selection, and push to insert into active flight plan.

5.12. Information (INFO) Menu

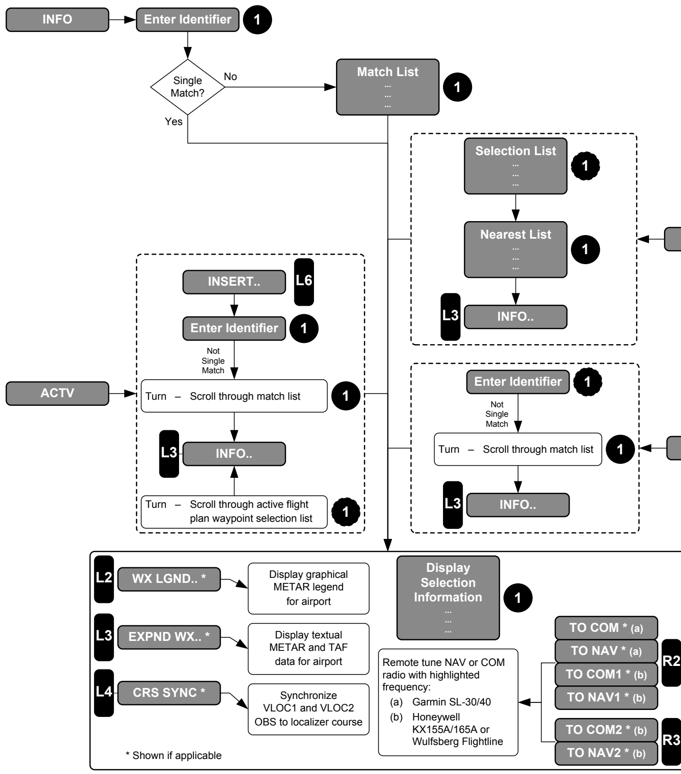


Figure 5-16: Information Menu

If **INFO** is activated from within the **ACTV**, **NRST**, or **Direct** menus, information on the highlighted waypoint from the applicable selection list is shown directly. Otherwise, the function checks for a current active waypoint. If there is an active waypoint, the active waypoint becomes the default entry. If there is no active waypoint, the nearest airport becomes the default entry. If the default entry is accepted, information for the default entry is shown. If the pilot rejects the default entry by entering identifier characters, a search for matching identifiers is performed. If there is a single result from the search, information for the result is shown. 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 list with matching identifiers is presented for the pilot to select the desired identifier.

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

1) Waypoints
2) Identifier
3) Type
4) Elevation (if available)
5) Long name
6) Bearing and distance
7) Latitude/Longitude
8) Navigation aides
9) Frequency
10) Airports
11) Communication frequencies
12) Runway data

For remote tuning, a single frequency is associated with the waypoint, and tiles allow transmission of the frequency to remote NAV or COM radios, **TO COM1** or **TO NAV1** (**R2**), while **TO COM2** or **TO NAV2** (**R3**). If more than one frequency is associated with the waypoint (i.e., airport waypoint), tiles are shown to allow transmission of a frequency to remote NAV or COM radios when a frequency is highlighted in the **INFO** block. If the frequency is less than 118 MHz, the tiles read **TO NAV#**, and the transmission is addressed to NAV radios. If the frequency is greater than or equal to 118 MHz, the tiles read **TO COM#**, and the transmission is addressed to COM radios.

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 5-17).

Figure 5-17: CRS SYNC

NOTE:

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

If Garmin SL-30/40 radios are enabled in the EFIS limits, only **TO COM (R2)** and **TO NAV (R2)** appear.

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

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

2) Push ❶ to view information.

5.13. Omnibearing Selector (OBS) Menu

The OBS menu allows the pilot to control the omnibearing selector for showing course deviations. Press **FMS (L2)** to specify either a manual or automatic OBS setting in which the current 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 a True North mode discrete input is not configured, the OBS menu does not toggle between "**TRUE NORTH**" and "**MAG NORTH**" modes.

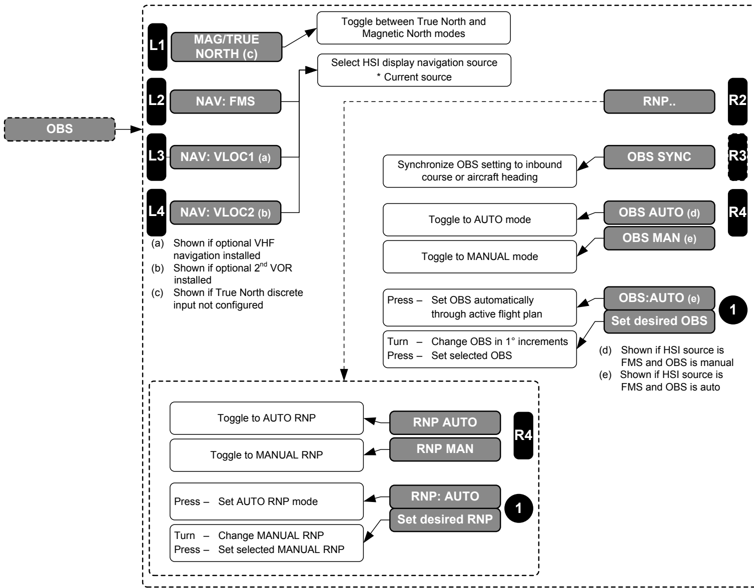


Figure 5-18: Omnibearing Selector (OBS) Menu

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 the RNP tile, **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

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

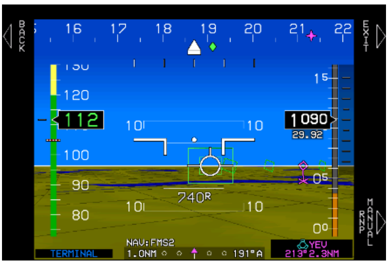
1) Before pressing **OBS (L4)** to make any OBS changes, view the current setting to see **FMS1** is selected.

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 ❶ to select new OBS course.

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

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

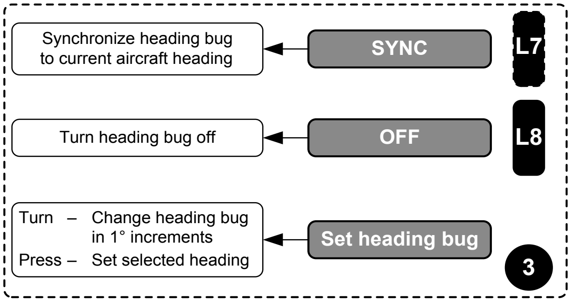


6) Press **RNP MANUAL (R4)**.

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

5.14. Heading Bug (HDG) Menu

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



IDU-680P showing PFD Page only

Figure 5-19: Heading Bug (HDG) Menu

5.14.1. Heading Bug (HDG) Menu (Step-By-Step)

1) Scroll ❸ to enter Heading mode.

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

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

5.15. Nearest (NRST) Menu

Upon activating the nearest menu, an option list appears for the pilot to select from a list of the nearest airports, VORs, ILSs, NDBs, fixes, user waypoints (if user waypoints exist), ARTCC frequencies, or FSS frequencies. Upon selecting a category from the option list, a selection 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 selection list for airports also contains an indication of the longest runway length at the airport.

The selection lists for airports contains only airports with runway length greater than or equal to the minimum runway length setting, when the system was configured during installation.

The selection list for airports, VORs, ILSs, NDBs, ARTCCs, and FSSs includes an associated frequency (CTAF in the case of airports). Tiles are shown to allow transmission of the associated frequency to remote NAV or COM radios. If the frequency is greater than or equal to 118 MHz, the tiles read **TO COM#**, and the transmission is addressed to COM radios. If the frequency is less than 118 MHz, the tiles read **TO NAV#**, and the transmission is addressed to NAV radios, **TO COM1** or **TO NAV1** (**R2**), while a **TO COM2** or **TO NAV2** (**R3**) position.

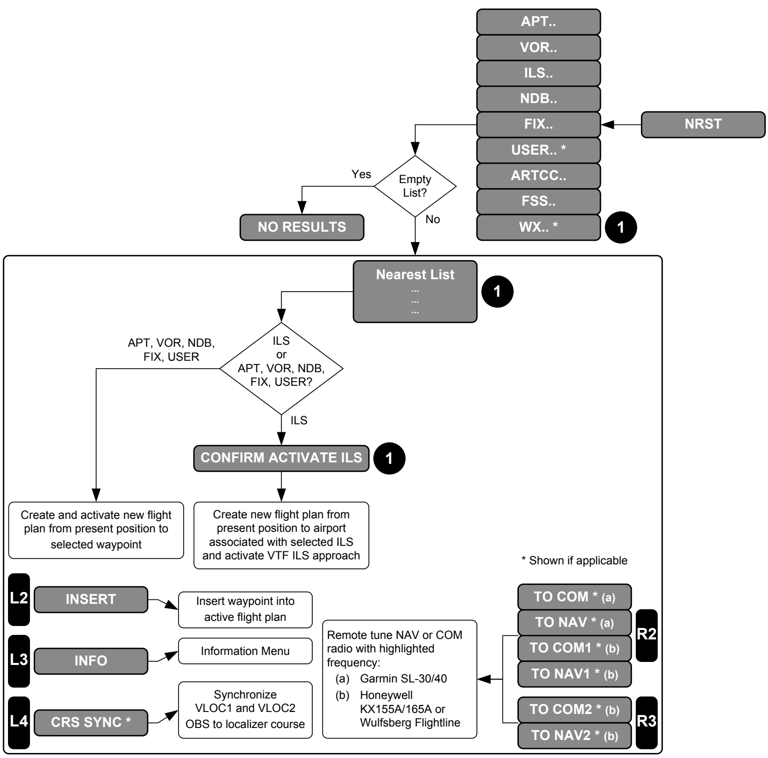


Figure 5-20: Nearest (NRST) Menu

NOTE:

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

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)** quickly inserts a waypoint into the active flight plan at the current active waypoint position. This feature facilitates rapid clearance changes from air traffic control. **INSERT (R2)** does not appear if the current active waypoint is within a procedure. This prevents corruption of IFR approaches, STARs, and DPs.

When the results for airports, VORs, ILSs, NDBs, fixes, and user waypoints are being displayed, **INFO (L3)** activates the information function and provide 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 a waypoint of type airport, VOR, NDB, fix, or user waypoint, a new active flight plan is created from present aircraft position to the selected waypoint. Upon selecting a waypoint of type ILS, **CONFIRM ACTIVATE ILS** is displayed. When the pilot confirms the ILS activations, 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, the heading bug is activated to current heading to act as a starting point for receiving vectors;

4) The **VLOC1** and **VLOC2** OBS settings are set to the associated localizer course;

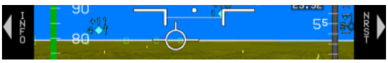
5) HSI source is switched as follows:

    a) If only one NAV is radio installed, the source for the selecting side is changed to **VLOC1**, but the other side does not change.

b) 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.

6) Connected NAV radios are remote tuned to ILS frequency.

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



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

2) Scroll ❶ to select **APT** from list push to enter.

3) Scroll ❶ to desired airport and select to either **INSERT**, **INFO**, or press **TO COMM1 (R2)** or **COMM2 (R3)** to send frequency to **COMM1** or **COMM**.

4) Or if a nav frequency, either:

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

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

2) Scroll ❶ to select ILS from list then push to enter.

3) If selection is a LOC, no action is taken. The selection must be an ILS.

4) Scroll ❶ desired airport and ILS approach then push to select and enter.

5) Push ❶ to confirm and activate ILS.

5.16. Direct Menu

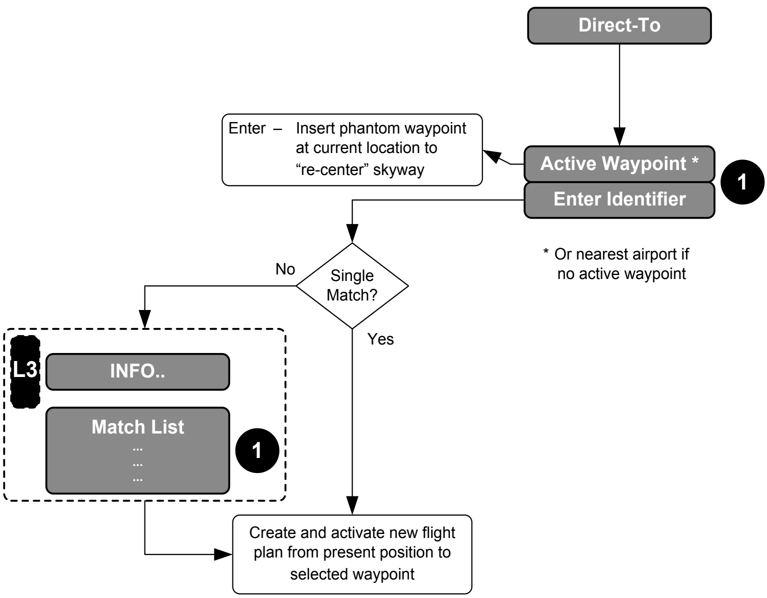


Figure 5-21: Direct Menu

Upon activating the direct menu from the top-level menu, the function checks for a current active waypoint. If there is an active waypoint, the active waypoint 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 from the search, 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 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. 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.

5.16.1. Direct Menu (Step-By-Step)

1) Press (R4) to enter the Direct menu.
2) Active or nearest airport waypoint appears.

3) Either push ➊ to insert a phantom waypoint at the current aircraft location or scroll ➊ to enter new identifier.

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

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

5.17. Time (TIME) Menu

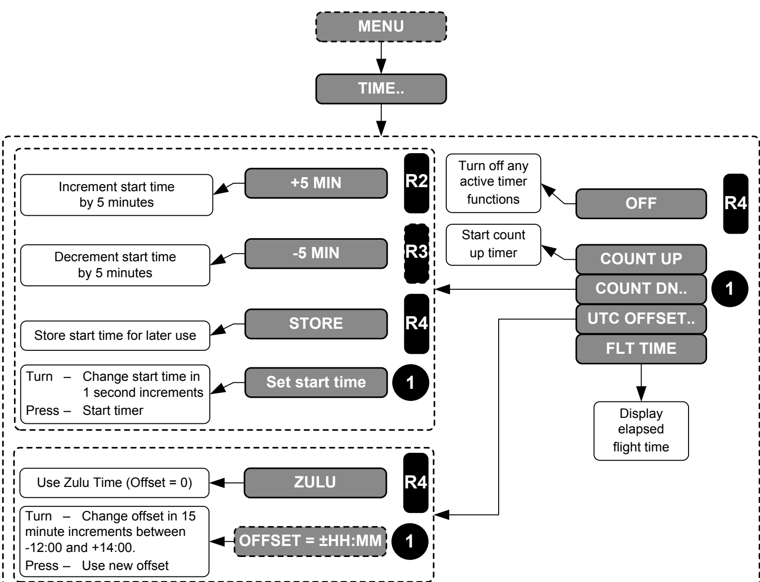


Figure 5-22: Time Menu

Upon selecting the timer menu, an option list appears for the pilot choose the count up timer, countdown timer, or flight time display. **OFF (R4)** also appears at this level for the pilot to turn off any active timer functions.

If the pilot selects the count up timer, the count up timer is activated. If the pilot selects the countdown timer, the pilot is prompted to enter a start time from which the countdown begins. Shortcut buttons to quickly add or decrement by five-minute increments are provided at this level. After entering a start time, the pilot may either start the countdown timer or select **STORE (R4)** (or push ❶) to store the start time for later use.

If the pilot selects the UTC offset selection, prompts 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 current 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.”

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

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

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

3) Scroll ❶ to select **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)** and **TIME (L4)** then press **OFF (R4)**.

6) To set offset for local time scroll ❶ to **UTC OFFSET..**, and then push to enter.

7) Scroll ❶ to desired offset value. Push to enter.

5.18. PFD Source (SOURCE) Menu

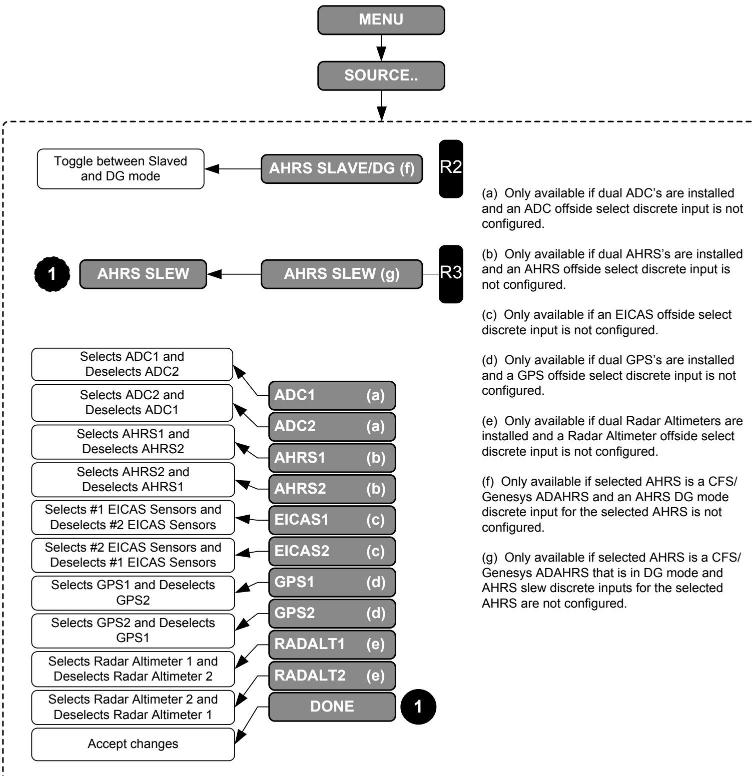


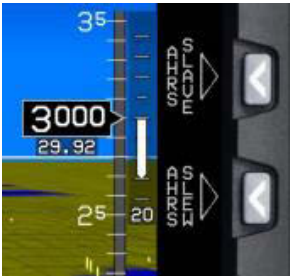
Figure 5-23: PFD Source Menu

Upon activating the PFD source menu, an option list of sensor sources is shown to select/deselect the following items:

1) ADC1;

2) ADC2;

3) AHRS1;
4) AHRS2;
5) EICAS1;
6) EICAS2;
7) GPS1;
8) GPS2;
9) Radar Altimeter 1; and
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** appears to enter a submenu to adjust the DG mode slewing value.

Figure 5-24: AHRS SLAVE/AHRS SLEW

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

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

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

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

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

Upon selecting the PFD bugs menu, the following options:

1) **MINS (R3)**: Set either BARO sync to current altitude, turn off, or set altitude in increments of 10’ or DH (set to default of 200’, turn off, or set DH in increments of 10’);

2) **IAS (L2)**: Set an airspeed bug to sync with current airspeed, turn off, or set the bug in increments of 1 knot IAS. (No bug setting less than 60KIAS whichever is lower. No higher than **V$_{NE}$**);

3) **VNAV CDA (R4)**: Set the 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 either synchronizing the VSI bug to the current VSI, turn the VSI bug off, or setting the VSI bug in increments of 100 feet per minute.

NOTE:

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

Select the minimums option to set either decision height or minimum altitude. Select the minimum altitude option to synchronize the minimum altitude to current altitude, turn the minimum altitude off, or set the minimum altitude in increments of 10 feet. Select the decision height option to set the decision height to a default height of 200 feet, turn the decision height off, or set the decision height in increments of 10 feet.

Select the airspeed bug option to synchronize the airspeed bug to current airspeed, turn the airspeed bug off, or set the airspeed bug in increments of 1 knot indicated airspeed. On the low end, airspeed bug settings are no less than 60KIAS and no greater than $\mathbf{V_{NE}}$.

Select the VNAV climb or descent angle option to set either climb angle or descent angle. At this further level, select either option to set the climb angle or the descent angle (as appropriate) in increments of 0.1° (a value of zero is not allowed). Corresponding feet per nautical mile is shown adjacent to the climb or descent angle setting in parentheses. In addition, a shortcut tile is available to set the climb or descent angle to 3°.

Select the VSI bug option to synchronize the VSI bug to the current VSI, turn the VSI bug off, or set the VSI bug in increments of 100 feet per minute.

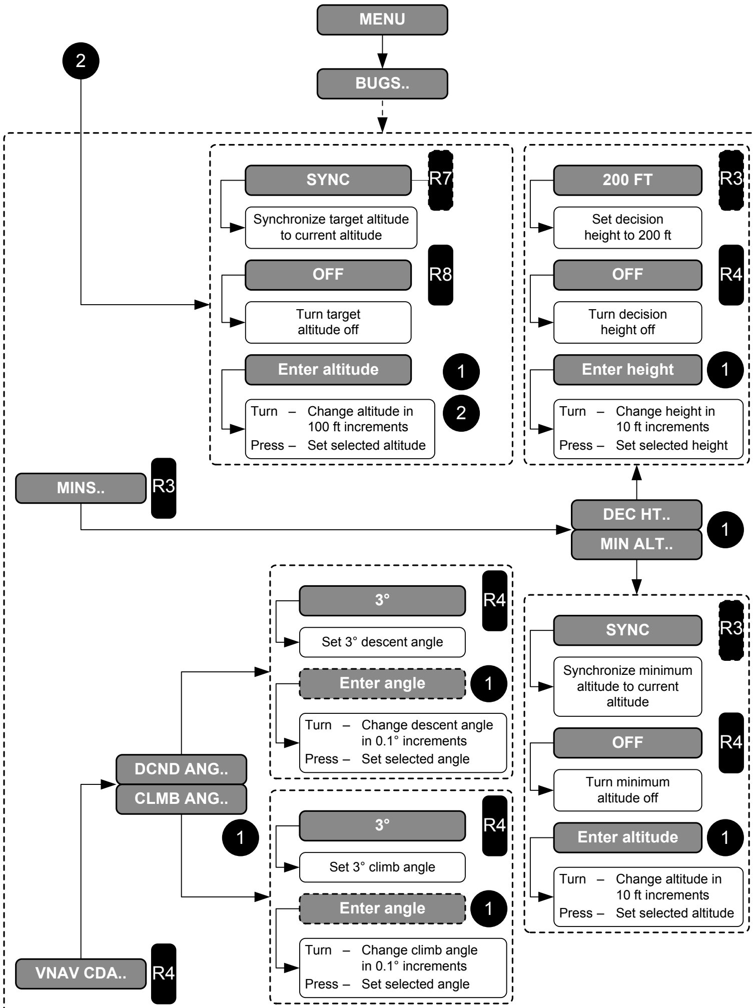


Figure 5-25: PFD BUGS (BUGS) Menu

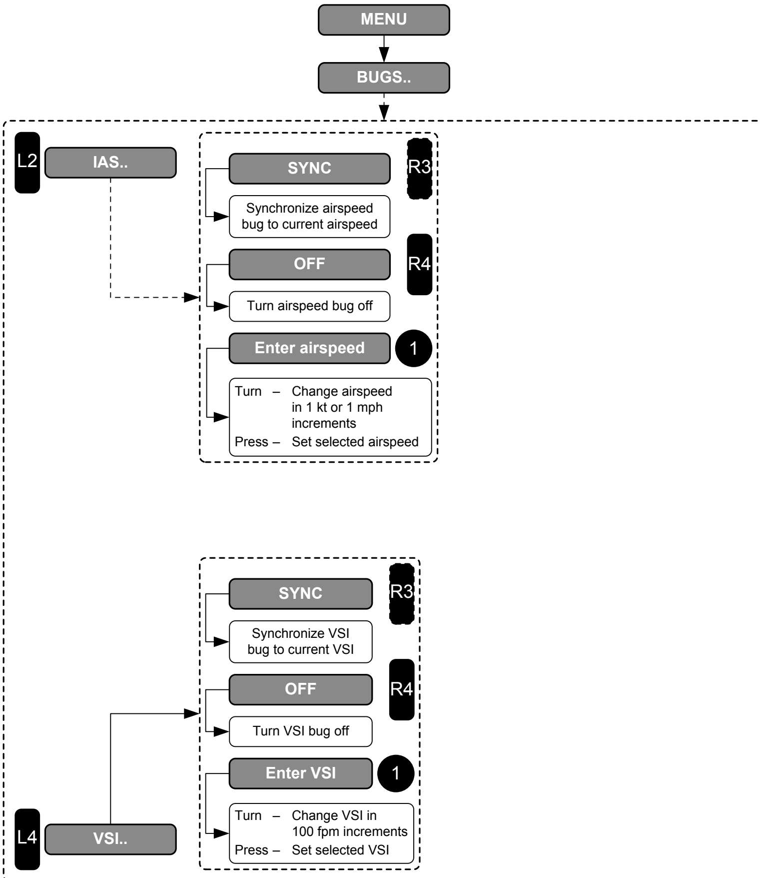
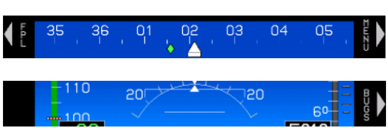


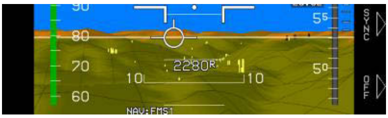
Figure 5-26: PFD BUG (BUGS) Menu (Continued)

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



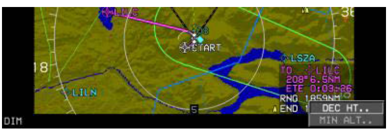
1) Press **MENU (R1)** then **BUGS (R2)** to enter the Bugs menu, or use Remote Bugs Panel if equipped as referenced in RBP appendix.

2) Press either **IAS (L2)**, **VSI (L4)**, **MINS (R3)**, or **VNAV CDA (R4)** to select desired menu.



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

4) If a different IAS bug is desired, scroll ❶ to select desired airspeed and push to enter new value.



5) If **MINS (R3)** is selected, scroll ❶ to select either **DEC HT..** or **MIN ALT..** and push to enter.

6) If **DEC HT..** is selected, scroll ❶ 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 selected, scroll ❶ to select either **DCND..** or **CLIMB..** Push to enter.

9) If **DCND..** is selected, scroll ❶ further to create the descent angle.

10) Push ❶ to enter new descent angle (3.3º) or select default 3°.

5.20. PFD Declutter (DCLTR) Menu

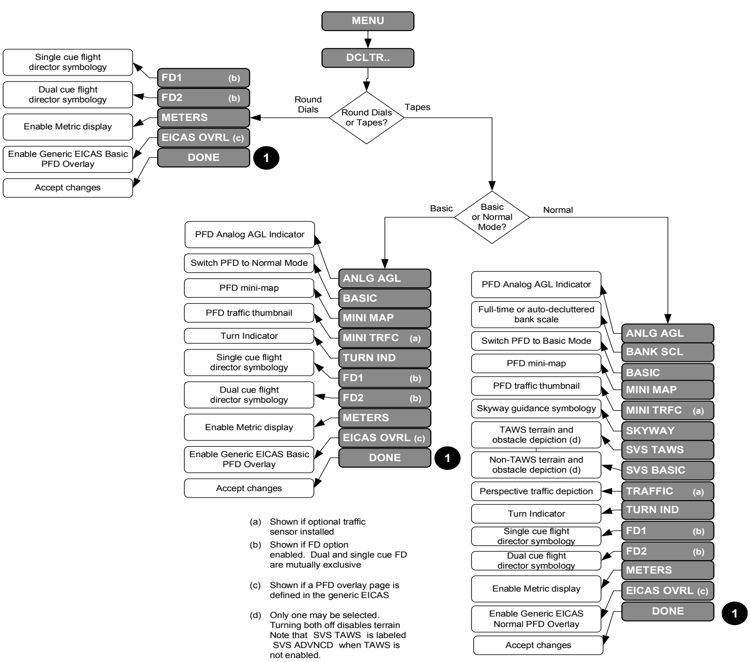


Figure 5-27: PFD Declutter (DCLTR) Menu

Upon activation of the PFD declutter menu, an option list of declutter items is shown.

Table 5-4: PFD Declutter Options and Features

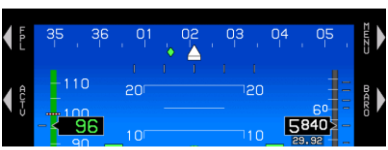
Declutter Options	Configuration			Notes
	Tapes	Basic	Round Dials	
PFD Analog AGL Indicator	✓	✓		
Full-Time or Auto Decluttered Bank Scale Display	✓			
Basic Mode	✓	✓		
PFD Mini-Map	✓	✓		
PFD Traffic Thumbnail	✓	✓		
Skyway Guidance	✓			
Airspeed Trend	✓			Feature only
Non-TAWS	✓			SVS TAWS is labeled "SVS ADVANCED" when TAWS is not enabled
TAWS	✓			
Perspective Traffic Depiction	✓			
Turn Rate Indication	✓	✓		
Single Cue Flight Director	✓	✓	✓	
Dual Cue Flight Director	✓	✓	✓	
METERS	✓	✓	✓	
EICAS OVRL	✓	✓	✓	

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

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

2) Scroll ❶ to select **ANLG AGL**, **BANK SCL**, **BASIC**, **MINI MAP**, **MINI TRFC**, **SKYWAY**, **TRAFFIC**, **TURN IND**, **TERRAIN**, **FD1**, **FD2**, **METERS**, or **EICAS OVRL**. Push to enter.

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



4) Bank Scale is removed while in level flight.

5.21. PFD Altimeter Menu

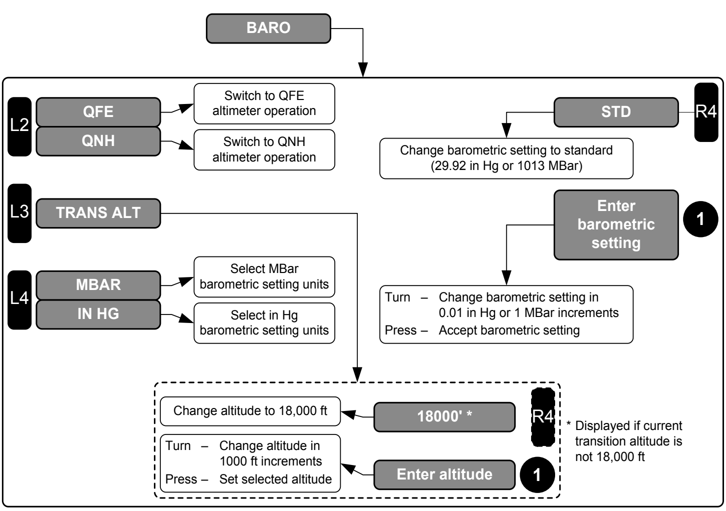


Figure 5-28: PFD Altimeter Menu

Press **BARO (R2)** to activate the altimeter menu. In the altimeter menu, scroll ❶ to increment (clockwise) or decrement (counter-clockwise) the barometric setting. Push ❶ to accept the new barometric setting. In addition, the following options are available in the altimeter menu:

1) **QNH/QFE (L2)**: Toggles between QNH altimeter operation 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.

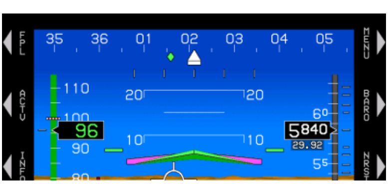
   c) **QNH**: Barometric setting resulting in the altimeter displaying altitude above mean sea level at the reporting station.

2) **TRANS ALT (L3)**: Changes the transition altitude used by the system 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'** tile is available to quickly set 18,000 feet as the transition altitude.

3) **MBAR/IN HG (L4)**: Sets the barometric setting units (inHg or mbar).

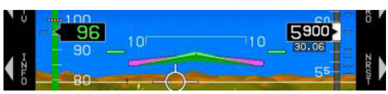
4) **STD (R4)**: Sets the barometric setting to standard (29.92 inHg or 1013 mbar).

5.21.1. PFD Altimeter Menu (Step-By-Step)



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

2) Scroll ❶ to set proper QNH and push to enter. In this example 30.06 inHg is set.



3) Crosscheck proper QNH under altitude indication.

5.22. MFD Fault Display (FAULTS) Menu

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

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

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

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

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

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

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

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

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

9) Readout of the current GPS/SBAS vertical figure of merit (GPS VFOM) in meters. This value is an indication of the 95% confidence vertical position accuracy. (For Example, the MSL altitude used in the TAWS algorithms use geodetic height converted to MSL with the current EGM (Earth Gravity Model) database. For this to be considered valid for use as MSL altitude, the VFOM must be less than or equal to 106 feet.) Additionally, the tertiary source for vertical speed is GPS/SBAS vertical speed providing the VFOM is less than or equal to 106 feet. When AGL altitude is based on BARO, it is because the RADALT was in a failed state (if so equipped) and the VFOM exceeded 106 feet rendering the vertical component of GPS altitude invalid in the MSL altitude calculation.

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

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

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

    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 WSI datalink is enabled, the datalink item indicates either loss of communications with the datalink receiver (DLNK X), loss of

satellite lock (DLNK NO LOCK), or the current bit error rate or the datalink (DLNK BER ###). WSI datalink is mutually exclusive with ADS-B datalink.

17) 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). ADS-B datalink is mutually exclusive with WSI datalink.

18) 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 any one of the following conditions is true:

    a) Loss of weather radar communication.

    b) Weather radar mode is OFF.

19) 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 any one 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.

20) If weather radar is enabled and the weather radar type is RDR-2000 or RDR-2100, an indication of radar control panel status (WXR RCP X or WXR RCP OK). Radar control panel status failed (WXR RCP X) indicates either loss of communication or a

failure status using the same test as invalid data SSM for output labels 270, 271, 273, or 275.

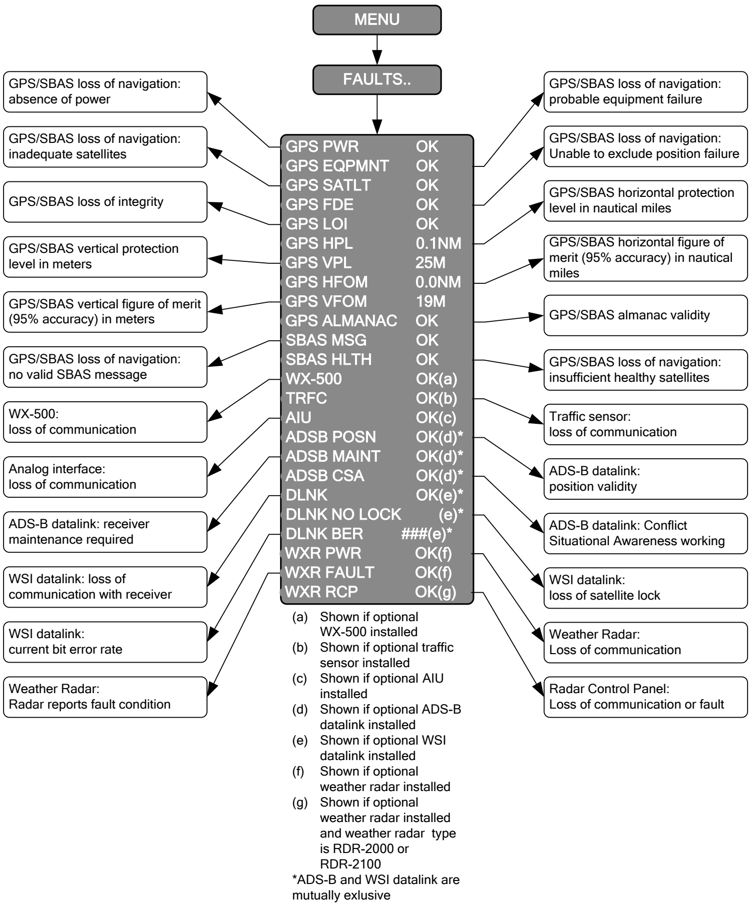


Figure 5-29: MFD Fault Display Menu

5.22.1. MFD Fault Display (FAULTS) Menu (Step-By-Step)

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

2) View status of GPS and equipment parameters in this passive list.

5.23. MFD Fuel Totalizer Quantity Setting (SET FUEL) Menu

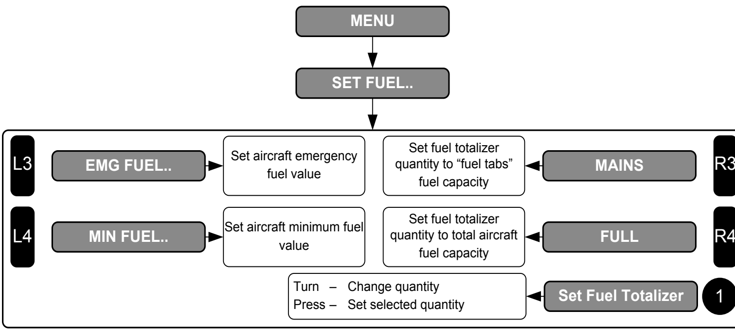


Figure 5-30: MFD Fuel Totalizer Quantity Menu

SET FUEL menu allows the pilot to:

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

2) 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.

Press **MAINS** (**R3**) to quickly set the quantity to the "fuel tabs" fuel capacity. Press **FULL** (**R4**) to quickly set the quantity to the total aircraft fuel capacity. Units of measure and fuel flow are shown in the quantity window when available.

5.24. MFD Page (PAGE) Menu

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

1) **MAP**: Shows the ND page.

2) **HSI**: Shows the HSI page.

3) **NAV LOG**: Shows the FMS page.

4) **TRAFFIC**: Shows the Traffic page (See Traffic Appendix).

5) **DATALINK**: Shows the Datalink page (See Datalink Appendix).

6) **WX-RDR**: Shows the Weather Radar page (See Weather Appendix).

7) **VIDEO**: Shows the Video page (See Video Appendix).

8) **EICAS**: Shows the EICAS page. Only available on the TOP Page Menu on a MFD.

9) **AUDIO/RADIO**: Shows the Audio/Radio page. Only available if audio/radio devices are configured (See AR Appendix).

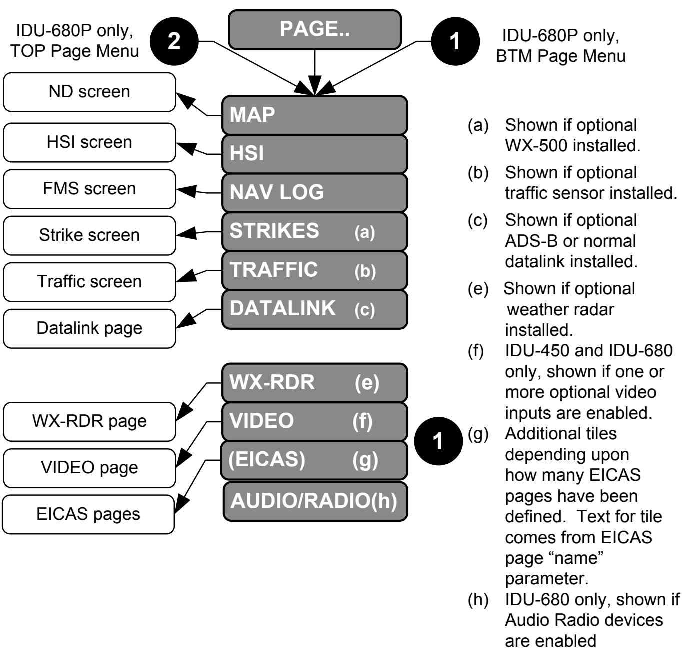


Figure 5-31: MFD Page (PAGE) Menu

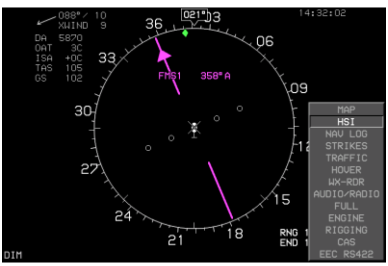
5.24.1. MFD Page (PAGE) Menu (Step-By-Step)

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

2) Push ❷ (**TOP**). Scroll to **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, **HOVER**, **WX-RDR,** or **VIDEO**, and Push to enter.

3) Or push ❶ (**BTM**). Scroll to **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, or **HOVER**, **VIDEO**, and push to enter.

5.25. MFD HSI Page (Step-By-Step)



1) Push ❶ or ❷ and scroll to **HSI** and push to enter.

2) Example shown is on MFD with **HSI** on bottom area.

5.26. MFD HSI Pointer (PTRS) Menu

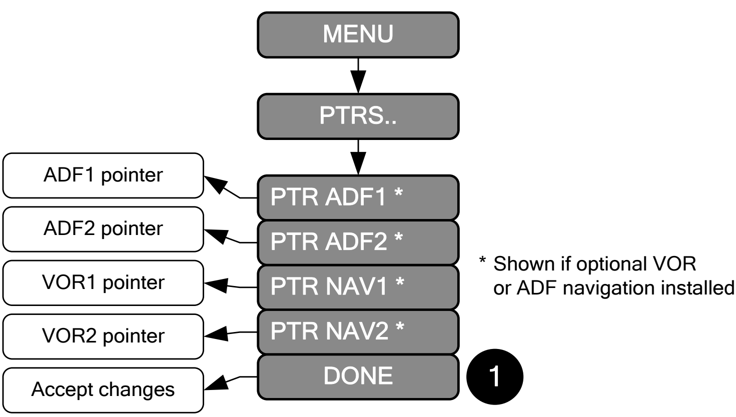


Figure 5-32: MFD HSI Pointer (PTRS) Menu

Upon selecting the HSI pointers menu when in the HSI page, an option list appears to allow the pilot to individually select:

1) display of ADF1 pointer (if ADF symbology is enabled);

2) display of ADF2 pointer (if dual ADF symbology is enabled);

3) display of VOR1 pointer (if VOR symbology is enabled); and

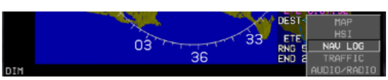
4) display of VOR2 pointer (if dual VOR symbology is enabled).

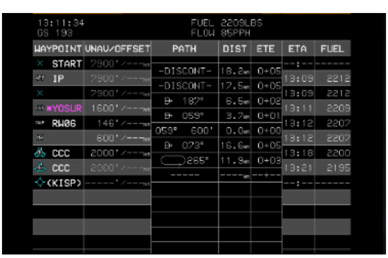
5.26.1. MFD HSI Pointer (PTRS) Menu (Step-By-Step)

1) Press **MENU (R1)** then **PTRS (R4** or **R8)** to enter the Pointer menu.

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

5.27. MFD NAV LOG Page (Step-By-Step)





1) Push ❶ or ❷. Scroll to **NAV LOG**. Push to enter.

2) Example shown is on PFD with **NAV LOG** on bottom area.

3) **NAV LOG** page cannot be formatted nor used for editing the active flight plan.

5.28. MFD ND Page Format (FORMAT) Menu

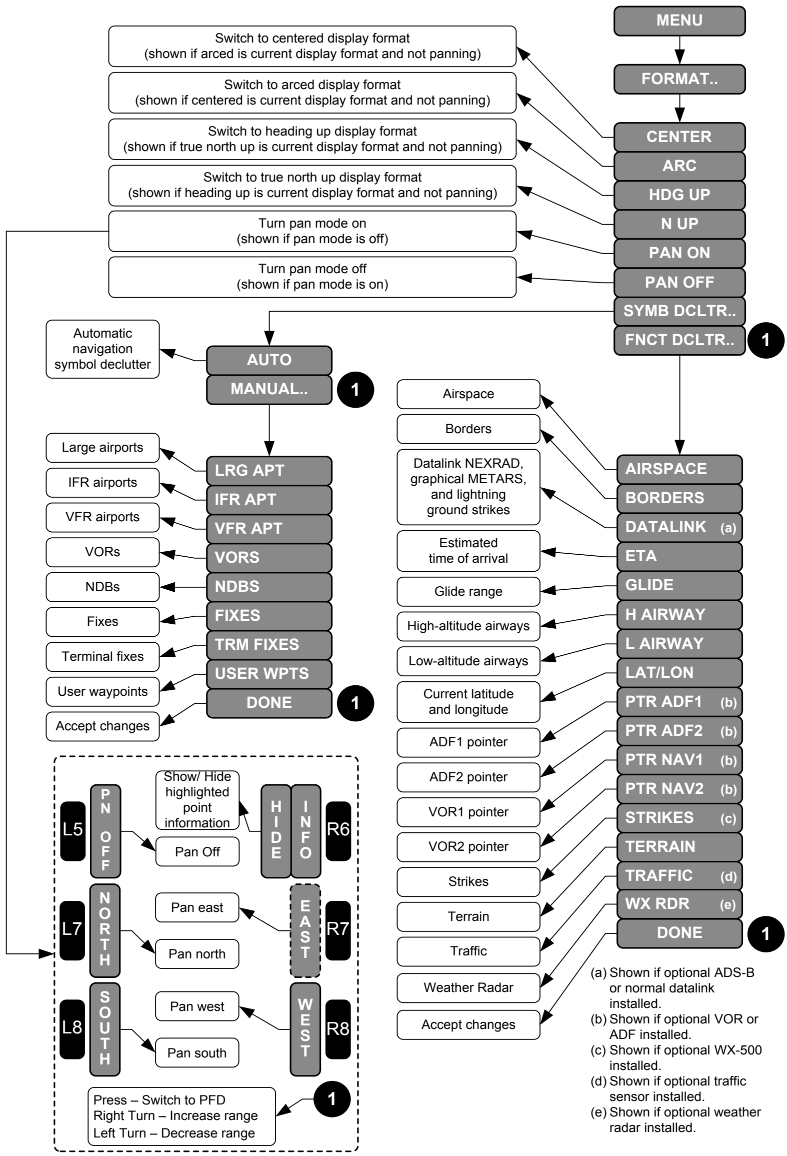


Figure 5-33: MFD ND Page Format (FORMAT) Menu

Upon selecting the MFD format menu when in the ND page, an option list appears with the following options:

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 a North up ND display format (if not panning).

3) **PAN ON/PAN OFF**: Toggles ND page pan mode.

4) **SYMB DCLTR**: Activates an option list to choose either automatic or manual navigation symbol declutter. If the pilot chooses manual navigation symbol declutter, a further option list appears for the pilot 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 5-34: 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 an option list for the pilot to individually toggle display of:

    a) airspace;

    b) borders;

    c) datalinked NEXRAD, graphical METARs, and lightning ground strikes (if datalink or ADS-B option is enabled);

d) estimated time of arrival (ETA);

e) glide range (if glide ratio is enabled and set in the limits, airplane configuration only);

f) high-altitude airways;

g) low-altitude airways;

h) current latitude and longitude display of ADF #1 pointer (if ADF symbology is enabled);

i) display of ADF #2 pointer (if dual ADF symbology is enabled);

j) display of VOR1 pointer (if VOR symbology is enabled);

k) display of VOR2 pointer (if dual VOR symbology is enabled);

l) display of strikes (if WX-500 option is enabled);

m) display of terrain;

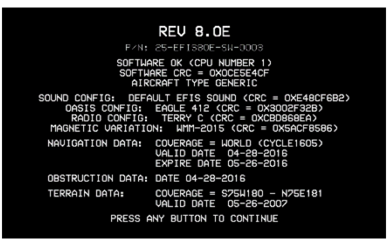
n) display of traffic (if traffic option is enabled); and

o) display of weather radar (if weather radar option is enabled).

Section 6 Quick Start Tutorial

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

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



Power up the EFIS system. 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 ❶, ❷, or ❸ 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 ❸ to adjust the heading bug setting.

PFD

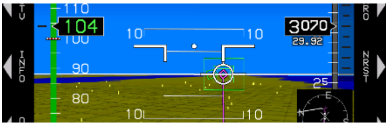
Press  **(R2)** to enter the altimeter menu for entering the proper QNH, setting QFE, changing transition altitude, or setting inches of mercury (inHg) vs. millibars (mbar).

Scroll ❶ to proper setting and push to enter value.

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

Scroll ❶ to the desired alpha or numerical character, push to confirm, and advance to the next position. Push to enter once, until all five spaces have been either entered or viewed.

Magenta star bearing to the waypoint and green diamond ground track symbols are displayed on the directional scale.



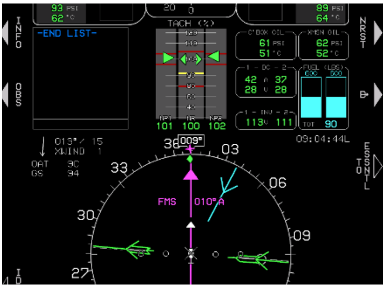
A direct route to the active waypoint is activated and appears as magenta tethered balloon on the PFD.

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.

Indicated airspeed is on the left, altitude is on the right and heading is on the bottom if there is no heading detected on the ND. A Turn indicator is located below the airspeed indicator. FMS/VLOC CDI is located on the bottom. The VSI is located below the altimeter.

MFD

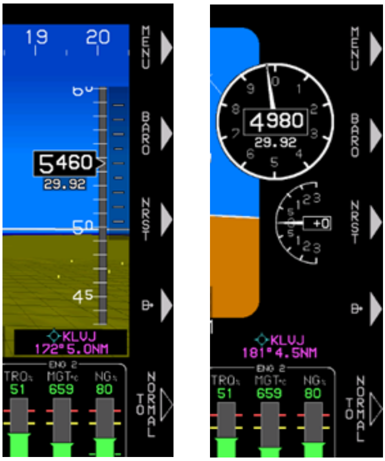


Analog navigation symbology on MFD HSI shown on bottom area.

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

PFD Essential Mode

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



Press 

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

On MFD, press 

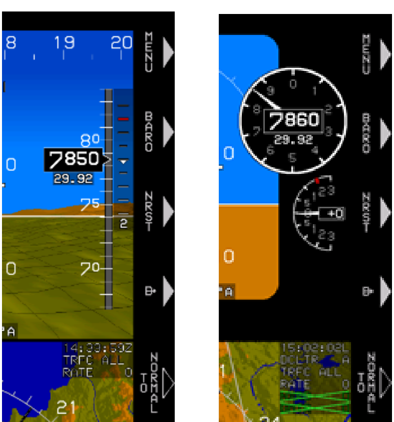
(R5) to display PFD on top view and EICAS on bottom view.

On MFD, press 

(R5) to display EICAS page (if enabled) on top and bottom view.

When EICAS is not enabled, press 

(R5) to restore MFD on top and bottom areas.



Flight Plans (Stored Routes)

Activate Flight Plan on PFD or MFD

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

Create Flight Plan on PFD or MFD

1) Press **FPL (L1)**.
2) Scroll ➊ to **CREATE-EDIT..** and push to enter.
3) Select **CREATE FLIGHT PLAN** and push to enter.
4) Press **ADD (R6)** to create first waypoint with ➊ by entering waypoints from beginning to end, or press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, or **NRST USR (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

Edit a User Waypoint PFD or MFD

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

Create a User Waypoint on PFD or MFD

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

Add Waypoint to an Active Route on PFD or MFD

1) Press **ACTV (L2)**.
2) Scroll ❶ 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)**, and then
   a) Scroll ❶ to make selection and push to enter, or
   b) Use ❶ to enter waypoint identifier and push to enter.

Delete Waypoint from an Active Route on PFD or MFD

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

Omnibearing Selector Function

Automatic OBS (FMS OBS Only)

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

Manual OBS

1) Press **OBS (L4)**.
2) 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 ❶ to desired OBS value and push to enter, or press **OBS SYNC (R3)** and push to enter.
4) If HSI source is **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)** scroll ❶ 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 ➊ to highlight the desired airport or user waypoint, push to enter.
3) Scroll ➊ to highlight **VFR APPR..** and push to enter.
4) Scroll ➊ to select desired runway and push to enter.

Change Runway during VFR Approach on PFD or MFD

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

Change Runway on IFR Approach on PFD or MFD

1) Press **ACTV (L2)**.
2) Scroll ➊ to destination airport and push to enter.

3) Select **APPR:** Scroll ➊ to desired approach. Push to enter.

4) Select **TRANS:** Scroll ➊ to desired transition. Push to enter.

5) Select **RW:** Scroll ➊ 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

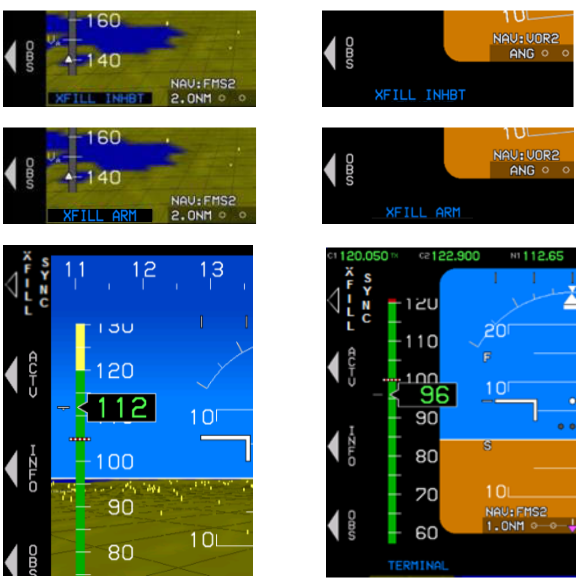
XFILL SYNC Operation

(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 to the other system from where the button press occurred.



Section 7 IFR Procedures

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7.1. Active Flight Plan

Upon activation of the active flight plan menu, the application checks for the existence of 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. The nav log shows each waypoint identifier and characterization (default, overfly [**OF**] or no radius [**0R**]), a symbol designating waypoint type and what type of procedure (if any) the waypoint is associated with, VNAV altitudes and offsets associated with each waypoint, and information related to the 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 shown in white, and those computed automatically are shown in gray. The current active waypoint is designated by an asterisk and shown in magenta but turns amber (yellow) in the event of a GPS Loss of Navigation 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, an option list is presented as follows.

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, an option 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 or a tenth of a minute.

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 the FMS system.

    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 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 the 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 already 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 the 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 selection 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 already 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 the 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 deletes any pre-existing STAR. If there is a pre-existing approach (IFR or VFR) to the airport, the STAR waypoints are inserted prior to the approach waypoints.

8) **DP**: If the 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 at the airport and more than one runway is 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 their 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 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.

The procedures, Approach with Vertical Guidance (APV), 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 the LNAV/VNAV procedures, the APV approach is implemented to take advantage of the high accuracy guidance and increased integrity provided by GBS/SBAS. This WAAS generated angular guidance allows the use of the same TERPS approach criteria used for ILS approaches. The resulting approach procedure minima, titled LPV (Localizer Performance with Vertical guidance), may have a decision altitude as low as 200 feet height above touchdown with visibility minimums as low as ½ mile (providing the terrain and airport infrastructure support the lowest minima criteria).

Another non-precision GPS/SBAS Approach, certified as an LP (Localizer Performance) 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.

The Genesys Aerosystems EFIS guides the pilot through every step of the approach procedure with Highway in the Sky three-dimensional 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 the 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 the 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).

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

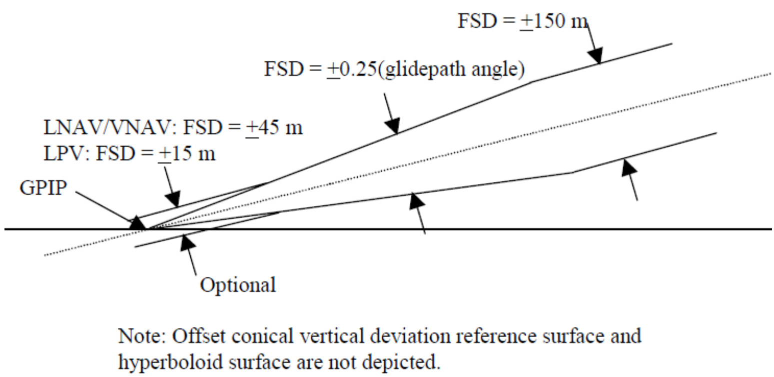


Figure 7-1: Vertical Deviation Indicator Linear Deviation

7.3.1. Highway in the Sky (Skyway)

When not decluttered, the PFD displays the active navigation route or manual OBS course 3-Dly using a series of skyway boxes, which overly the flight plan route at a desired altitude and provide lateral and vertical guidance. The 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 upon 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 altitude 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.

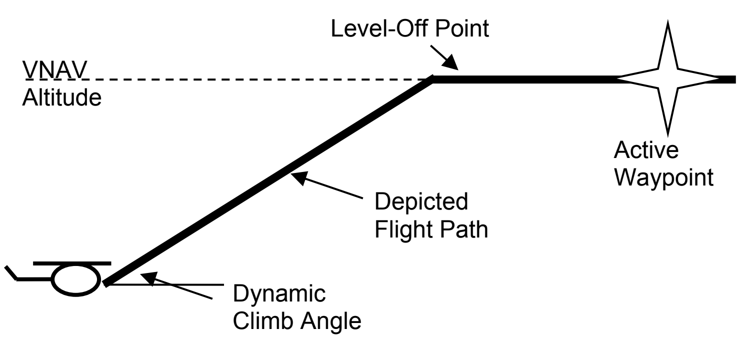


Figure 7-2: Highway in the Sky (Aircraft Referenced)

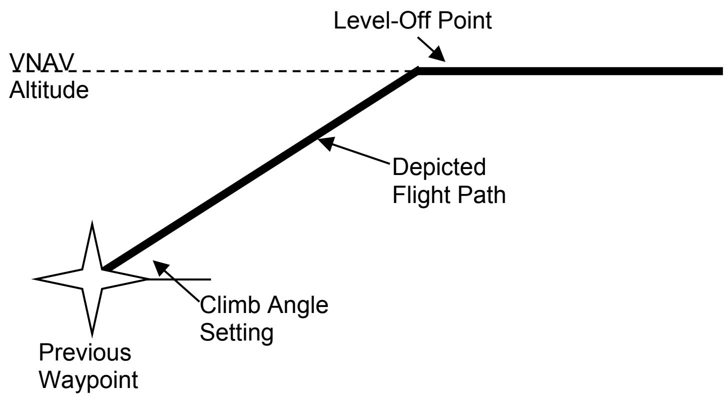


Figure 7-3: Highway in the Sky (Geo-Referenced Backward)

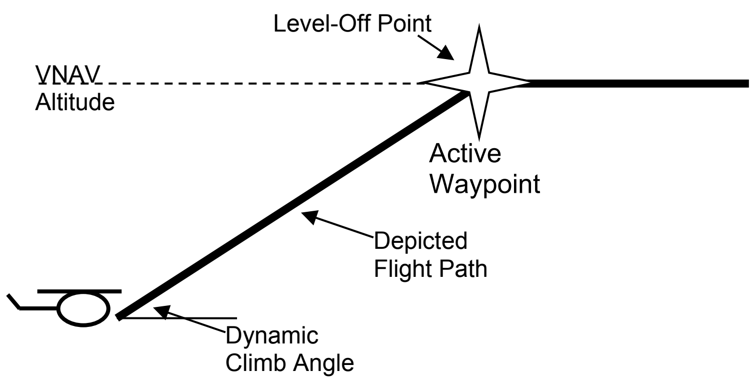


Figure 7-4: Highway in the Sky (Geo-Referenced Forward)

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 in Table 7-2.

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 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 Final Approach Fix and Missed Approach Point	Missed Approach Point location	Straight line from Final Approach Fix to Missed Approach Point location and altitudes.
No or invalid Final Approach Segment data block Intermediate waypoints exist between Final Approach Fix and Missed Approach Point	Missed Approach Point location	Steepest descent angle based upon straight lines from Final Approach Fix and subsequent intermediate waypoints to Missed Approach Point 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, an important safety benefit for pilots of single-engine aircraft. 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.

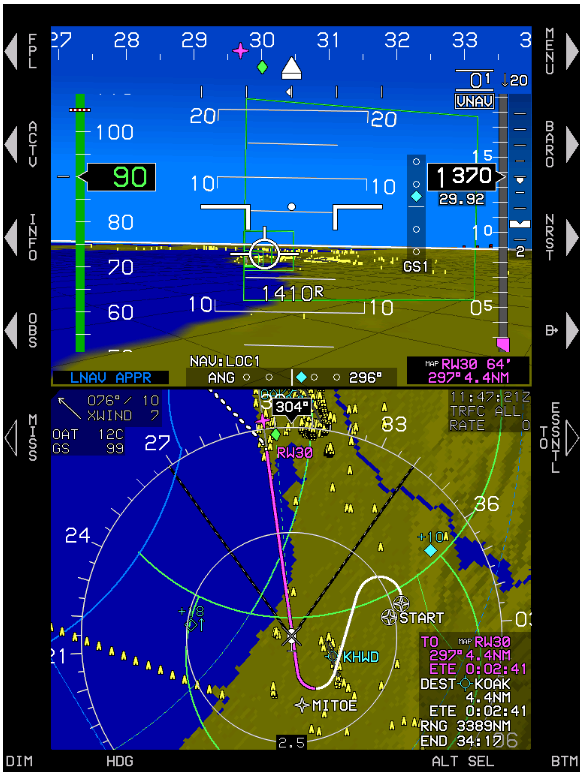


Figure 7-5: Highway in the Sky Final Approach Segments

7.3.2. Waypoint Sequencing

Where automatic waypoint sequencing is suspended due to reasons 1, 2, or 4 in § 7.3 , the EFIS switches from “TO” operation to “FROM” operation when appropriate. If not suspended, automatic waypoint sequencing occurs in the following conditions:

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

2) Aircraft location is within two turn diameters (based upon current True Airspeed and 15° angle of bank) of the active waypoint location; and

3) Aircraft 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. Radius for turning segments (other than DME arc or Radius to a Fix segments) is 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

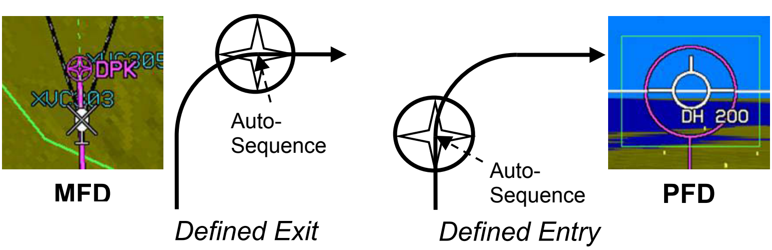


Figure 7-6: Fly-Over Waypoints

To create the desired flight path, each waypoint is designated as a fly-by or a fly-over waypoint. Waypoints are further subdivided into waypoints with a defined entry heading and waypoints with a defined exit heading. Waypoint auto-sequencing for fly-by waypoints occurs at the bisector of the turn. Waypoint auto-sequencing for fly-over waypoints occurs over the waypoint.

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 either inserting a waypoint into the active flight plan or performing the 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

Table 7-3: RNAV Path Terminator Leg Type			
Path	**Designator**		**Terminator**
Track Between	T		
Heading To	V		

Examples: **CF**= Course to Fix, and **FM**= Course from a Fix to a Manual Termination, etc. (See Section 9 Appendix for table of ARINC-424 Path-Terminator Leg Types.)

7.3.4. Fly-By Waypoints

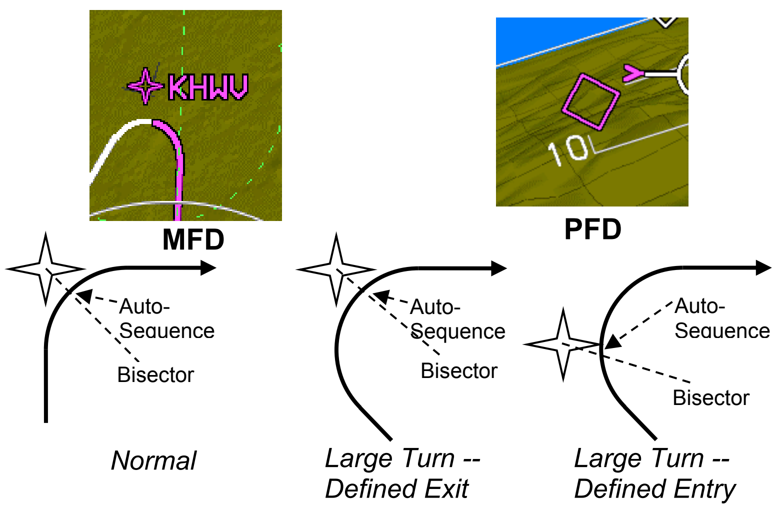


Figure 7-7: Fly-By Waypoints

These waypoints are type 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 type Fly-By with defined Entry Heading. All other waypoints are type Fly-By with Defined Exit Heading.

Table 7-4: Leg Segments for Paths Constructed by IDU

Path Type	Waypoint Entry	Waypoint Exit	# of Segments and Description
Straight Leg, DME Arc or Radius to a Fix	Fly-By	Fly-By	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. 1st Half of Fly-By turn at exit waypoint.
	Fly-By	Fly-Over Defined Exit Heading	2nd half of fly-by turn at entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. Turn to exit heading prior to exit waypoint.
	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.

Table 7-4: Leg Segments for Paths Constructed by IDU

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic or arc path from entry waypoint to exit waypoint.
	Fly-Over Defined Entry Heading	Fly-By	Turn from entry heading after entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. 1st half of fly-by turn at exit waypoint.
	Fly-Over Defined Entry Heading	Fly-Over Defined Exit Heading	Turn from entry heading after entry waypoint. WGS-84 geodesic or arc path from entry to exit turns. Turn to exit heading prior to exit waypoint.
	Fly-Over Defined Entry Heading	Fly-Over Defined Entry Heading	Turn from entry heading after entry waypoint. WGS-84 geodesic or arc path from entry turn to exit waypoint.
Procedure Turn	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic path from entry waypoint on outbound heading for 30 seconds. Turn to procedure turn heading (45°). Outbound on procedure turn heading for 72 seconds. Turn to inbound heading (135°).

Table 7-4: Leg Segments for Paths Constructed by IDU			
Path Type	**Waypoint Entry**	**Waypoint Exit**	**# of Segments and Description**
			WGS-84 geodesic path to exit waypoint. Entry Waypoint and Exit Waypoint are same point.
Holding Pattern	Fly-Over Defined Entry Heading	Fly-Over Defined Entry Heading	Turn to proper entry procedure heading. This heading varies. For a parallel entry, it is 180° from the holding course. For direct and teardrop entries, it is the heading required to get to entry of inbound turn. WGS-84 geodesic path to entry of inbound turn. Inbound turn. Degree of turn varies depending upon entry procedure and heading. WGS-84 geodesic path to holding fix for direct and teardrop entries. WGS-84 geodesic path to entry of turn to holding pattern heading for parallel entries. Turn to holding pattern heading for parallel entries. This leg is not used for direct and teardrop entries. Turn to holding pattern outbound leg (180°). Holding pattern outbound leg (length based upon either time or distance as specified by navigation database). Turn to holding pattern inbound leg (180°).

Table 7-4: Leg Segments for Paths Constructed by IDU

Path Type	Waypoint		# of Segments and Description
	Entry	Exit	
			Holding pattern inbound leg (length based upon either time or distance as specified by navigation database).

7.3.5. Direct-To

If the IDU 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.

7.4. 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.

7.4.1. 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 is 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.

7.4.2. 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.

7.4.3. Dead Reckoning

The EFIS provides a 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.

7.4.4. 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.

7.4.5. 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 that 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 to this occurs 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. A parallel offset entry waypoint (“PTK+”) is shown in Figure 7-8.

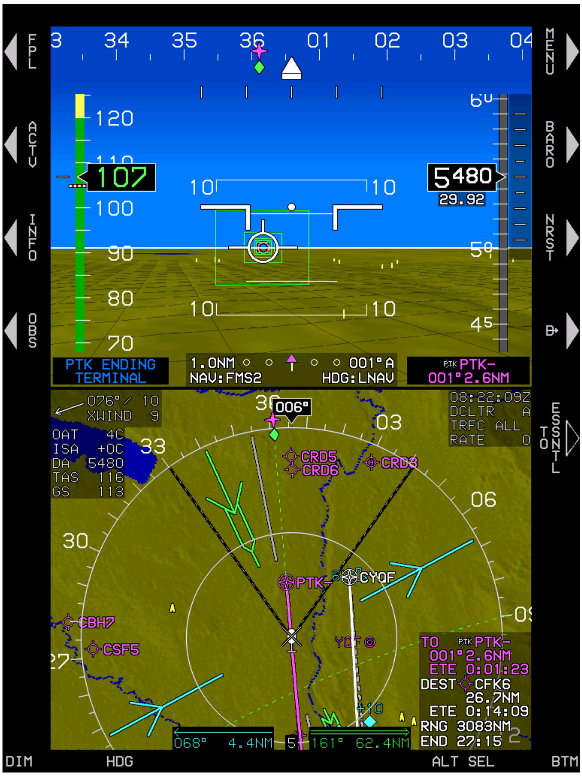


Figure 7-8: Parallel Offset PTK+

The EFIS provides guidance to parallel tracks at a selected offset distance. When executing a parallel offset, the navigation mode and all performance requirements of the original route in the active flight plan are applicable to the offset route. The EFIS provides for entry of offset distance in increments of 1 nm, left or right of course, and is capable of offsets of at least 20 nm. When IDU is operating in offset mode, it is clearly indicated with an advisory flag with blue letters on a black background, 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.

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.

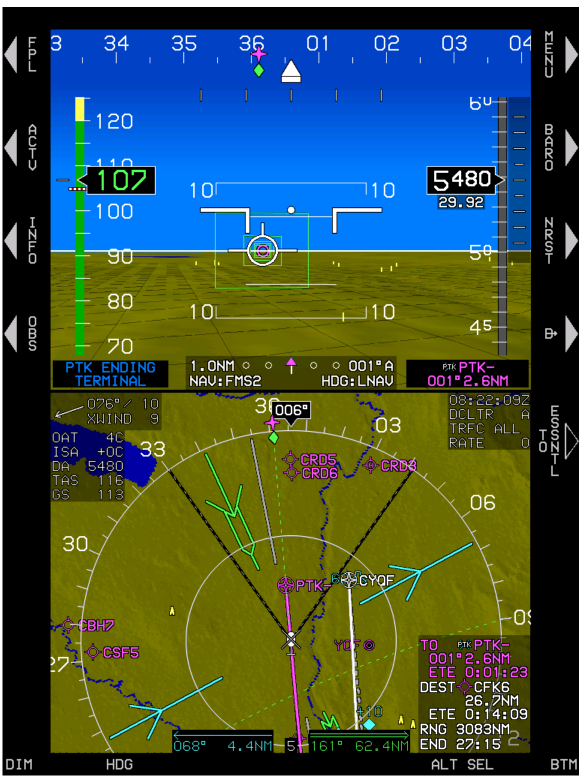


Figure 7-9: Parallel Offset PTK- /PTK ENDING

7.5. Default GPS/SBAS Navigation Modes

In the default GPS/SBAS operating 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 7-5: 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

See Section 9 Appendix for ARINC-424 Path-Terminator Leg Types.

The system switches to default navigation modes based upon region of operation.

Table 7-6: Default Navigation Modes Based on 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 (±3°) 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>

Table 7-6: Default Navigation Modes Based on 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)*; and 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; and within 30NM of the active runway*; and MAWP or FAWP is active waypoint; and if the FAWP is the active waypoint: bearing to FAWP is within 45° of final approach segment track (treated as a mode entry criteria)*; and desired track to FAWP is within 45° of final approach segment track (treated as a mode entry criteria)*; and 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*; and within 30NM of the active runway*; and active runway is the active waypoint.
Terminal	Not in Departure Mode; and not in Approach Mode; and active waypoint is part of a departure or active waypoint and previous waypoint are parts of an arrival or approach or within 30NM of departure airport, arrival airport, or runway.
Enroute	Not in Departure, Approach, nor Terminal Modes.

7.6. GPS/SBAS CDI Scale

Table 7-7: 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 NM; start transition when entering enroute mode.		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		Change to ±1 NM.	
From Departure		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 departure procedure.	

7.7. 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 predicted to be supported. 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.

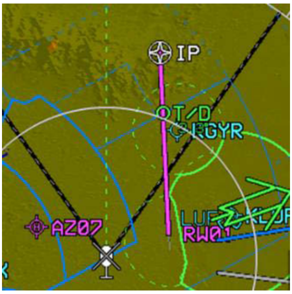
7.7.1. Approach Path Definition

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.

7.7.2. 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 “IP” waypoint 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. Until the FAWP has been sequenced, the IDU indicates a VTF IFR approach has been selected (mode annunciation “VECTORS”) to indicate guidance is not relative to a published approach path, and TERPS clearances are not assured.

7.7.3. 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

7.8. 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 IDU 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 (±1NM) 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 (±1NM) 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 (±1NM) is used. Otherwise, the FSD is ±0.3 NM (DEPARTURE mode) and changes to terminal mode FSD (±1NM) at the turn initiation point of the first waypoint in the DP.

7.9. Loss of Navigation Monitoring

The IDU continuously monitors, independent of any pilot action, for loss of navigation capability. In manual RNP mode or automatic RNP mode prior to sequencing the FAWP, the loss of navigation caution is displayed with a 10-second time to alert if 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. The FAULTS menu enables the pilot to distinguish the cause of the loss of navigation caution. The caution returns to its normal state upon termination of the responsible condition. See Section 5 Menu Functions and Step-By-Step Procedures for Information (INFO) Menu (Step-By-Step).

NOTE:

RNP capability of an aircraft varies depending upon the aircraft equipment and navigation infrastructure. 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

This aircraft is equipped for these individual levels of RNP but may not be capable due to limited satellite coverage.

7.10. Discontinuities

Where the IDU 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 result in activation of 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. Discontinuities are created where the NavData coding specifies a manual termination leg (ARINC-424 path types, FM [Course from a Fix to Manual Termination] and VM [Heading to Manual Transition]).

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) STAR
2) ILS Instrument Approach
3) LOC BC Instrument Approach
4) RNAV GPS Instrument Approach to LPV minima
5) NRST ILS Instrument Approach
6) VOR DME Instrument Approach
7) SID

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.

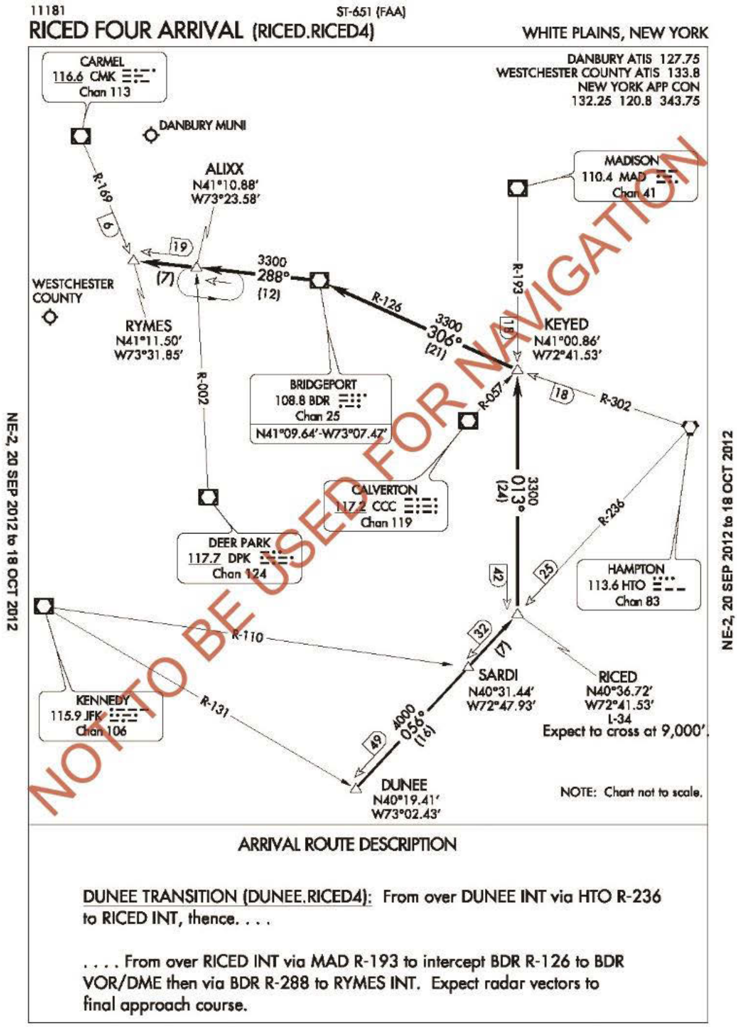


Figure 7-11: Standard Terminal Arrival Route (STAR)

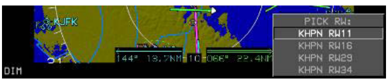
1) Arrival airport must be entered as a waypoint.

2) Push ❶ with desired airport highlighted.

3) Scroll ❶ to **STAR..** and push to enter.

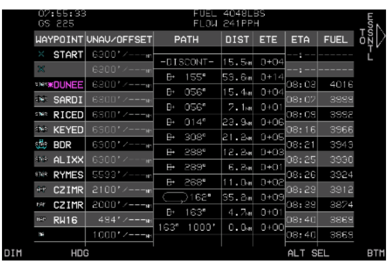
4) Scroll ❶ to desired STAR and push to enter.

5) Scroll ❶ to desired transition. Push to enter.



6) Scroll ❶ to desired runway. Push to enter.

7) Scroll ❶ to desired waypoint to comply with ATC clearance and push to enter.



8) Once a VNAV altitude has been entered for any waypoint within the STAR, subsequent waypoints follow with altitude, bearing, distance, and ETE/ETA values.

9) View STAR route on the MAP page.

10) If ATC issues clearance to another waypoint on the STAR, press **ACTV (L2)**, scroll ❶ to desired waypoint, press  **(R4)**, and then push to enter.

11) If ATC issues clearance direct DUNEE intersection on course, scroll ❶ to **DUNDEE**, press **(R4)**, and then push ❶ to enter.

12) If instructed to hold at RICED, scroll ❶ to **RICED** and push to enter. Scroll ❶ to **HOLD..** Push to enter.

13) Scroll ❶ to **LEG DIST:** and enter desired leg (1-25 NM) length and push to enter. If Leg Time is not desired, push to enter and exit menu. Holding pattern is generated.

14) Press **CONT (L5)** to exit the hold and continue the approach procedure.

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

All approach operations begin with the same basic steps. This example selects the ILS RWY 6 at Bridgeport/IGOR I. Sikorsky (KBDR).

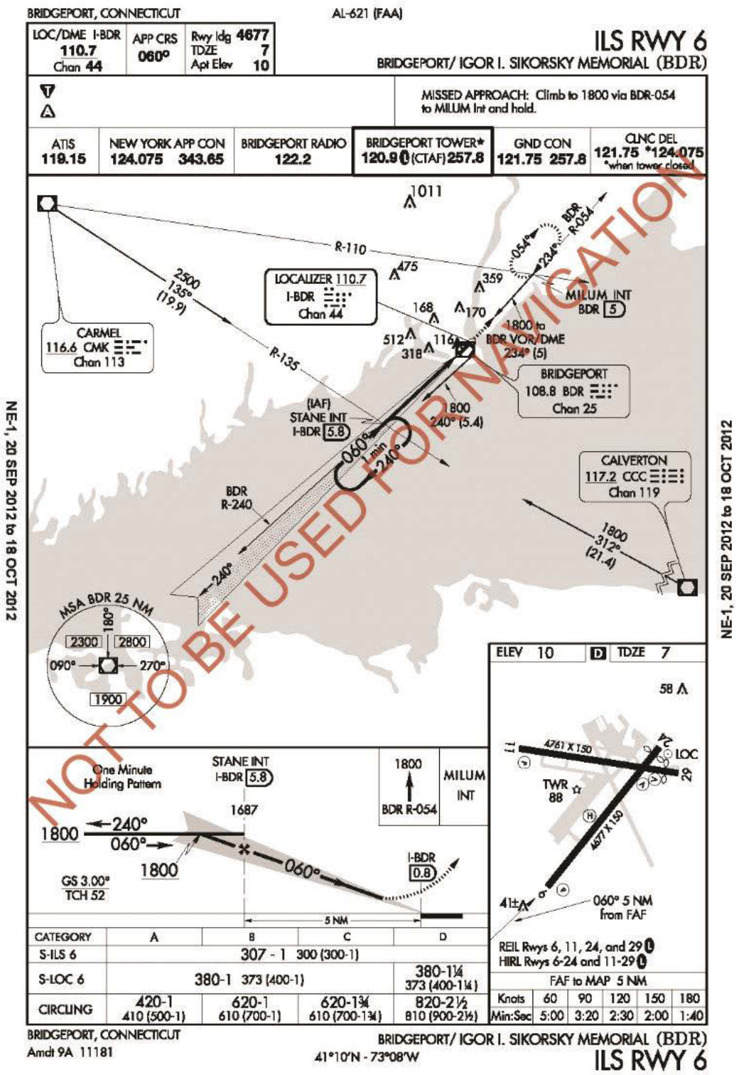


Figure 7-12: ILS RWY 6 (BDR)

1) Press **ACTV (L2)**. Select intended landing airport as the active waypoint.

2) Scroll ❶ to desired airport. Push to enter.

3) Scroll ❶ and select **IFR APPR...** Push to enter.

4) Scroll ❶ to desired approach. Push to enter.

5) Scroll ❶ to desired transition (*indicates the most logical from current position). Push to enter.

6) Scroll ❶ to desired landing runway then push to enter.

7) Top of Descent is over STANE intersection.

8) Decision height has been set to 300’, and MDA for the localizer minima has been set to 380’ MSL. Nav #1 is tuned to the I-BDR Localizer frequency, and the final approach course is set to 060°.

9) Inside the FAF with auto waypoint sequencing suspended again until **ARM** is pressed.

10) After **ARM** is pressed, SUSPEND disappears, and auto waypoint sequencing continues through the full missed approach procedure.

11) VDI disappears upon passage of the MAP.

12) On short final slightly below glideslope.

13) Below localizer minimums and not yet at decision height.

14) LNAV APPR is present as a default type of approach.

7.11.3. LOC Back Course Instrument Approach (Step-By-Step

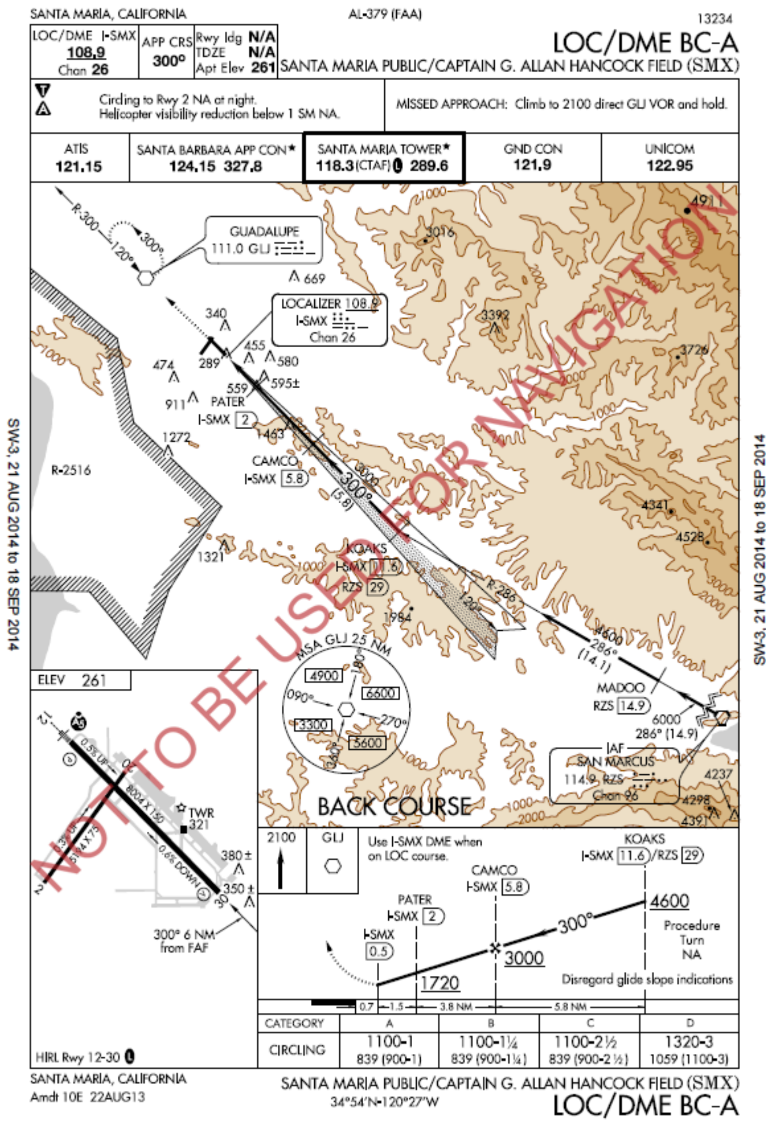


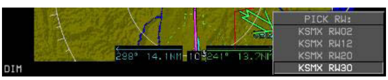
Figure 7-13: LOC Back Course Approach

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

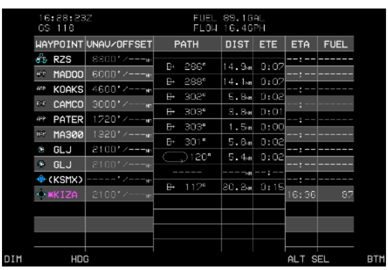
2) Scroll ❶ to **IFR APPR..** and push to enter.

3) Scroll ❶ to **LBCA** and push to enter.

4) Scroll ❶ to desired transition (*indicates the most logical from current position). Push to enter.



5) Scroll ❶ to desired runway. Push to enter.



6) Follow ATC clearance and determine where to proceed. To view NAV LOG, push ❶ then scroll to **NAV LOG** and push to enter.

7) Assume ATC issued clearance to proceed direct to KOAKS, **ACTV (L2)** and **(R4)** were pressed when KDAKS was highlighted.

8) To set minimums, press **MENU (R1)**, **BUGS (R2)**, **MINS (R3)**, scroll ❶ to **MIN ALT..**, and push to enter. Scroll ❶ to set desired minimum altitude and push to enter.

9) Set 108.9 MHz in Nav #1 or #2 as applicable and press **OBS (L4)**. Press **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)** as applicable. Scroll ❶ to set front course bearing of 120° and push to enter. This results in proper sensing of Back Course CDI indications.

10) Due to aircraft heading being more than 105° beyond the front course bearing of 120°, HSI indicates a BC1 120° setting. Back Course sensing is therefore automatic with reversal of the CDI presentation for natural tracking guidance.

11) Approaching step down fix PATER, press **ARM (L6)** to arm the missed approach procedure.

12) Missed approach procedure automatically sequences when passing the MAWP, or press **MISS (L5)** at any time.

13) During the missed approach procedure, the FMS changes to FMS guidance.

7.11.4. RNAV (GPS) Instrument Approach to LPV Minima (Step-By-Step)

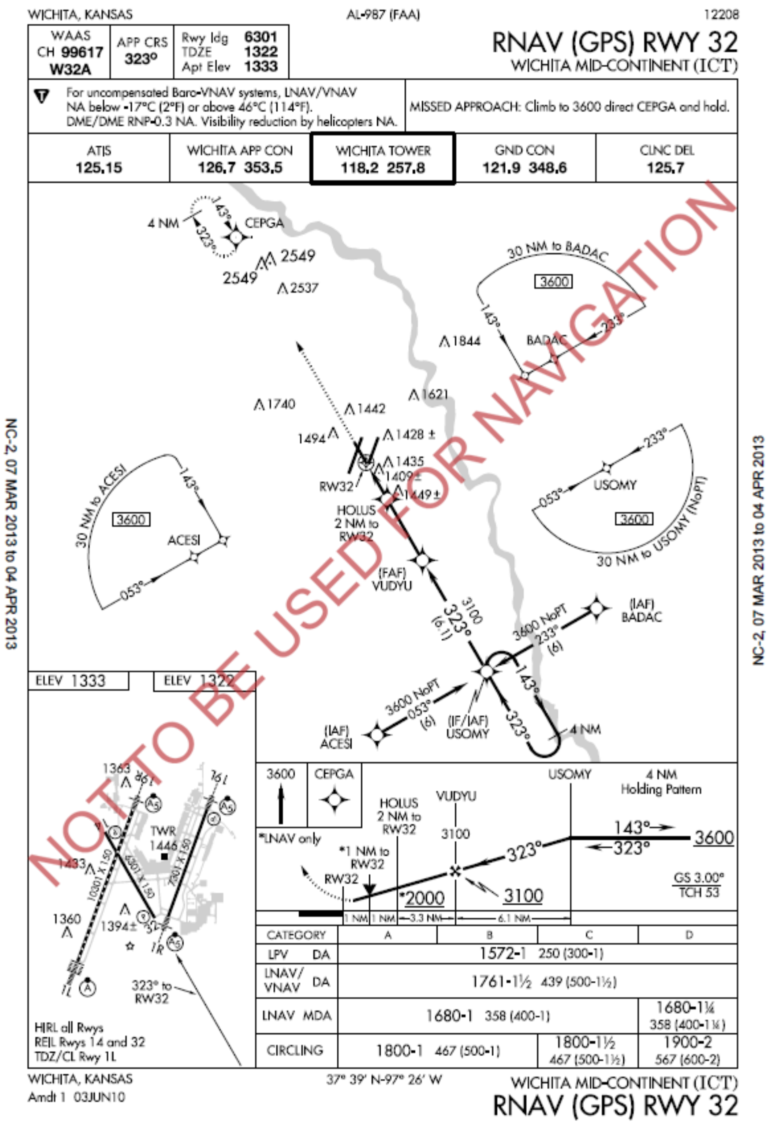


Figure 7-14: RNAV (GPS) Instrument Approach to LPV Minima

1) Select airport and **IFR APPR..** as in previous examples.

2) For example, scroll ❶ to **RNAV32 (99617)** then push to enter.

3) Scroll ❶ to desired transition and runway. Push to enter.

4) Scroll ❶ to scale map to desired value and observe Top of Descent point within instrument approach procedure.

5) Observe active leg magenta line and next leg in white.

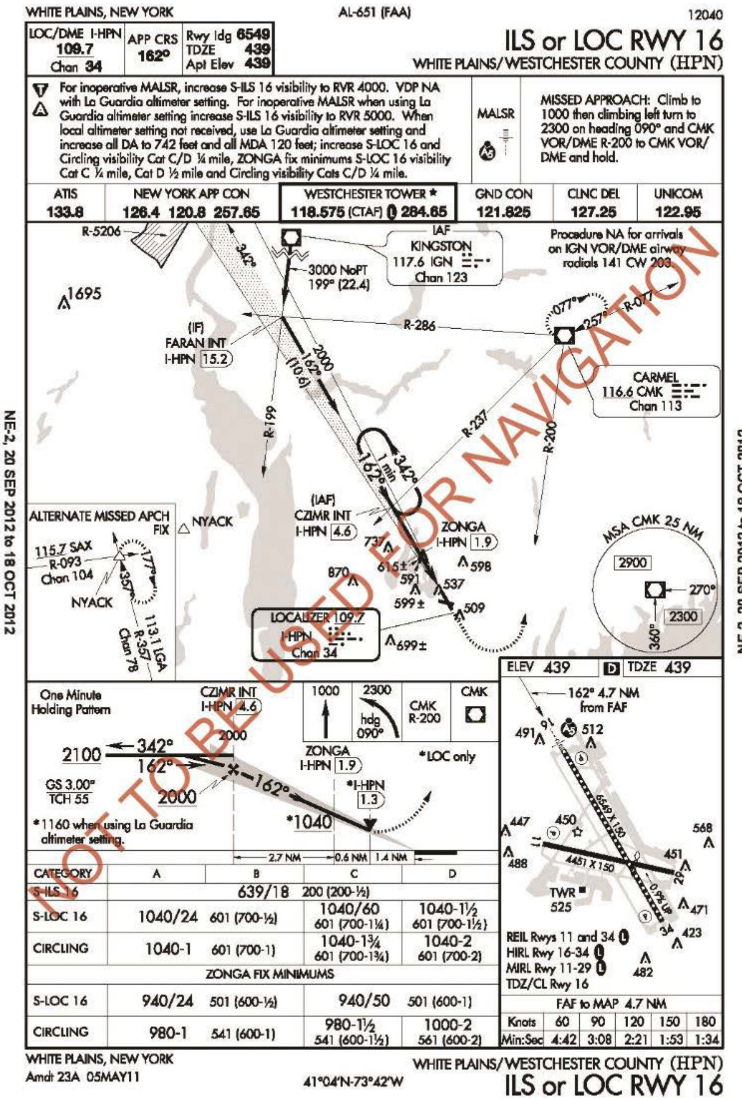
6) Inside FAF, press **ARM (L6)** prior to step down **FIX**, **HOLUS**.

7) VDI displays vertical guidance for the LPV vertical profile based on GPS/SBAS.

8) Obstructions appear on PFD and MAP page.

9) Example shows the Flight Path Marker lined up on the active runway after passing through minimums and on glidepath. “MINIMUMS, MINIMUMS” is heard as an aural annunciation.

7.11.5. NRST ILS Instrument Approach (Step-By-Step)



CATEGORY	A	B	C	D
S-ILS 16	639/18	200 (200-½)		
S-LOC 16	1040/24	601 (700-½)	1040/60 601 (700-1¼)	1040-1½ 601 (700-1½)
CIRCLING	1040-1	601 (700-1)	1040-1¾ 601 (700-1¾)	1040-2 601 (700-2)
ZONGA FIX MINIMUMS				
S-LOC 16	940/24	501 (600-½)	940/50	501 (600-1)
CIRCLING	980-1	541 (600-1)	980-1½ 541 (600-1½)	1000-2 561 (600-2)

FAF to MAP 4.7 NM					
Knots	60	90	120	150	180
Min:Sec	4:42	3:08	2:21	1:53	1:34

WHITE PLAINS, NEW YORK
Amdt 23A 05MAY11
41°04'N-73°42'W
WHITE PLAINS/WESTCHESTER COUNTY (HPN)
ILS or LOC RWY 16

NE-2, 20 SEP 2012 to 18 OCT 2012

Figure 7-15: NRST ILS Instrument Approach

1) Press **NRST (R3)** then scroll ❶ to **ILS..** and push to enter.

2) Scroll ❶ to desired airport and runway then push to enter ("ILS" must precede airport).

3) Push ❶ to **CONFIRM ACTIVATE ILS**.

The following actions occur:

1) A direct flight plan to the ILS airport is created.
2) A Vectors-to-Final ILS approach is activated.
3) Heading Bug is activated to the current heading.
4) VLOC 1 and VLOC 2 OBS settings are set to the associated localizer course.
5) ILS automatically switched to NAV #2.

6) EFIS changes to LOC1, and VDI indicates source of glideslope GS1.

7) Inside the FAF, **ARM (L6)** and **MISS (L5)** appear with auto waypoint suspended.

8) Press **ARM (L6)** to continue auto waypoint sequencing.

9) During the missed approach, the HSI reset to FMS1, and dashed magenta and white lines lead the flight to the Holding Waypoint.

10) Scroll ❶ to scale the MAP for desired view of published missed approach procedure.

7.11.6. VOR/DME Instrument Approach (Step-By-Step)

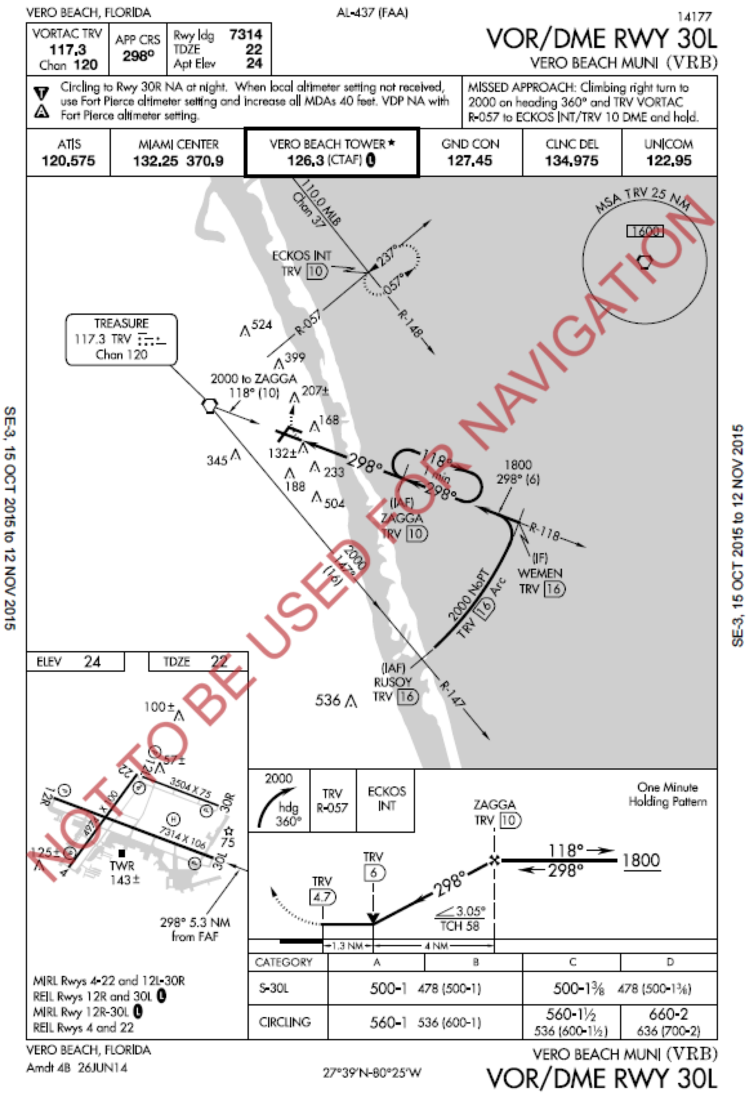
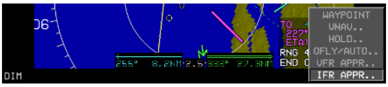


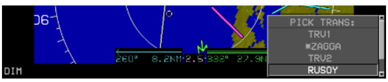
Figure 7-16: VOR/DME Instrument Approach

1) With the destination airport entered as the waypoint, select **IFR APPR..** and type of approach.



2) Scroll ❶ to select desired runway. Push to enter.

3) View active flight plan and press **EXIT (R1)** to remove menu.



4) Scroll ❶ to view procedure with desired MAP scale.

5) Minimums are set to 500’ as the aircraft tracks along the 16 DME ARC to **WEMEN** at 2000’.

6) HSI has changed to NAV: VOR2 with CDI centered on the final approach course.

7) PFD with HSI page selected inside of FAF and MAP not armed.

8) Auto waypoint sequencing has been suspended.

9) PFD view has changed to zoom mode.

10) PFD is changed to show the MAP in the bottom area.

11) PFD below minimums and beyond the MAWP.

12) MAP Page in ARC view displaying MAP routing to MAHWP and terrain rendering with obstructions.

7.11.7. Standard Instrument Departure (SID) (Step-By-Step)

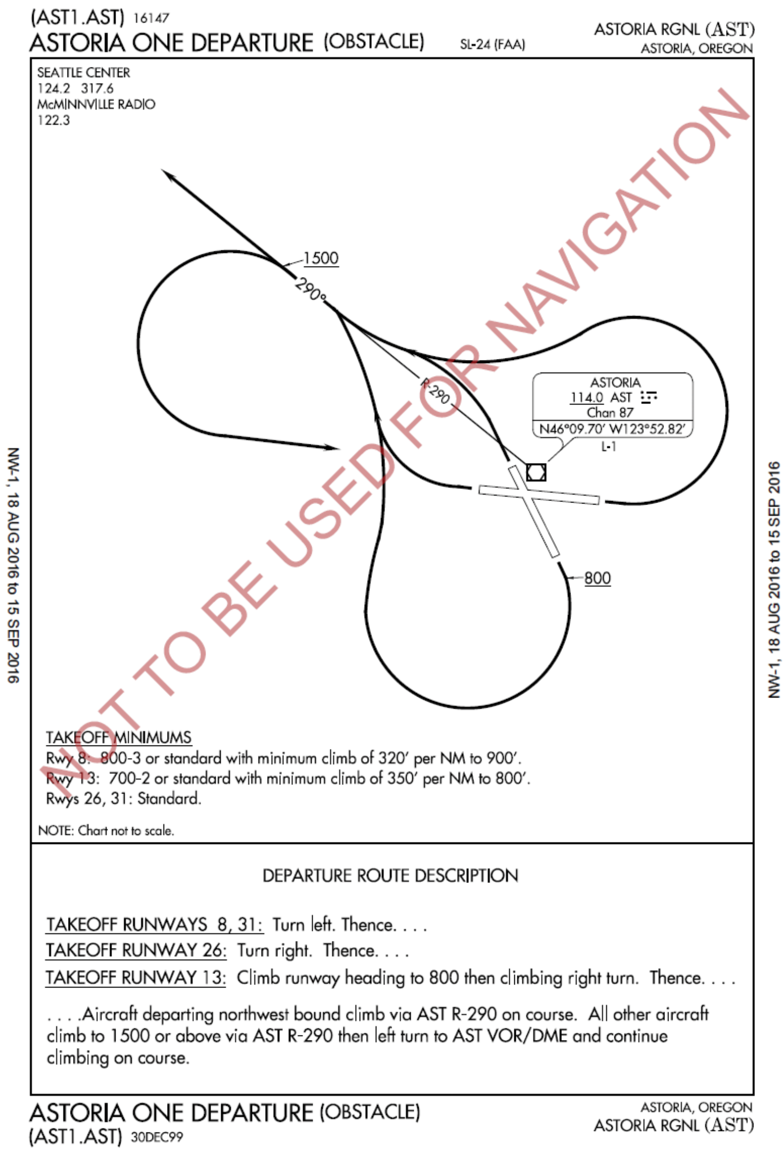
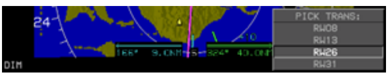


Figure 7-17: Standard Instrument Departure (SID)

1) Press **ACTV (L2)**. Scroll ❶ to KAST and push to enter.

2) Scroll ❶ to **DP..** and push to enter.

3) Scroll ❶ to desired AST1 and push to enter.



4) Scroll ❶ to desired transition. Push to enter.

5) Scroll ❶ to desired runway. Push to enter.

6) View VOR1 tracking the AST 290°R outbound thence on course as per ATC clearance.

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.

NOTE:

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 VERT LON 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

Enhanced HTAWS and HTAWS

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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 TAWS are:

Terrain Display: Display of terrain and obstacles on PFD and ND.

Forward Looking Terrain Awareness (FLTA): Uses a terrain database and an obstruction database to alerts to hazardous terrain or obstructions in front of the aircraft.

Excessive Rate of Descent (GPWS Mode 1): Alerts when the rate of descent is hazardously high as compared to height above terrain (i.e., descending into terrain).

Excessive Closure Rate to Terrain (GPWS Mode 2): Alerts when the rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain).

Sink Rate after Takeoff or Missed Approach (GPWS Mode 3): Alerts when a sink rate is detected immediately after takeoff or initiation of a missed approach.

Flight into Terrain when not in Landing Configuration (GPWS Mode 4): Alerts when descending into terrain without properly configuring the aircraft for landing.

Excessive Downward Deviation from an ILS Glideslope (GPWS Mode 5): Alerts when an excessive downward glideslope deviation is detected on the final approach segment of an ILS approach.

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.

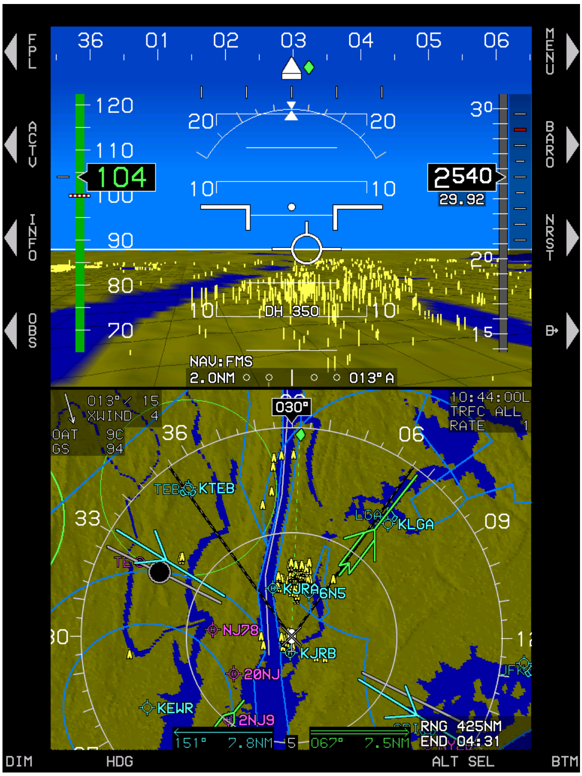


Figure 8-1: Terrain Display

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
2) Obstruction database
3) Airport and runway database
4) Aircraft position
5) Aircraft track
6) Aircraft groundspeed
7) Aircraft bank angle
8) Aircraft altitude
9) Aircraft vertical speed

8.3.1. FLTA Modes

The 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, the 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.

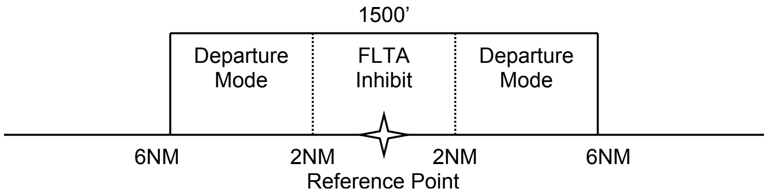


Figure 8-3: Default FLTA INHBT

2) **Other Modes**: For other default FLTA modes, the reference point for automatic FLTA inhibiting and mode envelope definition 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:

   a) **Approach Mode**: Exists when within 1900 feet and 5NM of the reference point.

   b) **Terminal Mode**: Exists from 5NM to 15NM from the reference point when below an altitude that varies from 1900 feet (at 5NM) to 3500 feet (at 15NM) above the reference point.

   c) **Enroute Mode**: Exists when not in any other mode.

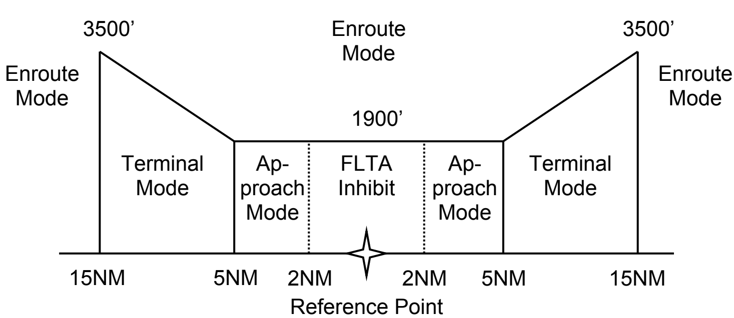


Figure 8-4: FLTA INHBT Mode Areas

8.4. 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 to the pilot. The dimensions of the search envelope depend upon TAWS type, FLTA mode (in § 8.3.1), aircraft track, aircraft groundspeed, aircraft bank angle, and vertical speed. Basic envelope parameters are as follows:

1) **TAWS Type**: TAWS type determines the value of several parameters used to calculate the search envelope (Table 8-2).

Table 8-2: FLTA Search Envelope for HTAWS

Envelope	Parameter	Notes
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. 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:	150 feet	Reduced to 100 feet when Low Altitude Mode is engaged
Approach Mode Level/Climbing Flight RTC:	150 feet	Reduced to 100 feet when Low Altitude Mode is engaged
Departure Mode Level/Climbing Flight RTC:	100 feet	
Enroute Mode Descending RTC:	100 feet	
Terminal Mode Descending RTC:	100 feet	
Approach Mode Descending RTC:	100 feet	
Departure Mode Descending RTC:	100 feet	

2) **Aircraft Track**: Terrain search envelope is aligned with aircraft track.

3) **Aircraft Groundspeed**: Used in conjunction with the range parameter to determine the look-ahead distance. In addition, aircraft groundspeed is used in conjunction with FLTA mode to determine the search volume width as follows:

   a) **Enroute Mode**: Search volume width is based upon 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**: Search volume width is based upon 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**: Search volume width is based upon 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**: Search volume width is based upon 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.

1) **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.

2) **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.

8.4.1. FLTA Search Volume

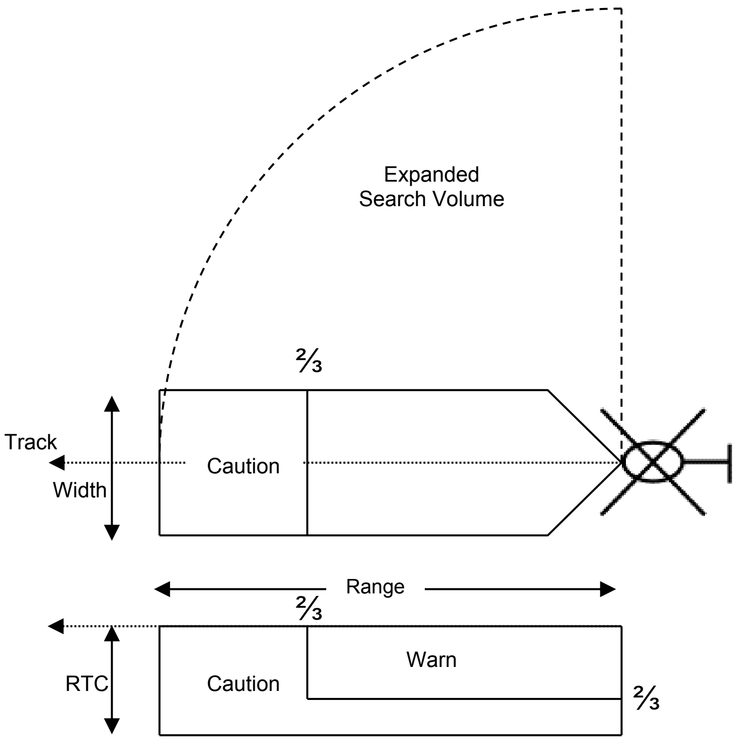


Figure 8-5: FLTA Search Volume

8.4.2. 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 enabled only if TAWS Inhibit is not enabled (TAWS Inhibit prevents terrain from being automatically enabled on the navigation display).

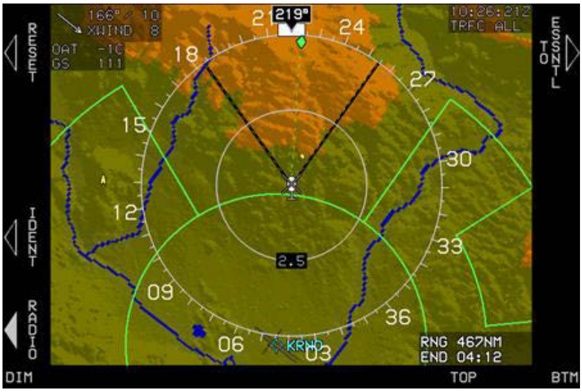


Figure 8-6: MFD in Popup Mode

In addition, when an FLTA warning is initiated or upgraded, an automatic popup mode is engaged as follows:

1) Display (bottom area) switched to navigation display.

2) Display (bottom area) switched to aircraft centered and heading up.

3) Display (bottom area) panning disabled.

4) Display (bottom area) scale set to:

   a) 10NM (groundspeed > 200 knots);

   b) 5 NM (groundspeed <= 200 knots and groundspeed > 100 knots); or

   c) 2NM (groundspeed <= 100 knots).

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 #2 with either HTAWS classes enabled and do not occur:

1) If TAWS Inhibit is enabled;

2) On an IDU-680 in Essential Mode, if Essential EICAS page is shown.

8.5. Excessive Rate of Descent (GPWS Mode 1)

GPWS Mode 1 function uses aircraft vertical speed information and AGL altitude to alert when rate of descent is hazardously high as compared to height 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	$62.5\% \times (\text{Sink Rate} - 600)$	$66\% \times \left(\begin{matrix}\text{Caution}\\\text{Threshold}\end{matrix}\right)$
1000 to 3000	Lesser of: 750, or, $25\% \times (\text{Sink Rate})$	

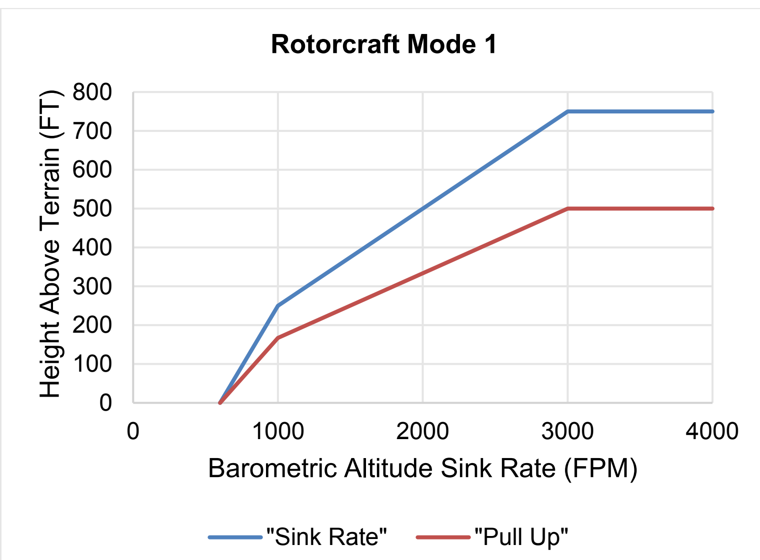


Figure 8-7: Rotorcraft GPWS Mode 1

8.6. Excessive Closure Rate to Terrain (GPWS Mode 2)

GPWS Mode 2 function is present in Class A TAWS and uses filtered AGL rate and AGL altitude to alert when rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain). AGL rate filtering is based upon a 10-second sampling time.

There are two Mode 2 envelopes: Mode 2A, which is active when not in landing configuration, and Mode 2B, which is active when in landing configuration. Envelope selection is determined as 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 $\leq$ 200 ft and Airspeed $\leq$ 80 KIAS

Table 8-5: HTAWS GPWS Mode 2A Envelopes (NOT in Landing Configuration)

<table>
<tr><th rowspan="2">AGL Rate (fpm)</th><th colspan="2">AGL Altitude (ft.)</th></tr>
<tr><th>“Caution, Terrain” Caution Threshold</th><th>“Pull Up” Warning Threshold</th></tr>
<tr><td>< 1905</td><td>$125\% \times (\text{AGL Rate} - 1600)$</td><td rowspan="2">$66\% \times \left(\begin{array}{c}\text{Caution}\\ \text{Threshold}\end{array}\right)$</td></tr>
<tr><td>> 1905</td><td>20% of the lesser of:
<table>
<tr><th>Airspeed (KIAS)</th><th>AGL Rate (fpm)</th></tr>
<tr><td>< 90</td><td>3120</td></tr>
<tr><td>90 to 130</td><td>$3120 + 72 \times (\text{Airspeed} - 90)$</td></tr>
<tr><td>> 130</td><td>6000</td></tr>
</table>
or
AGL Rate</td></tr>
</table>

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

Table 8-6: HTAWS GPWS Mode 2B Envelopes	
AGL Altitude (ft.)	
"Caution, Terrain" Caution Threshold	**"Pull Up" Warning Threshold**
Lesser of: 300, or, $20\% \times (\text{AGL Rate} - 2000)$	$66\% \times (\text{Caution Threshold})$

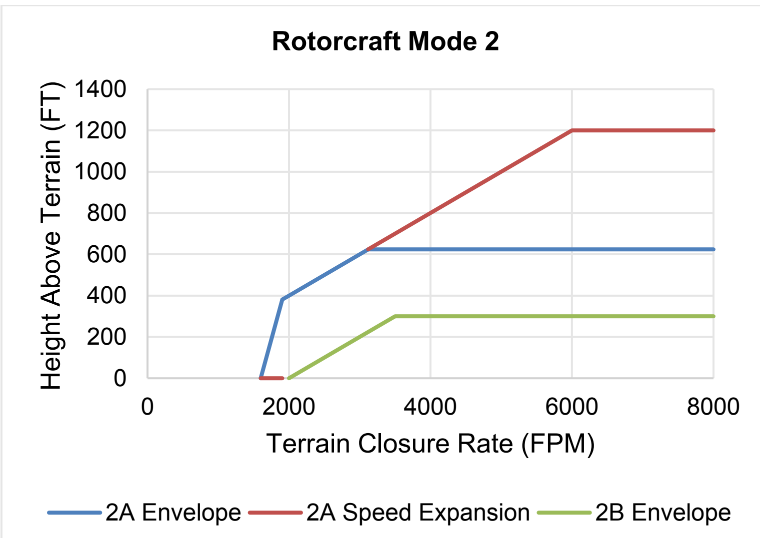


Figure 8-8: Rotorcraft GPWS Mode 2

8.7. Sink Rate after Takeoff or Missed Approach (GPWS Mode 3)

The 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 700 feet AGL, traveling more than 6NM 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, a GPWS Mode 3 warning is generated as defined below.

"**Don't Sink**" AGL = 140% of sink rate

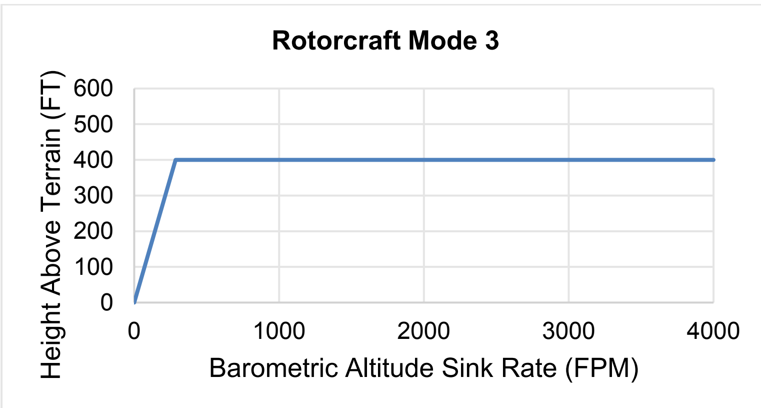


Figure 8-9: Rotorcraft GPWS Mode 3

8.8. 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 or flaps 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

The rotorcraft Mode 4 envelope consists of a low-speed region and a high-speed region. In the low-speed region, TOO LOW appears in conjunction with a single "Too Low Gear" aural alert. In the high-speed region, TOO LOW appears in conjunction with a single "Too Low Terrain" aural alert. In addition, rotorcraft Mode 4 has autorotation expansion, and when engaged, the aural alert is "Too Low Gear" regardless of speed.

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.

Table 8-8: HTAWS GPWS Mode 4A Envelopes

Segment	Speed (KIAS)	AGL Altitude (ft.)
4A Low-Speed	< 100	150 (400 in autorotation)
4A High-Speed	≥ 100	

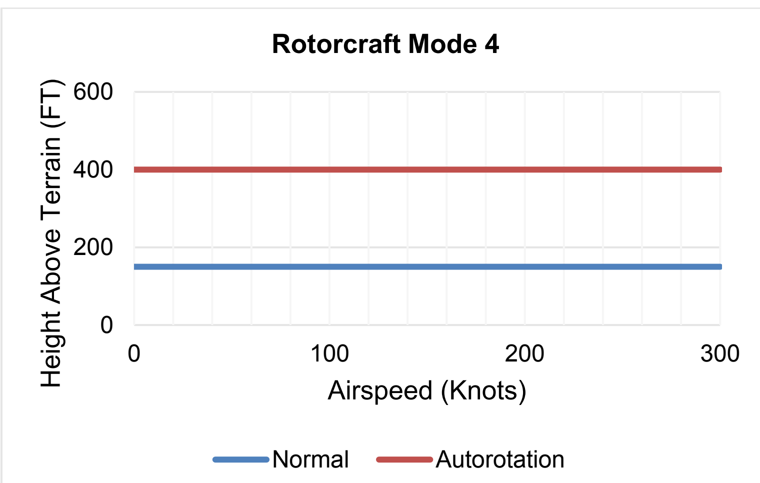


Figure 8-10: Rotorcraft GPWS Mode 4

8.9. 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. The curve compares glideslope deviation to AGL altitude as in Table 8-9. (Reference: RTCA/DO-161A Mode 5 for TAWS)

Table 8-9: HTAWS GPWS Mode 5 Envelopes

Caution Threshold	Warning Threshold
Greater of: $\begin{bmatrix} 1.3 + 1.4\% \times \\ (150 - \text{AGL Altitude}) \end{bmatrix}$ Dots or 1.3 Dots	Greater of: $\begin{bmatrix} 2 + 1\% \times \\ (150 - \text{AGL Altitude}) \end{bmatrix}$ Dots or 2 Dots

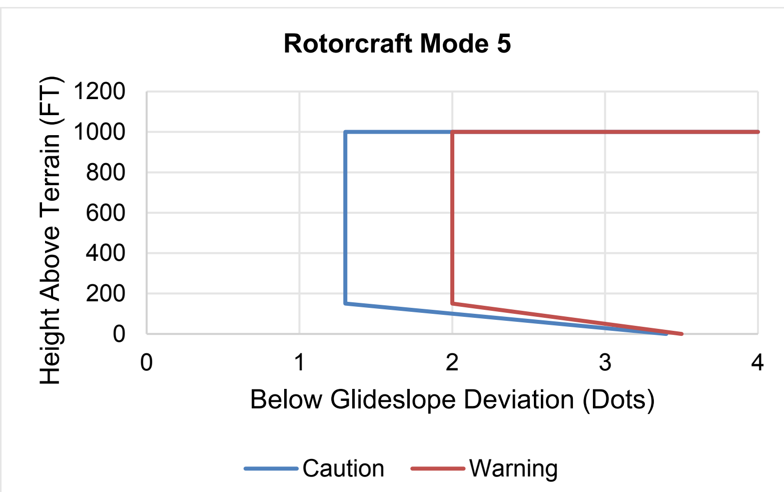


Figure 8-11: Rotorcraft GPWS Mode 5

8.10. External Sensors and Switches

The EFIS TAWS requires a variety of inputs from external sensors and switches to perform its functions. They are 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) inputs for TAWS. GPS/SBAS receiver connects directly to the EFIS IDU.

2) **Air Data Computer (ADC)**. Source of barometric altitude, outside air temperature, and vertical speed for TAWS and connects directly to the EFIS IDU.

3) **ILS Receiver**. Glideslope receiver is the source of glideslope deviation for the TAWS.

4) **Radar Altimeter (RA)**. Source for radar altitude for the TAWS.

5) **Gear Position Sensors**. Landing gear position discretes, as configured in the system limits, are the source of landing gear position for TAWS.

6) **Flap Position Sensor**. Flap position discrete, as configured in the system limits is the source of flap position for the TAWS.

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

8) **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 the PFD).

9) **Audio Mute Switch**. Used for silencing active aural alerts. Audio Mute Switch is of the momentary type and is connected directly to the EFIS IDU. The Audio Mute Switch is momentarily pulled to ground when silencing of active aural alerts is desired.

10) **Glideslope Deactivate Switch**. As configured in the system limits, is used for inhibiting the GPWS Mode 5 function. Glideslope Deactivate Switch is of the momentary type and is momentarily activated when inhibition of the GPWS Mode 5 function is desired.

Applicability of external sensors and switches for the applicable TAWS is as follows.

Table 8-10: External Sensors and Switches (Applicable TAWS)

Aircraft Type	Rotorcraft RG	Rotorcraft FG	Rotorcraft
HTAWS Class	Enhanced	Enhanced	Norm
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

8.11. TAWS Basic Parameter Determination

Fundamental parameters used for TAWS functions are as follows.

Table 8-11: 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	GPS/SBAS	Geodetic Height converted to MSL with current EGM database. To be considered

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		valid to use as MSL altitude, VFOM must be less than or equal to 106 feet. Secondary source of MSL altitude is barometric altitude from an air data computer. Barometric altitude is determined based upon a barometric setting in the following order of preference: 1) If either the pilot or co-pilot system is operating in QNH mode, the QNH barometric setting is used (i.e. on-side barometric setting preferred); or 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. If neither of the above conditions is met, MSL altitude is marked as invalid. When a reporting station elevation is determined and outside air temperature is valid, a temperature correction is applied. TAWS uses the lower of the barometric altitude or the temperature-corrected altitude. In the case of QNH-

Table 8-11: HTAWS Basic Parameters Determination		
Parameter	**Source**	**Notes**
		mode barometric setting, reporting station elevation is derived from waypoint or active runway elevations in the active flight plan using the following logic: 1) If the aircraft is in **TERMINAL, DEPARTURE**, **IFR APPROACH**, or **VFR APPROACH** mode and an active runway exists, reporting station elevation is the elevation of the active runway threshold. 2) Otherwise, if the aircraft is in **TERMINAL** mode, reporting station elevation is the elevation of the airport causing **TERMINAL** mode. 3) In **ENROUTE** mode, no reporting station elevation can be determined. 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. **QFE**: Barometric setting resulting in the altimeter displaying height above a

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		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.
Terrain Data	Terrain Database	To be considered valid, the following must apply: 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 CRC-32 checks at system initialization and during runtime.
Obstacle Data	Obstacle Database	To be considered valid, the following must apply: 1) Aircraft position is valid; 2) Aircraft position is within the boundaries of the obstacle database; and 3) The obstacle database is not corrupt as determined by CRC-32 checks at system initialization.

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
AGL Altitude	Radar Altitude	Secondary source for AGL Altitude is MSL altitude less terrain altitude.
Vertical Speed	Instantaneous Vertical Speed	IVSI values come from barometric vertical speed from an ADC "quickened" with vertical acceleration from an AHRS. 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: 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 CRC-32 check at system initialization.

8.12. TAWS Automatic Inhibit Functions (Normal Operation)

The following automatic inhibit functions occur during normal TAWS operation to prevent nuisance warnings:

1) FLTA function is automatically inhibited when in 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.

8.12.1. 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 § 8.8).

2) **System Sensor/Database Failures**: System sensor failures, non-installation of optional sensors, database failures, and combinations thereof affect the TAWS as follows.

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Displaced	FLTA	PDA	GPWS Mode 1	GPWS Mode 2	GPWS Mode 3	GPWS Mode 4	GPWS Mode 5
GPS/SBAS (H)	AC Position	Inhibit	Inhibit	Inhibit					
TD	Terrain Elev.	Inhibit	Inhibit						
ILS	Glide-slope Dev.								Inhibit
MSL	MSL Altitude	Inhibit	Inhibit	Inhibit					
GPS/SBAS (H) + RADLT	AC Position, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC	MSL Altitude, VSI	Inhibit	Inhibit	Inhibit	Inhibit		Inhibit		
TD + RADLT	Terrain Elev. AGL Altitude	Inhibit	Inhibit		Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Displaced	FLTA	PDA	GPWS Mode				
					1	2	3	4	5
MSL + RADLT	MSL Altitude, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC + RADLT	MSL Altitude, VSI, AGL ALT	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Notes:

1) Combinations listed give the minimum combinations with the worst consequences. Many other combinations are possible, but their effects are subsumed within the combinations listed.

2) GPS/SBAS (H) = HFOM > max (0.3NM, HAL). Indication is loss of terrain display on PFD and ND.

3) GPS/SBAS (V) = VFOM > 106'.

4) GPS/SBAS = GPS/SBAS (H) + GPS/SBAS (V). Indication is loss of terrain display on PFD and ND.

5) TD = Terrain Data invalid. This would be due to being beyond the database boundaries or database corruption.

6) ADC = Air Data Computer. Indication is ADC1 FAIL or ADC2 FAIL flag, or red Xs indicating a single ADC failure.

7) RADALT = Radar Altimeter. Indication is lack of radar altimeter source indication on radar altimeter display, RADALT FAIL.

8) ILS = ILS Glideslope Deviation. Indication is lack of glideslope needles.

9) MSL = MSL Altitude Invalid. Indication is NO TAWS in the absence of other failures.

8.12.2. 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 manually inhibited by actuation of the external TAWS Inhibit Switch. The TAWS Inhibit Switch 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 by actuation of the momentary Glideslope Cancel Switch when below 1000’ AGL. GPWS Mode 5 manual inhibit automatically resets by ascending above 1000’AGL.

8.13. TAWS Selections on PFD

PFD Declutter menu includes three option possibilities for TAWS:

1) SVS TAWS

2) SVS BASIC

3) None

Figure 8-12 through Figure 8-16 show all possible scenarios including “None” where the aircraft pierces the TAWS FLTA Terrain envelope, and SVS TAWS is automatically enabled for the safest possible warning alert condition.

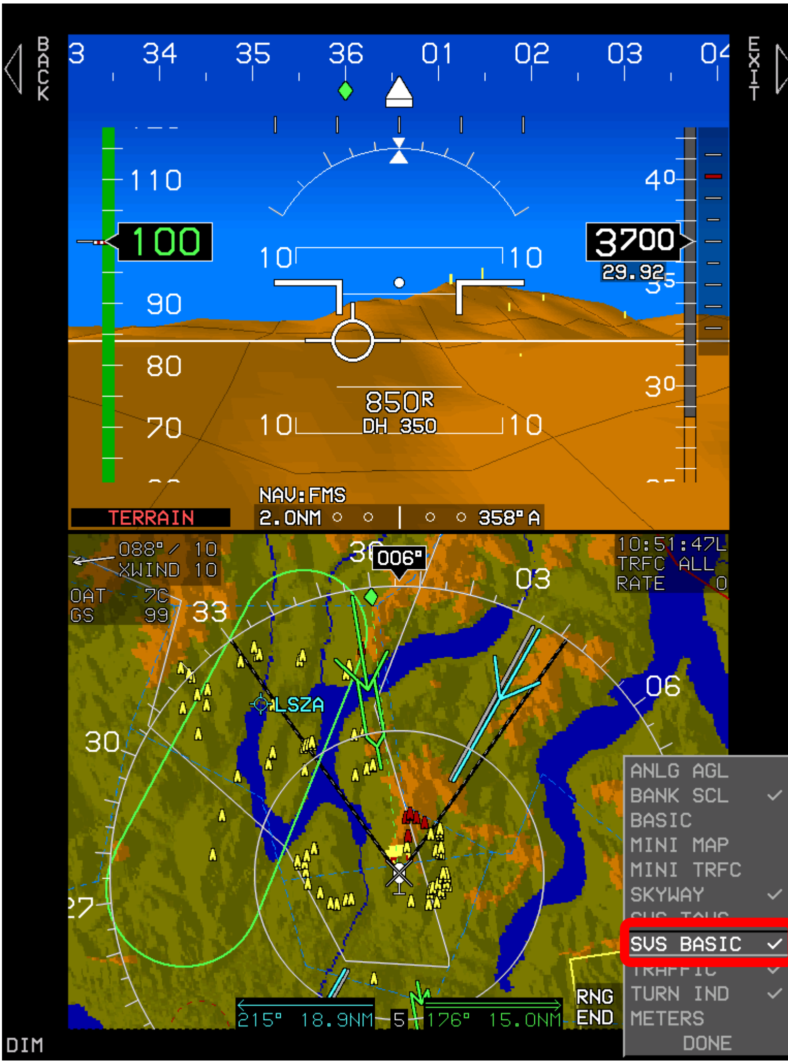


Figure 8-12: PFD SVS BASIC Option

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

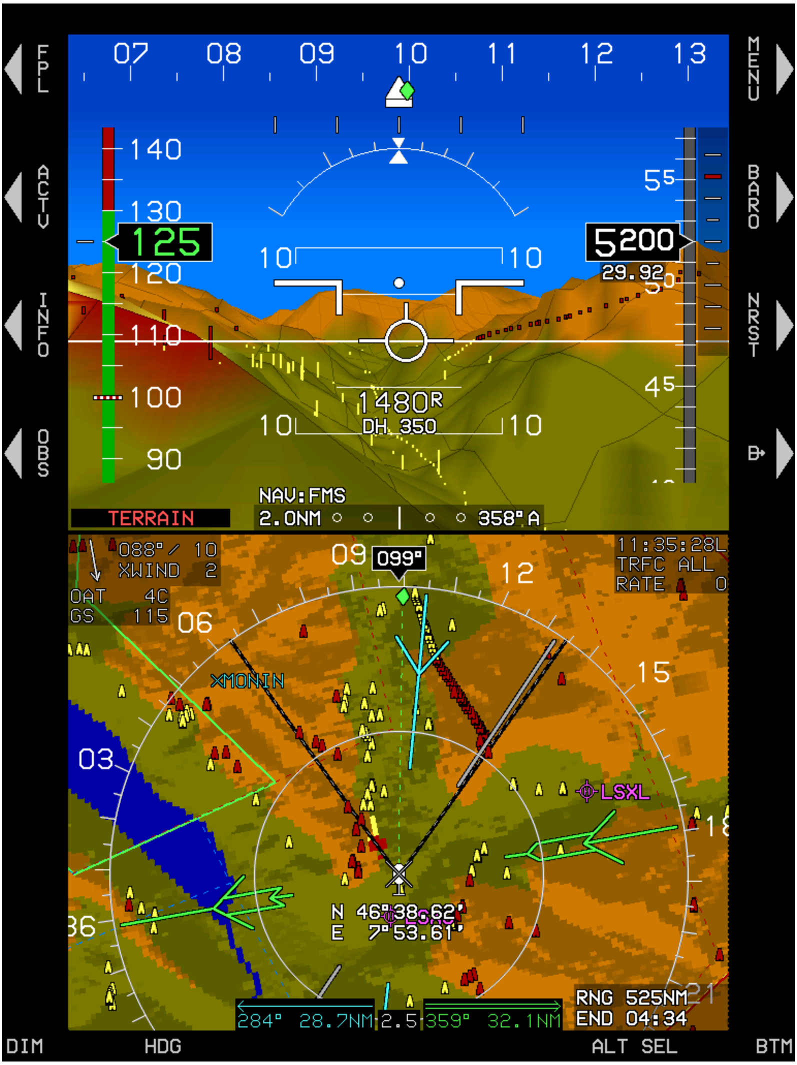
Figure 8-13: PFD SVS TAWS Option

Obstruction within TAWS FLTA Caution envelope with aural annunciation "Caution Obstruction, Caution Obstruction." Obstruction symbols flash.

Figure 8-14: PFD SVS TAWS Option and Obstruction Caution

Obstruction within TAWS FLTA warning envelope with aural annunciation “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

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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, it is up to the pilot to determine what equipment code is applicable for domestic or international flight plans. It is solely up to the aircraft operator to determine what certifications pertain to them. All certifications are outlines in the Airplane or Rotorcraft Flight Manual Supplement. Helpful FAA links for this information may be found at:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/air_traffic_services/flight_plan_filing/

9.3.1. 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), and 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.

9.3.2. Terrain Clearance

Use the flight path marker to evaluate climb performance in regards to 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 (overlaying blue sky), the climb is sufficient for the present time, and no further action is necessary until level off.

9.3.3. 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, Comm/Nav frequencies, and runway lengths are displayed.

9.3.4. Unique Names for Flight Plans

Multiple routes between the same airport pairs are numbered automatically (KCEW-KDHN) [0], (KCEW-KDHN) [1], etc.). With some ingenuity, pilots may work around this and apply 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 the different routing to clear the MOA or whatever creates the necessity for specific routing.

9.3.5. 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 advisory may appear due to the altimeter setting not on 29.92 inHg or 1013 mbar.

9.3.6. Warnings, Cautions, and Advisories

Review all conditions found in the Section 2 System Overview for Warnings, Cautions, and Advisories. These conditions precisely define the scenario for the various warnings, cautions, and advisory flags as they appear including the time delay where appropriate.

9.4. 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 2/3rds 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 (oil rigs, 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.

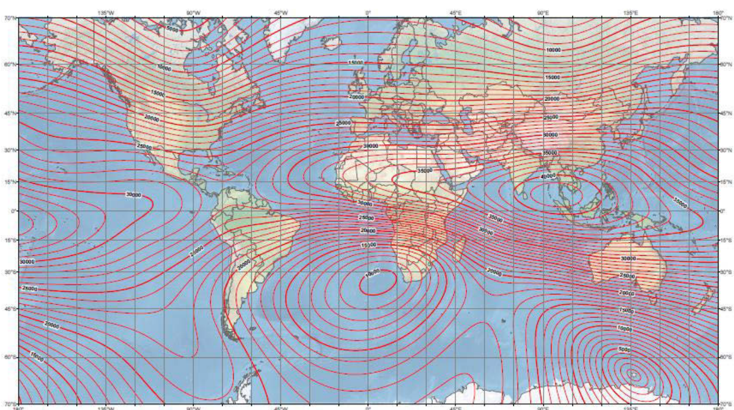


Figure 9-1: US/UK World Magnetic Model

There are two modes for the EFIS:

1) Magnetic North mode: Heading from the 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, and 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 the 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, and 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.

9.5. 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'
30,000'	75'
40,000'	100'
50,000'	125'

Allowable installed system error is added on top of instrument error and these values are derived from the regulations as follows.

Table 9-2: Regulatory Reference	
Regulation	**Allowed Error**
14 CFR § 23.1325	At sea level, the greater of 30’ or 30% of the calibrated airspeed in knots. This increases proportionally to SAE AS8002A Table 1 at higher altitudes.
14 CFR § 25.1325	
14 CFR § 27.1325	
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’:

1) Calculate allowable instrument error based upon altitudes:
   Allowable Instrument Error #1 = 50’
   Allowable Instrument Error #2 = 50’

2) Calculate allowable installed system error based upon altitudes and calibrated airspeed:
   Allowable Installed System Error #1 = 30’
   Allowable Installed System Error #2 = 30’

3) Calculate altitude miscompare threshold based upon sum of above allowable errors:
   Altitude Miscompare Threshold = 160’

9.6. Airspeed Miscompare Threshold

The airspeed miscompare threshold is based upon allowable airspeed error. There are two components to allowable airspeed error, instrument error and installed system error. 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

Table 9-3: Airspeed Error	
Calibrated Airspeed	**Allowed Error**
150 knots	2 knots
200 knots	2 knots
250 knots	2.4 knots
300 knots	2.8 knots
350 knots	3.2 knots
400 knots	3.6 knots
450 knots	4 knots

Allowable installed system error is added on top of instrument. Error and these values are derived from the regulations as follows.

Table 9-4: Airspeed Regulatory Reference	
Regulation	**Allowed Error**
14 CFR § 23.1323	Starting from (1.3 x $\mathbf{V_{S1}}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.3 x $\mathbf{V_{S1}}$).
14 CFR § 25.1323	Starting from (1.23 x $\mathbf{V_{SR1}}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.23 x $\mathbf{V_{SR1}}$). Note: System uses $\mathbf{V_{S1}}$ as a substitute for $\mathbf{V_{SR1}}$.
14 CFR § 27.1323	Starting from (0.8 x $\mathbf{V_{CLIMB}}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (0.8 x $\mathbf{V_{CLIMB}}$).
14 CFR § 29.1323	For Climbing Flight (VSI > 250 feet per minute): Starting from ($\mathbf{V_{TOS}}$ – 10): 10 knots Do not perform a comparison if either value is below ($\mathbf{V_{TOS}}$ – 10) For Other Flight Regimes:

Table 9-4: Airspeed Regulatory Reference	
Regulation	**Allowed Error**
	Starting from (0.8 x $\mathbf{V}_{TOS}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (0.8 x $\mathbf{V}_{TOS}$). Note: System uses $\mathbf{V}_{CLIMB}$ as a substitute for $\mathbf{V}_{TOS}$.

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.

9.7. Jeppesen 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.

9.8. ARINC-424 Path-Terminator Leg Types

Table 9-5: Path Terminators

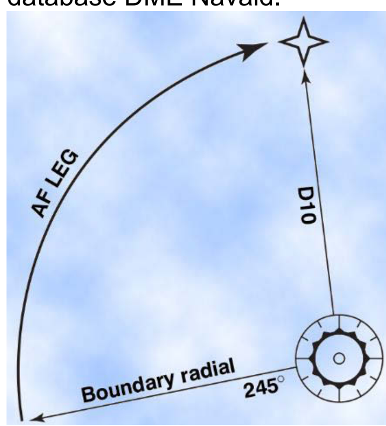
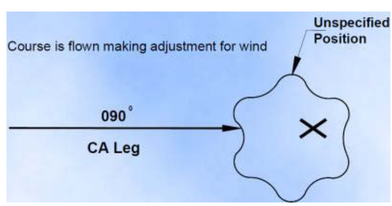
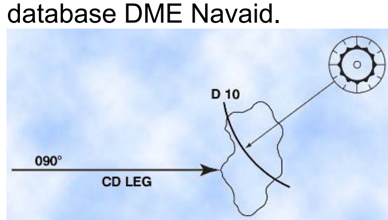
Type ARINC-424 Leg	**Abbreviation**	**Example**
DME Arc	**AF**	Arc to a Fix or defines a track over ground a specified constant distance from a database DME Navaid. 
Course to Altitude (Course is flown making adjustment for wind)	**CA**	
Course to DME Distance	**CD**	Leg defines a specified course to a specific DM Distance, which is from a specific database DME Navaid. 

Table 9-5: Path Terminators

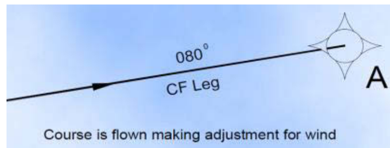
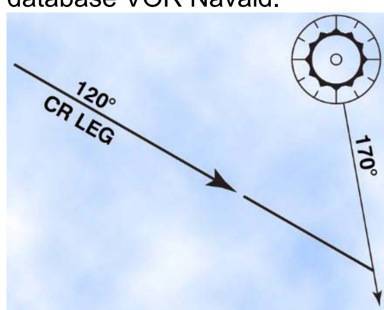
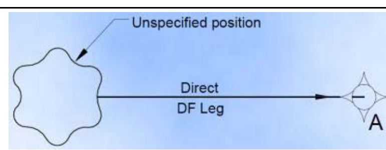
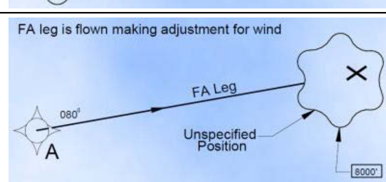
Type ARINC-424 Leg	Abbreviation	Example
Course to Fix	**CF**	
Course to Intercept	**CI**	Leg defines a specified course to intercept a subsequent leg. 
Course to Radial	**CR**	Leg defines a course to a specified radial from a specific database VOR Navaid. 
Direct to Fix	**DF**	
Course from Fix to Altitude	**FA**	

Table 9-5: Path Terminators

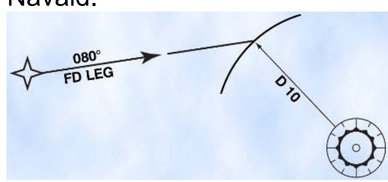
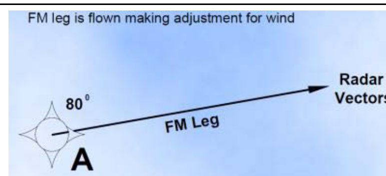
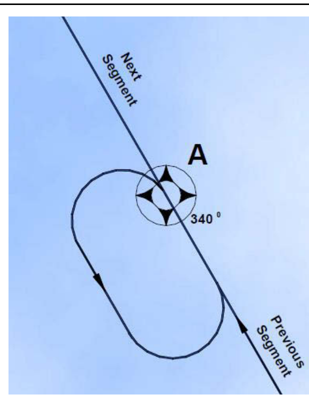
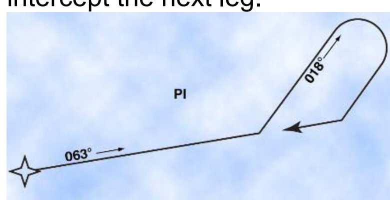
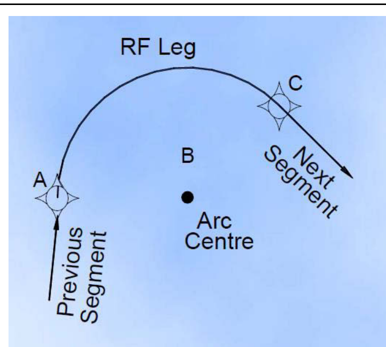
Type ARINC-424 Leg	Abbreviation	Example
Course Fix to along Track Distance	**FC**	Leg defines a specified track over ground from a database fix for a specific distance. 
Course from Fix to DME Distance (Different Fix)	**FD**	Leg defines a specific track from a database fix to a specific DME Distance from a DME Navaid. 
Course from Fix to Manual termination	**FM**	
Terminates at an altitude Terminates at the fix after one orbit Manual termination	**HA** **HF** **HM**	

Table 9-5: Path Terminators		
Type ARINC-424 Leg	**Abbreviation**	**Example**
Initial Fix leg	**IF**	Leg defines a database fix as a point in space. It is only required to define the beginning of a route or procedure. 
Procedure Turn	**PI**	Leg defines a course reversal starting at a specific fix, includes Outbound Leg followed by 180 degree turn to intercept the next leg. 
Precision Arc to Fix	**RF**	

<table>
<tr><th colspan="3">Table 9-5: Path Terminators</th></tr>
<tr><th>Type ARINC-424 Leg</th><th>Abbreviation</th><th>Example</th></tr>
<tr><td>Track from Fix to New Fix</td><td>TF</td><td>Defines a great circle track over ground between two known database fixes. Preferred type for straight legs.

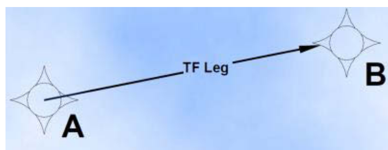
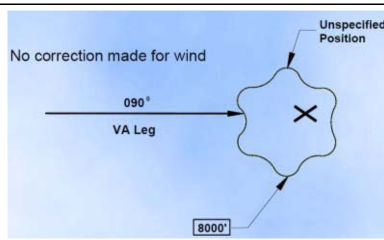
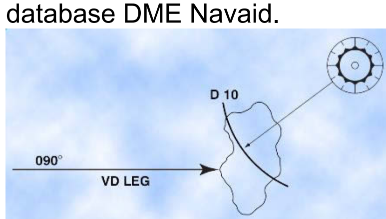
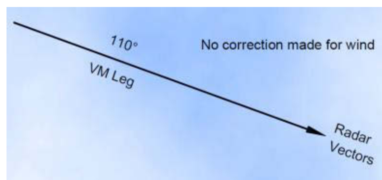
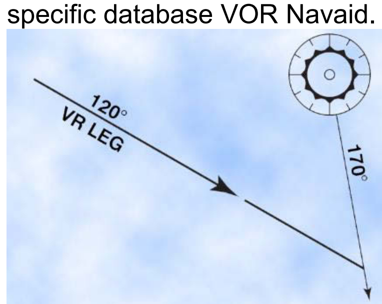
</td></tr>
<tr><td>Track to a Fix</td><td>TF</td><td>
</td></tr>
<tr><td>Heading to Altitude</td><td>VA</td><td>
</td></tr>
<tr><td>Heading to DME Distance</td><td>VD</td><td>Leg defines a specified heading terminating at a specified DME Distance from a specific database DME Navaid.

</td></tr>
</table>

Table 9-5: Path Terminators		
Type ARINC-424 Leg	**Abbreviation**	**Example**
Heading to Intercept	**VI**	Leg defines a specified heading to intercept the subsequent leg at an unspecified position. 
Heading to Manual Termination	**VM**	
Heading to Radial	**VR**	Leg defines a specified heading to a specified radial from a specific database VOR Navaid. 

9.9. Data Logging and Retrieval

The Genesys Aerosystems EFIS logs all data associated with a flight, including all flight instrument and navigation data. This data may be downloaded for review after flight. Data from the last five flights or 20 hours are logged at a one-second interval.

Select “Download LOG Files” on the IDU to create a “\log” directory on the USB Memory device and copy data logging files into the“\log” directory of the USB Memory device. Data logging files contain recordings of flight and engine parameters of up to five hours each from the previous five operations of the system. 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, the second line contains engine parameters.

9.10. Delete LOG Files

1) Select “Delete LOG Files” option to delete all log files contained in the log directory. This option may be performed if there are problems updating a navigation database or application software due to an excessively large log file.

2) The files deleted are named “LOG00.dat” thru “LOG04.DAT” and “MSGLOG.DAT.” Performing this option does not affect operations of the EFIS, as the EFIS automatically generates new “LOG00.DAT” and “MSGLOG.DAT” files once a flight has started.

3) Press any button on the IDU or push/rotate ❶ to return to the Ground Maintenance menu.

9.10.1. Downloading Screen Capture from Ground Maintenance Pages

1) With IDU powered off, open USB door and insert USB.

2) Power up IDU and gain access to GMF desired page.

3) Press **(R4)** to capture view of the page. The files are written to the user\log\ subdirectory and named either “GROUNDdd.BMP” or “LIMEDTdd.BMP,” so they may be copied with "Download LOG files."

4) Exit GMF copied page and return to GMF abbreviated Ground Maintenance Functions.

5) Scroll ❶ to Download Log Files and push to enter.

6) Remove USB. Insert into computer and view list (20 maximum) of files including “GROUNDdd.BMP” or “LIMEDTdd.BMP.”

9.11. Routes and Waypoints

9.11.1. VFR Flight Planning

The navigation database includes VFR waypoints which consist of five digits beginning with the letters "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 the INFO checked for proper location.

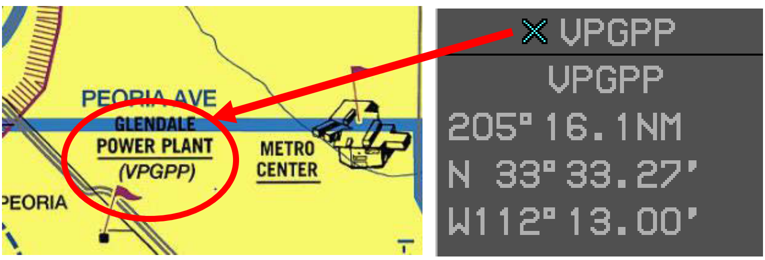


Figure 9-2: VFR Waypoint

9.11.2. Download Routes and User Waypoints

1) To download all routes and user waypoints stored in the IDU to the USB External Memory Drive, selecting "Download Routes and User Waypoints" option from the Ground Maintenance Page. This option is useful for fleet operations where multiple aircraft fly the same routes.

2) Routes are stored on the USB Memory external 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 External Memory Drive as USER.DAT.

9.11.3. Upload Routes and User Waypoints

To copy all routes and user waypoints from a USB to the IDU, select "Upload Routes and User Waypoints" on the Ground Maintenance page. This option used in conjunction with the "Download Routes and User Waypoints" option enables the pilot to store the same routes and user waypoints in multiple aircraft.

9.11.4. Delete Routes and User Waypoints

Select “Delete Routes” on the Ground Maintenance page to remove all routes and the user waypoint file USER.DAT from the IDU. Use this option to delete the contents of the route directory when corrupted routes cause the IDU to continually reboot.

9.12. EFIS Training Tool (ETT)

NOTE:

See the Installation and User Guide distributed with the ETT install files for directions to install and use the EFIS Training Tool.

9.13. USB External Drive Memory Limitations

NOTE:

Maximum USB memory is not a factor, but the following should be considered:

USB must be formatted as FAT.

FAT-16 for USB Drives 2 GB or smaller

FAT-32 for any larger sized drive. If the drive is not recognized, try another source.

When powering up the IDU with a USB inserted and the following message displays, the USB external drive is likely too large and or not acceptable for loading or transferring data.

1) Error: No updater files found on USB drive.
2) Ensure the USB with required files is properly connected.
3) Try again after reboot.
4) Press any button to continue.
5) Try a different USB external drive.

9.14. Service Difficulty Report

Print, complete, then fax to 940-325-3904

Name:	Phone:
Flight No:	Date:
Aircraft:	Registration#:
Software Version:	Error Code:
Route:	Duration of Flight:
Conditions:	
Remarks: (Include time, altimeter Setting, OAT, ALT, TAS, GS, Heading, track, position, flight segment, pilot action, system response, is problem repeatable?).	

9.15. 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.	

9.16. Environmental Requirements

The IDU-680 meets the requirements of RTCA/DO-160F as defined.

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 deg C Operating High temp: +70 deg C Ground Survival Low Temp: -55 deg C Ground Survival High Temp: +85 deg 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.	
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

Sec.	Condition	Cat.	Test Category Description	Notes
8.0	Vibration	H + R + U	H – Demonstrates performance at high-level, short duration transient vibration levels R - (Fixed-Wing) Demonstrates performance at higher, robust vibration levels and after long term vibration exposure. 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.	Cat. H, curve R Cat. R, curves B, B1 Cat. U, curve G
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.	
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.	

Sec.	Condition	Cat.	Test Category Description	Notes
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 (Radiated and Conducted)	Y	Equipment and interconnecting wiring installed in severe electromagnetic environments and to show compliance with the interim HIRF rules.	Radiated: K 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,	

Sec.	Condition	Cat.	Test Category Description	Notes
			such as passenger cabin or cockpit.	
22.0	Lightning Induced Transient Susceptibility	A3J33	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

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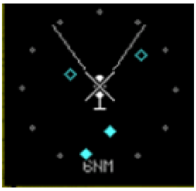
T 1. Traffic Thumbnail (Tapes only)



When selected from declutter options, the traffic thumbnail has clock face markings normally fixed at the 6 NM scale. In the event of a traffic warning (TA or RA), the traffic thumbnail is automatically enabled while the traffic warning is active, and the aircraft is above 500' AGL.

Figure T-1: Traffic Thumbnail

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, it too disappears in the Unusual Attitude Mode.

T 2. 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 2.1. Traffic Rendering Rules

Table T-1: Traffic Rendering Rules

Type Traffic	Distance	Results
OT and PA Traffic	Beyond 6 NM	Not displayed
TCAS-I, TCAS-II, TAS, or TIS-A Sensor	Within 200' of ground	Not displayed

Table T-2: 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.

Table T-3: Traffic Symbology

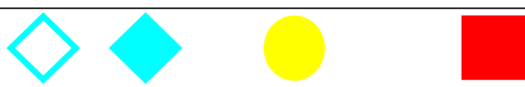
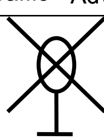
Type Traffic	Symbology
TCAS-I, TCAS-II and TIS-A	 Other Traffic; Proximate Advisory; Traffic Advisory (Flashing); Resolution Advisory (Flashing)
Ownship symbol	

Figure T-2: Traffic Symbology

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. Ownship Symbol

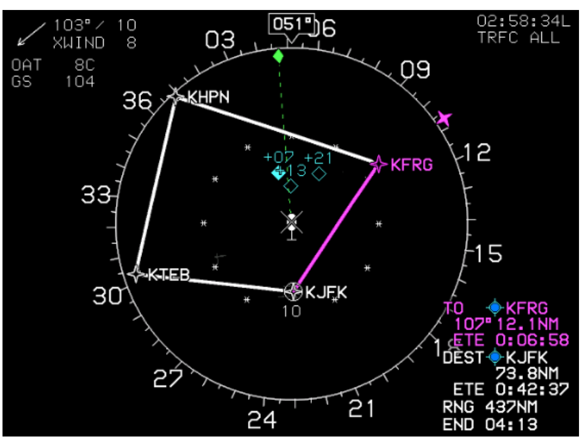


Figure T-3: Traffic Display Format

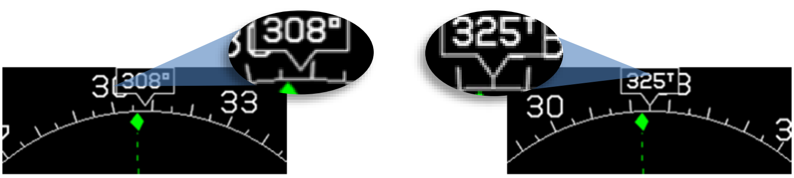
The traffic display uses a centered display format with the ownship symbol centered in the traffic screen with data displayed out to an equal distance in all directions. When the AHRS is in DG Mode, “DG” appears to the right of the ownship symbol.

T 3.2. Traffic Screen Range

Traffic screen selected 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 the pilot 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



Normal Mode **True North Mode**

Figure T-4: 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 Symbology. 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 Loss of Navigation caution.

T 3.4. 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, 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 Loss of Navigation caution.

The traffic screen displays airport runways in correct relationship and scale to the ownship symbol.

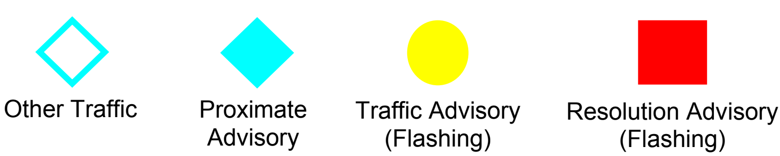


Figure T-5: TCAS-I, TCAS-II, TAS and TIS-A Traffic Symbols

When the source of traffic 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 upon the traffic's current track and groundspeed. The prediction time period, in minutes, is pilot-selectable. Aircraft identification is simple text located near the traffic symbol. The color of the aircraft identification data matches the color of the traffic symbol. Traffic identification data usually reflects aircraft registration number or scheduled airline flight number.

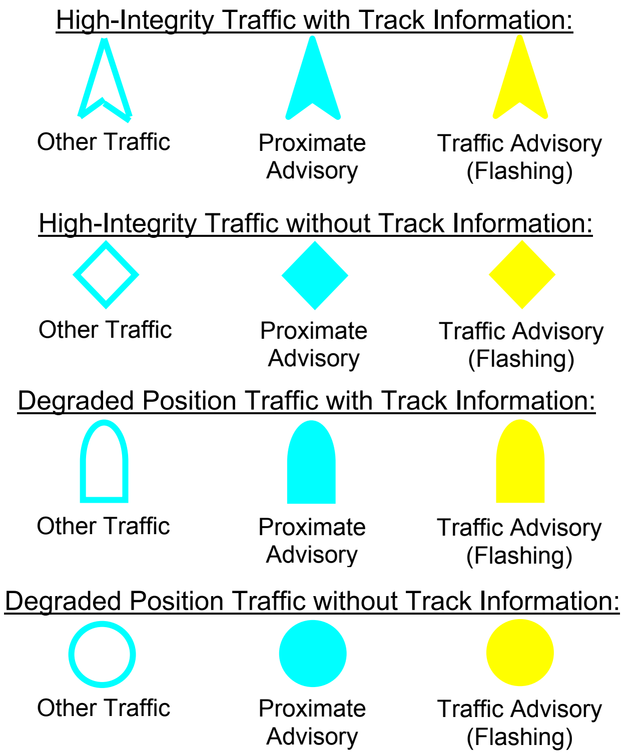


Figure T-6: ADS-B and TIS-B Traffic Symbols

T 3.5. Clock and Options

The following are displayed in the upper right corner of traffic screen:

1) **Zulu Time or LCL Time**: As specified in Table T-4.

2) **Timer**: As specified in Table T-4.

3) **Traffic Status**: As specified in Table T-4. See § T 2.1 for traffic rendering rules.

4) **ADS-B Traffic Vector Length**: When display of ADS-B traffic vector symbols is selected, length of the traffic vector is annunciated as “**VECT ##**” where “##” is the traffic vector length in minutes.

Table T-4: Clock Options

Feature	Options	Notes
Zulu Time or Local Offset	Zulu or Local	Shown in **hh:mm:ss** and synchronized with the GPS/SBAS constellation.
Timer	**COUNT UP** **COUNT DN..** **FLT TIME**	Countdown or count-up timer is displayed when selected and matches timer shown on the PFD.
Declutter Mode	**DCLTR A** **DCLTR M**	= Automatic declutter mode = Manual declutter mode
Traffic Status	Enabled or Disabled	 With “Show Full Sensor Status Flag” enabled in EFIS limits, Status is annunciated disabled as if manually deselected. In the event of a traffic warning (TA or RA), the traffic thumbnail is automatically enabled, while the traffic warning is active and the aircraft is above 500’AGL. If traffic is disabled, the “X” is red. When selected and enabled, status of traffic altitude filtering is displayed as follows: AUTO = **TRFC AUTO**, NORMAL = **TRFC NORM**, ABOVE = **TRFC ABV,** ALL = **TRFC ALL**, BELOW = **TRFC BLW**.

T 3.6. Fuel Totalizer/Waypoint Bearing and Distance Functions

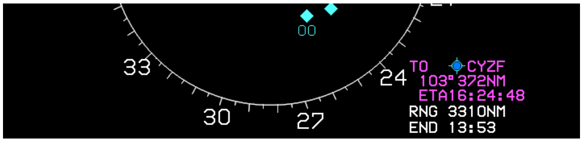


Figure T-7: Fuel Totalizer/Waypoint Bearing and Distance Functions

T 3.7. MFD Traffic Format (FORMAT) Menu

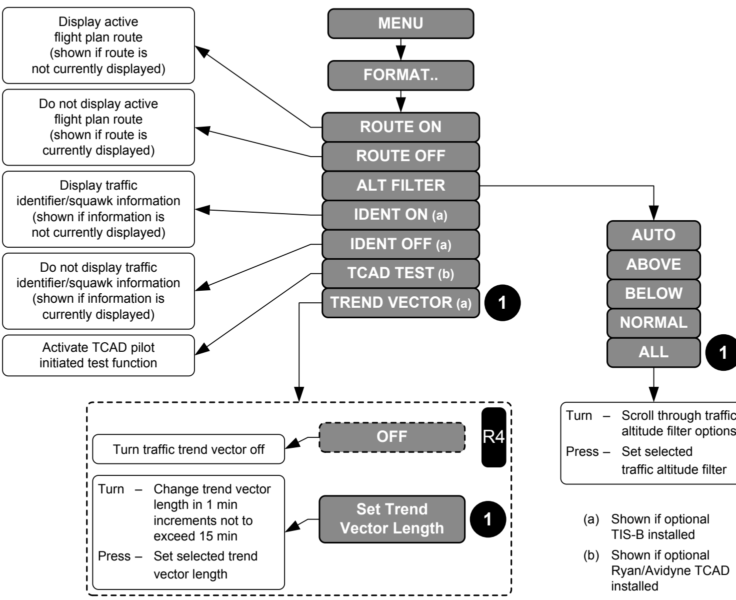


Figure T-8: MFD Traffic Format (FORMAT) Menu

Upon selecting the MFD format menu when in the Traffic page, an option list appears with the following options:

1) **ROUTE ON/ROUTE OFF**: Toggles showing the active flight plan route on the Traffic page.

2) **IDENT OFF/IDENT ON**: When the TCAS flag is TIS-B, toggles showing traffic identifier/squawk information.

3) **ALT FILTER**: Sets traffic altitude filter to **AUTO**, **ABOVE**, **BELOW**, **NORMAL**, or **ALL**.

4) **TCAD TEST**: When the TCAS flag is Ryan/Avidyne TCAD, activates the TCAD pilot initiated test function.

5) **TREND VECTOR**: When the TCAS flag is TIS-B, used to select the traffic trend vector length in minutes. **OFF (R4)** appears at this level to quickly turn off the traffic trend vector.

Table T-5: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Countdown Timer Start Time	
Countdown Timer Default Value	
Heading Bug	
VLOC OBS Settings	
Timer Starting Signal	
Traffic Filter Setting	
UTC Offset	
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.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Navigation Source	
PFD Traffic Thumbnail Show Flag	

Table T-5: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility. Note that some of these parameters are also independent between top and bottom 680 MFD areas as specified in the notes.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.
MFD Map Function Declutter Settings	Independent between top and bottom 680 MFD areas
MFD Show ETA Flag	
MFD Traffic Page Settings	Independent between top and bottom 680 MFD areas

T 4. MFD Page (PAGE) Menu

TRAFFIC: Shows the Traffic page.

T 5. MFD Fault Display (FAULTS) Menu

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

Remote Bugs Panel (RBP)

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RBP 1. Remote BUGs Panel

The Remote Bugs Panel (RBP) provides dedicated controls for frequently needed bugs and additional controls for setting IDU parameters such as defined in Table RBP-1.

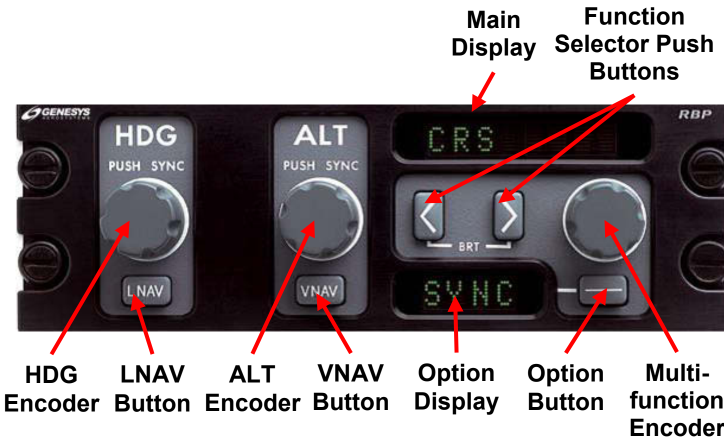

Figure RBP-1: Remote Bugs Panel

The RBP has an internal dimming control functionality, which allows it to control its own backlighting and display brightness with an internal light sensor to adjust the initial display and backlight brightness. Press the two arrow buttons simultaneously to gain access for brightness control while the multifunction encoder is used to make the brightness adjustments. Press the Option button to exit the brightness control program return the RBP to normal operation.

The design of this RBP promotes the ease of operation while minimizing pilot workload complexity. The HDG and ALT control encoders behave exactly as the encoders on the IDU-680 where they appear during most screen configurations. During initialization, the RBP always begins with the GENESYS RBP displayed on the Main and Option display screens.

Table RBP-1: Remote Bugs Panel (RBP)

Button/Encoder	Function	Scroll	Press/Push
Heading Encoder	Heading Bug	Increment or decrement heading bug	Synchronize heading bug to current heading
Altitude Encoder	Altitude Bug	Increment or decrement target altitude bug	Synchronize target altitude bug to current altitude
Multifunction Encoder	GPS Course	Increment or decrement GPS course setting	Synchronize GPS course to current bearing to the active waypoint
Multifunction Encoder	VOR 1 Course	Increment or decrement VOR 1 course setting	Synchronize VOR 1 course to the current bearing to the station
Multifunction Encoder	VOR 2 Course	Increment or decrement VOR 2 course setting	Synchronize VOR 2 course to the current bearing to the station
Multifunction Encoder	Airspeed Bug	Increment or decrement Airspeed Bug setting	Synchronize Airspeed Bug to current airspeed
Multifunction Encoder	Vertical Speed Bug	Increment or decrement Vertical Speed Bug setting	Synchronize Vertical Speed Bug to current VSI
Multifunction Encoder	Climb Angle Set	Increment or decrement Climb Angle setting	Set Climb Angle Setting to 3º
Multifunction Encoder	Descent Angle Set	Increment or decrement Descent	Set Descent Angle Setting to 3º

Table RBP-1: Remote Bugs Panel (RBP)

Button/Encoder	Function	Scroll	Press/Push
		Angle setting	
Multifunction Encoder	Decision Height Bug	Increment or decrement Decision Height Bug	Set Decision Height Bug to 200' AGL
Multifunction Encoder	Minimum Altitude Bug	Increment or decrement Minimum Altitude Bug	Set Minimum Altitude 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	N/A	No Function
Option "---" Button	Airspeed Bug	N/A	Toggle Airspeed Bug (On or Off)
Option "---" Button	Vertical Speed Bug	N/A	Toggle Vertical Speed Bug (On or Off)
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 Decision Height Bug (On or Off)
Option "---" Button	Minimum Altitude Bug	N/A	Toggle Decision Height Bug (On or Off)
Arrow Buttons	Function Scroll	N/A	Scroll through possible functions for the "set" Multi-Function

Table RBP-1: Remote Bugs Panel (RBP)

Button/Encoder	Function	Scroll	Press/Push
			Encoder. Press both arrow buttons simultaneously to place RBP into dimming mode
VNAV Button	VNAV	N/A	Switch EFIS autopilot pitch steering and commanded VSI between VNAV sub-mode and target altitude sub-mode
LNAV Button	LNAV	N/A	Switch EFIS autopilot roll steering between LNAV sub-mode and heading sub-mode

Table RBP-2: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
AHRS 1 and 2 mode and slewing values	
VNAV Climb Angle	
VNAV Descent Angle	
Decision Height Setting	Used when “Dual Decision Height Flag” is false.
Heading Bug	
Minimum Altitude Bug Value	

Table RBP-2: Menu Synchronization

Menu Parameter	Notes
VLOC OBS Settings	
Airspeed Bug Setting	
Target Altitude Bug Setting	
Settable V-Speeds	
VSI Bug Setting	
Crosslink Synchronization Status	
For menu synchronization. The following 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.	
Active Flight Plan Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Decision Height Setting	Used when “Dual Decision Height Flag” is true.
Navigation Source	
PFD Analog AGL	
PFD Altitude (meters) Show Flag	
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.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs to support weather radar

Table RBP-2: Menu Synchronization

Menu Parameter	Notes
	vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.
MFD Map and HSI Page Pointer Settings	Independent between top and bottom 680 MFD areas
MFD Map Function Declutter Settings	Independent between top and bottom 680 MFD areas
MFD Show ETA Flag	
MFD Map NavData Symbol Declutter Settings Independent between top and bottom 680 MFD areas	

WX-500 Lightning Strikes

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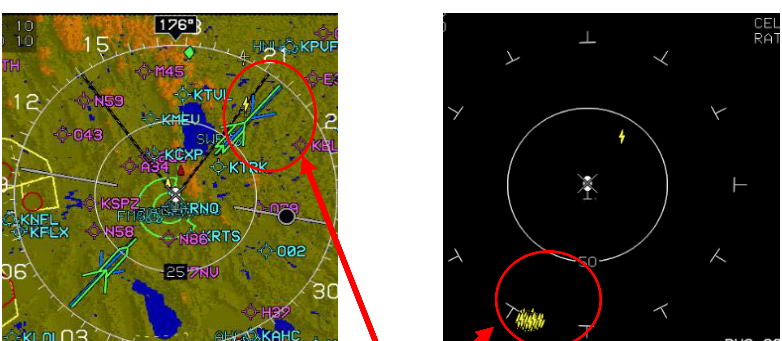
S 1. WX-500 Data

When selected, the ND displays Cell Mode lightning strikes in correct relationship to the ownship symbol with the following limits.

Table S-1: Lightning Strikes

View	Time or Distance Limit
Strikes not shown	Display scale less than 25 NM
Strikes not shown	More than 3 minutes old
Strikes less than 20 seconds old	Shown with lightning symbol
Strikes between 20 seconds and 2 minutes old	Shown with large cross symbol
Strikes between 2 minutes and 3 minutes old	Shown with small cross symbol

The pilot may select either an arced or centered display format with the ownship displaced toward the bottom of the screen so strike data are displayed in a larger scale while displaying all data within range ahead of the aircraft. 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 the DG mode, a “DG” indication appears to the right of the ownship symbol.



ND Lightning Display **Strike Screen Display**

Figure S-1: Lightning Symbols

S 2. 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 2.1. Air Data and Groundspeed

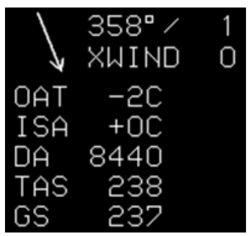
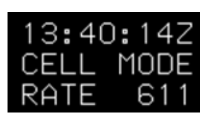


Figure S-2: Air Data and Groundspeed in Upper Left Corner

S 2.2. Clock and Options

Clock with Local Offset Time



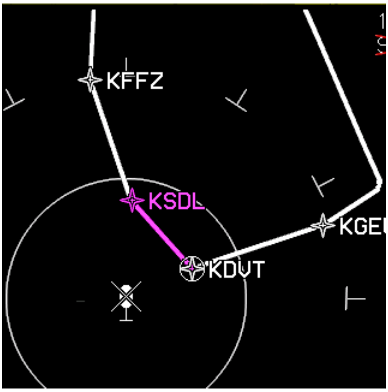
Clock with Zulu Time

Figure S-3: Clock and Options

S 2.3. 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 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 and turn amber (yellow) in the event of a GPS Loss of Navigation 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

Table S-2: WX-500 Status

Condition	**Annunciation**
System Normal, Strikes Selected	**RATE ###** depicts current strike rate Strike symbols shown
System Normal, Strikes De-selected "Show Full Sensor Status Flag" in EFIS Limits.	**STRIKES** overlaid with green "X" Strike symbols removed
System Failed, "Show Full Sensor Status Flag" in EFIS Limits.	**STRIKES** overlaid with red "X" Strike symbols removed
System in Test Mode	**STRK TST** shown Strike symbols removed

A new strike rate value is calculated every five seconds during normal operation, based upon strikes within the selected display range. The number of fresh strikes (less than 20 seconds old) is used to generate a strike rate representing strikes per minute. Strike rate increases are displayed immediately upon calculation, while decreases in strike rate are damped. Activating the strike clear function resets the strike rate to zero.

S 2.4. Fuel Totalizer/Waypoint Bearing and Distance Functions

Figure S-5: Fuel Totalizer, Waypoint Bearing/Distance in Lower Right Corner

S 2.5. MFD Strike Format (FORMAT) Menu

Upon selecting the MFD format menu when in the Strike page, the following option list appears:

1) **CENTER/ARC**: Toggles between a centered and arced Strike page display format.
2) **ROUTE ON/ROUTE OFF**: Toggles showing the active flight plan route on the Strike page.
3) **STRK MODE/CELL MODE**: Toggles between strike mode strikes and cell mode strikes on the Strike page.
4) **STRK TEST:** Activates the WX-500 pilot initiated test function.

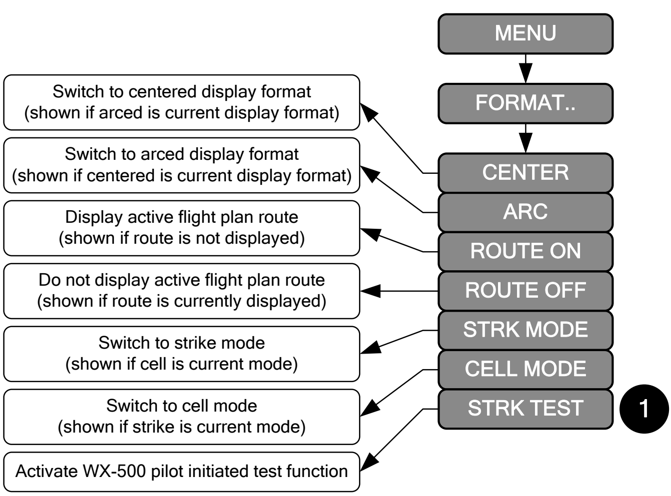


Figure S-6: MFD Strike Format (FORMAT) Menu

Table S-3: Menu Synchronization	
Menu Parameter	**Notes**
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Countdown Timer Start Time	
Countdown Timer Default Value	
Heading Bug	
VLOC OBS Settings	
Timer Starting Signal	
Traffic Filter Setting	
True North Mode	
UTC Offset	
Crosslink Synchronization Status	
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.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Navigation Source	
PFD Altitude (meters) Show Flag	
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.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs

Table S-3: Menu Synchronization

Menu Parameter	Notes
	to support weather radar vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.
MFD Map and HSI Page Pointer Settings	Independent between top and bottom 680 MFD areas
MFD Map NavData Symbol Declutter Settings	Independent between top and bottom 680 MFD areas
MFD Strike (WX-500) Page Settings	Independent between top and bottom 680 MFD areas

S 3. MFD Page First-Level Option Descriptions

CLR STRKS (L6) or **WX LGND (L6)**: On ND page or Strike page with WX-500 option enabled, **CLR STRKS** activates the strike clear option. On Datalink page, **WX LGND** activates the datalink weather legend.

S 4. MFD Page (PAGE) Menu

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

STRIKES: Shows the Strike page.

S 5. MFD Fault Display (FAULTS) Menu

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

Audio/Radio Management

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AR 1. Introduction

Customers configured with various radios with different features will have to review their specific AFM or AFMS for the specific instructions and features available with the equipment installed. All attempts have been made to configure the ETTs for accommodation of nearly all radio combinations. This appendix is a generic description of the Audio/Radio Page functionality.

AR 2. Audio/Radio Page

The Audio/Radio page is a common interface for managing multiple devices and presents the interfaced audio and radio devices configured for the EFIS displays. It allows selection of devices, changing of frequencies, settings, modes, volumes, and other values for the devices.

Figure AR-1: Audio Radio Page Format

AR 2.1. Audio/Radio System Colors

WHITE used for items set by the pilot and held internally by the EFIS or items where device feedback is not expected -- such as STBY frequency/codes, TX indicator when there is no TX feedback, or Marker Beacon Receiver High/Low sensitivity modes. When used for an analog bar indication, light gray is used in low-light conditions.

CYAN (light cyan for visibility) used for information received from the device not related to a pilot setting. Examples include VOR/ILS/LOC identifier, transponder flight level indication, transponder reply indication, and radio receive indication.

MAGENTA (light magenta for visibility) used for pilot-settable items sent to the devices but awaiting feedback confirmation. Examples include ACTV frequency/codes, operating modes, and transmit enabled.

GREEN (light green used for visibility) used for pilot-settable items that have been confirmed as set via feedback from the device, such as ACTV frequency/codes, operating modes, and transmit enabled indications.

AMBER (YELLOW) used for items requiring immediate pilot awareness. Currently only used for stuck microphone and DME hold indications.

RED used for items requiring immediate pilot action. Currently only used to indicate a device failure (red “X”).

GRAY used for device name and selection box drawn around the selected device line. Light gray is used for devices, which do not confirm their attribute setting.

AR 2.2. Common Symbols

Some symbols are common for different lines of the AR page.

AR 2.2.1. Device Label

Each line of the AR page displays a label up to five characters long, in gray, for the device represented by that line.

Line Select: Each device is pilot-selectable indicated by a gray rectangle drawn around the line for that device.

Figure AR-2: Device Label Line Select

AR 2.2.2. Fail

Figure AR-3: Device Failure Indication

When communications from a device have ceased for more than two seconds, the AR page displays on the line for that device only the label and a red “X” across the line. When communications with the device resume, the red “X” is removed, and the defined symbology for the device is displayed.

AR 2.2.3. TX Indicator

Table AR-1: TX Indicator Symbols

Symbol	Meaning	Notes
TX	Transceiver selected for transmit	Only displayed for one device at a time.
TX	Audio controller is failed.	
TX	Confirmed transmit selection	When an audio controller is in use
TX	Confirms device is actively transmitting.	When an audio controller is in use
TX	Indicates a stuck microphone	TX indicator and box flashes at 1 Hz rate.
STX	Indicates Split Transmit with same color as TX indicator	When audio controller is enabled to split transmit, pilot and co-pilot sides may independently select active transceiver.

AR 2.2.4. Level Bar

The level bar indicates a varying range of attributes, commonly volume. The white rectangle is filled with a color as defined in Table AR-1 proportionately increasing from left to right, representing the magnitude of its value.

Table AR-2: Level Bar

Symbol	Meaning	Notes
	Message being sent and not yet confirmed	Light magenta until confirmation is received
	Level increasing from left to right. Minimum value is an empty level bar filled in black.	Device is confirming attribute setting
	Volume is muted	Muted device line
	Range of attribute at 50%	Device does not confirm attribute setting

NOTE:

When an audio controller fails, the line for the intercom is displayed as shown in Figure AR-1. However, the failure of the audio controller may cascade across the other devices. When the audio controller fails, only the devices with audio control through those other devices' interfaces display a volume level bar.

AR 2.2.5. Selected Line Highlight

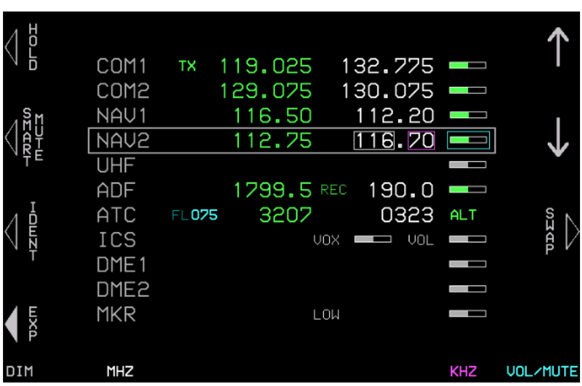


Figure AR-4: Selected Line Highlighted

When the selected line is enabled for frequency, code, mode, or volume level adjustment, an indication of the value to be changed by the encoders is shown. Color of the rectangle corresponds to the encoder label color, which modifies the value within the rectangle.

AR 2.3. VHF COM Transceiver

When VHF communication transceivers are configured for management from the audio/radio page, the AR page line for the device is displayed in the following manner.

AR 2.3.1. VHF COM Symbols

Figure AR-5: VHF Com Symbols

Table AR-3: VHF Com Transceiver Line Symbols

Symbol	Meaning	Notes
TX	Selected for transmit	When TX is selected for transmit row.
R	Actively receiving device	
118.975	Active frequency in magenta	When confirmed, active frequency is light green.
T	Magenta when in squelch test mode	When mode confirmed, light cyan.
132.775	Standby frequency in white	When selection confirmed, frequency is white.
	Volume level of VHF Com Transceiver.	

AR 2.4. VHF NAV Receiver

When VHF navigation receivers are interfaced for management from the audio/radio page, the AR page line for the device is displayed in the following manner.

AR 2.4.1. VHF NAV Receiver Symbols

Figure AR-6: VHF NAV Receiver Line Symbols

Table AR-4: VHF NAV Receiver Line Symbols

Symbol	Meaning	Notes
MQP	Decoded station identifier	Only with receivers able to decode an identifier. Displays up to five characters.
117.70	Active frequency displayed in magenta	Light green when device confirms frequency.
Ⓗ	DME receiver or channel associated with navigation receiver is set to Hold Mode	
T	When device confirms test mode, light green	Light magenta when in test mode.
112.20	Standby frequency	For devices that accept a standby frequency, standby frequency is white when device confirms the frequency selection.
	Volume level of VHF NAV Receiver.	

AR 2.5. ADF Receiver

When ADF receivers are interfaced for management from the audio/radio page, the AR page line for the device is displayed in the following manner.

AR 2.5.1. ADF Receiver Symbols

Figure AR-7: ADF Receiver Symbols

Table AR-5: ADF Receiver Symbols

Symbol	Meaning	Notes
	Decoded station identifier in light cyan	Only on receivers able to decode an identifier.
	Active frequency is initially magenta	When receiver confirms frequency selection, active frequency is light green.
	Displayed in magenta when device is set to ADF mode	When magenta, device is set as the following: “BFO” = BFO mode “TST” = test mode “REC” = receive or antenna mode. When mode is confirmed, mode is light green.
	Standby frequency is white	When receiver confirms selection, frequency is white.
	Volume setting for the ADF Receiver.	

AR 2.6. Transponder

When a transponder is interfaced for management from the audio/radio page, the AR page line for the device is displayed in the following manner.

AR 2.6.1. Transponder Symbols

Figure AR-8: Transponder Symbols

Table AR-6: Transponder Symbols

Symbol	Meaning	Notes
FL029	Altitude reported by transponder	When altitude is invalid, displayed as “---.” When set with flight level, altitude is prefixed by cyan “FL” and reported in 100s of feet with 3 digits with leading zeros. When set for meters, altitude is suffixed by cyan “M” with reported altitude in meters.
1200	Active transponder code is magenta.	Light green when device confirms code selection.
R	Reporting active reply to an ATC interrogation	If device is not reporting active position identification but is reporting an active reply to an ATC interrogation
I	Reporting an active position identification, “ident”	
7700	Standby code	
STBY	Standby mode is magenta	When initially set, transponder displays the following in magenta: “GRD” = ground mode “ON” = ON mode (Mode A) “ALT” = altitude mode (Mode C) When device confirms selection, mode is green.

AR 2.7. DME Receiver

DME receiver parameters are established through interfaces with VHF navigation receivers. When a DME receiver device is interfaced, the DME receiver is displayed as an Audio-Only Device.

AR 2.8. Intercom

When an audio controller is interfaced for management from the audio/radio page, the AR page line for the device is displayed in the following manner.

AR 2.8.1. Intercom Symbols

Figure AR-9: Intercom Symbols

Table AR-7: Intercom Symbols

Symbol	Meaning	Notes
CALL	Audio controller reporting a call	If a high-priority call, intercom line flashes “CALL” at 0.5 Hz with 50% duty cycle.
PLT ISO	If audio controller has a pilot isolate feature and it is enabled, displayed in light magenta.	When audio controller confirms Pilot Isolate is enabled, PLT ISO is light green.
RX	If audio controller has a master volume control, “RX” and volume level bar.	RX level represents master volume of all devices
VOX	Voice operated switch	Threshold or filter level of microphone before sound is allowed to be heard on the intercom system
	VOX or volume level bar	
VOL	Volume level	Volume communications over intercom system

AR 3. Audio-Only

Some devices may be interfaced for transmit enable and volume adjust through an audio controller, which the IDU is controlling. Additional functionality of these devices is not handled by the IDU. When an audio-only device is interfaced for management from the AR page, the AR page line for the device is displayed in the following manner.

AR 3.1. Audio-Only Symbols

Figure AR-10: Audio-Only Symbols

Table AR-8: Audio-Only Symbols

Symbol	Meaning	Notes
	Name of device being controlled	
	Transmit enabled	If controlling audio controller fails, devices lose selection and volume adjustment.
	Volume level	

AR 3.2. Marker Beacon Receiver

When marker beacon receivers are interfaced for management from the audio/radio page, the AR page line for the device is displayed in the following manner.

AR 3.3. Marker Beacon Receiver Symbols

When interfaced for receiver sensitivity switching through the EFIS, the Word “HIGH” or “LOW” appears to represent the configured Marker Beacon receiver.

Figure AR-11: Marker Beacon Receiver Symbols

AR 4. AR Tune Menu

Press **RADIO (L8)** to change Audio Radio parameters with the AR Tune Menu, which only appears in the bottom area of the IDU as follows.

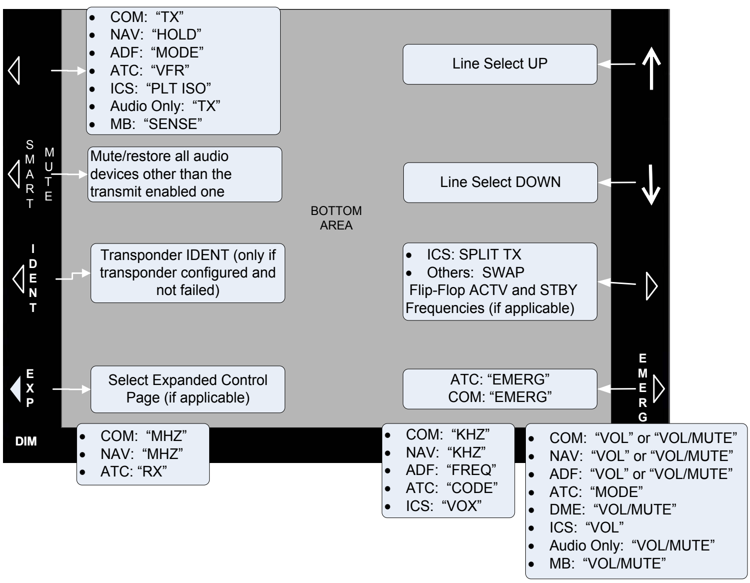


Figure AR-12: AR Tune Menu

Table AR-9: AR Tune Menu Labels

Menu (Location)	**Function**	**Notes** (if applicable)
TX (L5)	If selected line is a VHF COM transceiver or Audio-Only device not currently transmit enabled, enables transmitting on selected transmitter. Enabling (only one device at a time) unmutes the	When audio controller fails, appearance and operations are inhibited. Transmissions go through the default emergency-

Table AR-9: AR Tune Menu Labels		
Menu (Location)	**Function**	**Notes** (if applicable)
	associated transceiver and disables transmitting on any other transmitter.	operation transmitter.
HOLD (L5)	When selected line is a VHF NAV receiver, toggles DME HOLD function for the DME channel associated with the selected navigation receiver.	**HOLD** requires the selected navigation receiver to be interfaced with a DME channel outputting a valid signal. When VHF NAV receiver fails, appearance and operation are inhibited, and the DME HOLD previously entered is disabled. DME Hold: button operation remains after DME is invalid if DME channel has hold mode enabled.
MODE (L5)	When selected line is an ADF receiver, progresses through ADF receiver modes: ADF, BFO, REC, and TST (in this order).	When ADF receiver fails, appearance and operation are inhibited.
VFR (L5)	When selected line is a transponder, places VFR code into the standby code position.	When transponder fails, appearance and operation are inhibited.
PLT ISO (L5)	When selected line is an intercom with Pilot Isolation mode, toggles Pilot Isolation mode of the intercom.	When audio controller fails, **PLT ISO (L5)** is inhibited.

Table AR-9: AR Tune Menu Labels		
Menu (Location)	**Function**	**Notes** (if applicable)
SENSE (L5)	When selected line is a Marker Beacon Receiver with adjustable sensitivity, toggles the sensitivity modes.	
SMART MUTE (L6)	Mutes all audio devices, except for the transmit-enabled device. Does not mute intercom systems.	When smart-muted, press **SMART MUTE (L6)** to return all mute values to previous setting, unless active transceiver was changed. Active transceiver is always unmuted.
IDENT (L7)	When configured for transponder control, enables IDENT feature of the transponder.	If transponder fails, appearance and operation are inhibited.
EXP (L8)	When selected line is a device with an expanded control page menu, activates the associated expanded control page menu.	If device fails, appearance and operation are inhibited.
UP ARROW (R5)	Moves the line select up and disappears when at the top line.	
DOWN ARROW (R6)	Moves the line select down and disappears when at the bottom line.	
SWAP (R7)	When the selected line is a device with ACTV and STBY frequencies, channels, or codes, press to toggle the ACTV and STBY frequencies, channels, or codes.	If device fails, appearance and operation are inhibited.
SPLIT TX (R7)	When selected line is an intercom, toggles split transmit mode.	If audio controller fails, appearance

Table AR-9: AR Tune Menu Labels

Menu (Location)	**Function**	**Notes** (if applicable)
		and operation are inhibited.
EMERG (R8)	Loads emergency VHF frequency in to VHF com radios stby frequency and transponder emergency code in stby code, regardless of the selected line. See Table AR-10.	
MHZ (❸)	When selected line is a VHF COM transceiver, scroll CW to increment or CCW to decrement STBY frequency by 1 MHz from 118 to 155 MHz. When selected line is a VHF NAV receiver, scroll CW to increment or CCW to decrement STBY frequency by 1 MHz from 108 to 117 MHz.	If selected device fails, appearance and operation are inhibited. (See AFM for Frequency range of installed VHF COM transceiver)
RX (❷)	When selected line is an intercom with master volume control, scroll CW to increment or CCW to decrement volume by 1 from 0 to 255 units.	If selected device fails, appearance and operation are inhibited.
KHZ (❷)	When selected line is a VHF COM Transceiver in 25 kHz spacing mode, scroll CW to increment or CCW to decrement STBY frequency by 25 kHz from 0 to 975 kHz. When selected line is a VHF COM transceiver	8.33 kHz spacing channels increment as .x00, .x05, .x10, .x15, .x25, .x30, .x35, .x40, .x50, .x55, .x60, .x65, .x75, .x80, .x85 and .x90. If selected device fails, appearance

Table AR-9: AR Tune Menu Labels		
Menu (Location)	**Function**	**Notes** (if applicable)
	in 8.33 kHz spacing mode, scroll CW to increment or CCW to decrement STBY channel by 8.33 kHz spacing channels from 0-990.	and operation are inhibited.
FREQ (❶)	When selected line is an ADF Receiver, scroll CW to increment or CCW to decrement STBY frequency within range of the ADF Receiver on a per-digit basis. Push to increment the digit selected for change.	Frequency range of RA-3502 ADF is 190.0 to 1799.5 kHz. Frequency range of ARINC 712 is 190 to 1750 kHz. If selected ADF Receiver fails, appearance and operation are inhibited.
CODE (❷)	When selected line is a transponder, scroll CW to increment or CCW to decrement STBY 4-digit code on a per-digit basis. Push to increment the digit selected for change.	If selected transponder fails, appearance and operation are inhibited.
VOX (❷)	When selected line is an intercom, scroll CW to increment or CCW to decrement.	If selected device fails, appearance and operation are inhibited.
MODE (❶)	When selected line is a transponder, scroll to change the transponder operating mode.	For BXP6402 transponder, operating modes (in order) are STBY, GRD, ON, and ALT. If transponder fails,

Table AR-9: AR Tune Menu Labels		
Menu (Location)	**Function**	**Notes** (if applicable)
		appearance and operation are inhibited.
VOL/MUTE (➊)	When selected line is a VHF NAV, ADF receiver, DME receiver, Audio-Only device, or Marker Beacon receiver, scroll CW to increment or CCW to decrement volume. When audio controller is configured and not failed, push to toggle muting of that device, not the selected active transceiver.	Volume changes and muting are normally audio controller functions. It is possible to override an audio controller so when command is “muted,” the device is still heard. (See AFM or AFMS for further details based on configuration). If audio controller fails and selected device does not have a native volume control mechanism, appearance and operation are inhibited.
VOL (➊)	When selected line is an intercom or a VHF COM Transceiver (selected as the active transceiver), scroll CW to increment or CCW to decrement the intercom volume level. If the selected device fails, appearance and operation are inhibited for the intercom line. If no audio controller is	If configured audio controller is failed, the selected line device is connected to the audio controller slot that may still be heard when the audio controller is failed, and the selected line device has a native volume control through the

Menu (Location)	Function	Notes (if applicable)
	configured, and selected line device has a native volume control through the IDU interface, scroll CW to increment or CCW to decrement the device volume level.	IDU interface, scroll CW to increment or CCW to decrement the level.

Table AR-9: AR Tune Menu Labels

AR 5. Expanded AR Page

Certain devices have an Expanded Control Page menu to manage less-frequently used device options. When the device is not failed, press **EXP (L8)** to access the Expanded Control Page menu. If the device fails, the expanded control page menu reverts to the audio-radio menu page and is always shown in the bottom area.

The first line of each Expanded Control Page displays the associated line from the AR Tune Menu – both text and symbols of the AR menu page line for that device. Expanded control page button options are as follows.

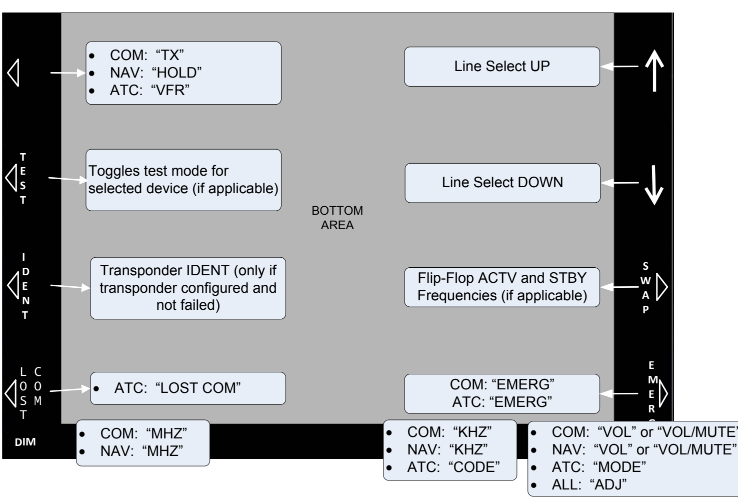


Figure AR-13: Expanded Control Page

Table AR-10: Expanded AR Page Menus

Menu (Location)	Function	Notes (if applicable)
TX (L5)	As described in Table AR-9, when the Expanded Control Page is for a VHF COM transceiver and first line is selected.	
HOLD (L5)	As described in Table AR-9, when the Expanded Control Page is for a VHF NAV receiver and the first line is selected.	
VFR (L5)	As described in Table AR-9, when the Expanded Control Page is for a transponder and the first line is selected.	
TEST (L6)	Toggles TEST mode, when the Expanded Control Page is for a device with a TEST mode.	Appearance and operation are independent from the selected line.
IDENT (L7)	Enables IDENT feature of the transponder, when configured for transponder control, and transponder is not failed.	Appearance and operation are independent from the selected line.
LOST COM (L6)	Inserts communications failure code (7600) into the standby code position, when the Expanded Control Page is for a transponder and the first line is selected.	
UP Arrow (R5)	As described in Table AR-9.	Appearance and operation are independent from the selected line.
DOWN Arrow (R6)		
SWAP (R7)		
EMERG (R8)	When Expanded Control Page is for a transponder, **EMERG (R8)** inserts the emergency code (7700) into the standby code position and emergency frequency (121.500) into the standby frequency positions for the VHF Com transceivers.	

Table AR-10: Expanded AR Page Menus		
Menu (Location)	**Function**	**Notes** (if applicable)
	When Expanded Control Page is for a VHF COM transceiver, **EMERG (R8)** inserts the emergency frequency (121.500) into the standby frequency position for the VHF Com transceivers and emergency code (7700) into the transponder standby code position.	
MHZ (❸)	As described in Table AR-9, when the Expanded Control Page is for a VHF COM Transceiver or VHF NAV Receiver and the first line is selected.	
KHZ (❷)	As described in Table AR-9, when the Expanded Control Page is for a VHF COM Transceiver or VHF NAV Receiver and the first line is selected.	
CODE (❷)	As described in Table AR-9, when the Expanded Control Page is for a Transponder and the first line is selected.	
VOL/MUTE (❶)	As described in Table AR-9, when the Expanded Control Page is for a VHF COM Transceiver or VHF NAV Receiver and the first line is selected.	
VOL (❶)	As described in Table AR-9, when the Expanded Control Page is for a VHF COM Transceiver or VHF NAV Receiver and the first line is selected.	
MODE (❶)	As described in Table AR-9, when the Expanded Control Page is for a transponder and the first line is selected.	
ADJ (❶)	Appears when a line other than the first line is selected.	Functionality depends on the line selected. Scroll CW or CCW for desired input.

AR 5.1. ADR7050 COM Transceiver

Figure AR-14: ADR7050 COM Transceiver EXP Page

Table AR-11: ADR 7050 COM Transceiver EXP Page

Line Number	Name and Control	Function	Notes (if applicable)
Second	SQUELCH Scroll ➊ CW to increment or CCW to decrement level	Squelch level setting In light magenta until confirmed then level bar filled with light green	Represents filter level applied to incoming signals before radio allows signals to be heard
Third	SIDETONE Scroll ➊ CW to increment or CCW to decrement level	Sidetone level setting In light magenta until confirmed then level bar filled with light green	Represents volume of transmitting voice heard by occupants when device is transmitting
Fourth	MIC GAIN Scroll ➊ CW to increment or CCW to decrement level	MIC gain level setting In light magenta until confirmed of then level bar filled with light green	Represents amount of amplification applied to the transmitting microphone

Table AR-11: ADR 7050 COM Transceiver EXP Page

Line Number	Name and Control	Function	Notes (if applicable)
Fifth	MIC THLD Scroll ❶ CW to increment or CCW to decrement level	Microphone threshold level setting. In light magenta until confirmed then level bar filled with light green	Represents filter level applied to the transmitting microphone before device allows signal to be transmitted
Sixth	CHANNEL Scroll ❶ to toggle 25 kHz and 8.33 kHz	Channel selection for 25 kHz or 8.33 kHz channel spacing	Represents tuning either 25 kHz spaced frequencies or 8.33 kHz channels

Figure AR-15: ADR7050 NAV Receiver

Table AR-12: ADR7050 NAV Receiver

Line Number	Name and Control	Function	Notes (if applicable)
First	NAV1 or NAV2 Push ❶ to MUTE	Changing frequencies and setting volume with level bar always light green	Change of frequency only in STBY position. Press **SWAP (R7)** to swap to active position
Second	AUDIO MODE Scroll ❶ to toggle VOICE and	Setting of audio filter to allow for better voice or Morse code signals to be heard.	

Table AR-12: ADR7050 NAV Receiver			
Line Number	**Name and Control**	**Function**	**Notes (if applicable)**
	IDENT. Light magenta until confirmed then light green		

AR 5.2. BXP6402 Mode-S Transponder

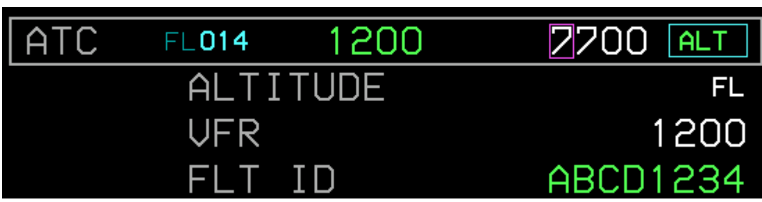


Figure AR-16: BXP6402 Mode-S Transponder

Table AR-13: BXP6402 Mode-S Transponder			
Line Number	**Name and Control**	**Function**	**Notes (if applicable)**
First	ATC, Altitude, and Reply/Ident indication. Controls squawk and mode. Scroll ❶ and ❷ for mode and code changes respectively.	Transponder status	
Second	ALTITUDE	Scroll ❶ to toggle METERS or FL	
Third	VFR	Scroll ❶ to increment or decrement (per-digit) the preset VFR squawk code. Push to cycle through the digits.	

Table AR-13: BXP6402 Mode-S Transponder			
Line Number	**Name and Control**	**Function**	**Notes** (if applicable)
Fourth	FLT ID	Light magenta until confirmed, then light green	Corresponds to the aircraft identification filed in the flight plan, or when no flight plan has been filed, the aircraft registration*

* When the flight ID line is selected, scrolling ❶ increments (CW) or decrements (CCW) the alphanumeric digits (“A –Z,” space and “0” – “9”) with space characters only allowed at the end of the Flight ID) on a per-digit basis and pushing ❶ to cycle through the digits.

NOTE:

Changing the Flight ID may only happen when the BXP6402 Transponder is confirmed in STBY Mode.

AR 5.3. ARINC 716 VHF Com Transceiver (8.33 Capable only)

Figure AR-17: ARINC 716 VHF COM Transceiver (8.33 Capable only)

Table AR-14: ARINC 716 VHF COM Transceiver (8.33 Capable only) *			
Line Number	**Name and Control**	**Function**	**Notes** (if applicable)
First	COM1 or COM2	COM1 and COM2 status	

Table AR-14: ARINC 716 VHF COM Transceiver (8.33 Capable only) *			
Line Number	**Name and Control**	**Function**	**Notes** (if applicable)
	MHZ ❸ or KHZ ❷ or VOL ❶ for frequency and volume control		
Second	CHANNEL Scroll ❶ to toggle between 25 kHz and 8.33 kHz option	Channel selection for 25 kHz or 8.33 kHz channel spacing	Represents tuning 25 kHz spaced frequencies or 8.33 kHz channels

*An ARINC 716 VHF Com transceiver may be capable of tuning 8.33 kHz channels in addition to 25 kHz spaced frequencies. Without this ability, there is no expanded page for this device.

AR 5.4. RN3320 Nav Receiver

Figure AR-18: RN3320 Nav Receiver

Table AR-15: RN3320 Nav Receiver			
Line Number	**Name and Control**	**Function**	**Notes** (if applicable)
First	NAV1 or NAV2 KHZ ❷; KHZ/MUTE ❶	NAV1 and NAV2 status	
Second	AUDIO MODE Scroll ❶ to toggle VOICE and NONE. Light magenta until confirmed then light green.	Setting of audio filter to allow for better voice or Morse code signals to be heard	

AR 5.5. Radio Frequencies Panel

Figure AR-19: Radio Frequencies Panel

The RFP is automatically configured by the Audio/Radio configuration when at least one device is configured and displays up to six devices.

Table AR-16: RFP Common Symbols

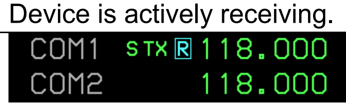
Device Label	**Color**	**Function**	**Notes** (if applicable)
Abbreviation may be up to 5 characters long.	White	Represents device controlled on RADIO page.	Abbreviation has precedence over device label.
FAIL		Current status	Communication from device has ceased for 2 seconds.
TX		Indicates which radio is transmit enabled	
VHF COM Transceiver		Displays when actively transmitting	Frequency is light magenta until confirmed then light green.
Receive		Device is actively receiving.	
Split Transmit	 RFP display excludes Split Transmitter indication.	 In this mode, pilot and co-pilot can simultaneously transmit over separate radios.	
VHF NAV Receiver		VHF NAV Receiver status	Field displays decoded station identifier (up to 5 characters) in

Table AR-16: RFP Common Symbols			
Device Label	**Color**	**Function**	**Notes** (if applicable)
			light cyan. Frequency is light magenta until confirmed then is light green.
ADF Receiver	ADF 1215.5	ADF Receiver status	Frequency is light magenta until confirmed then light green.
Transponder	ID 1200 I ALT I Active position identification R Active reply to interrogation Following modes are light magenta until confirmed, then are light green: STBY, GRD, ON, and ALT.		Transponder field is light magenta until confirmed then light green.

AR 6. Device-Specific Failures

Some devices have specific failure modes presented across multiple lines of the AR Page display. When an audio controller fails, only the devices with audio control through those other devices' interfaces and connected to audio controller slots that are heard when failed display a volume level bar.

AR 6.1. TX Indicator

TX indication shows a transceiver is selected for transmit.

Figure AR-20: VHF Transceiver Transmit Selection Indicator

AR 6.2. AMU50

See AFM or AFMS if aircraft is configured with the AMU50.

AR 6.3. JRAC-001

See AFM or AFMS if aircraft is configured with the JRAC-001.

Table AR-17: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Audio-Radio device parameters	
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.	
Active Flight Plan Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
Audio-Radio device parameters	
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.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.

AR 7. Top-Level Menu Option Descriptions

1) **IDENT (7L)**: When configured for transponder control, enables "IDENT" feature of the transponder. When the transponder is failed, IDENT does not appear.

2) **RADIO (8L)**: When configured for Audio/Radio control, activates the AR menu option.

3) **MENU (R1)**: First-level associated with the current display page.

AR 8. First-Level Menu Option Descriptions

1) **#3 Encoder (❸)**: Function depends upon IDU number and mode (Normal vs. Essential) as follows:

   a) On a PFD (IDU#1) or MFD (IDU#2) with an AR page showing, scroll **MHZ ❸,** when the selected line is a VHF Com Transceiver or UHF, to increment (CW rotation) or decrement (CCW rotation) the STBY frequency by 1 MHz from 118 to 136. When the selected line is a VHF NAV Receiver, increments or decrements the STBY frequency by 1 MHz from 108 to 117.

2) **#2 Encoder (❷)**:

   a) When showing an AR page, scroll **KHZ ❷,** when the selected line is a VHF COM Transceiver in 25 kHz spacing mode, to increment (CW rotation) or decrement (CCW rotation) the STBY frequency by 25 kHz from 0 to 975 kHz. When the selected line is a VHF Com Transceiver in 8.33 kHz spacing mode, increments or decrements the STBY frequency by 8.33 kHz spacing channels from 0 to 990. If the selected device fails, KHZ encoder appearance and operation are inhibited.

   b) When showing an AR page, **FREQ** appears when the selected line is an ADF Receiver and increments (CW rotation) or decrements (CCW rotation) the STBY frequency within the frequency range of the ADF receiver on a per-digit basis. Push to increment the digit selected for change. If the selected ADF receiver fails, FREQ encoder appearance and operation are inhibited.

c) When showing an AR page, **CODE** appears when the selected line is a Transponder, increments (CW rotation) or decrements (CCW rotation) the STBY 4-digit octal code on a per-digit basis. Push to increment the digit selected for change. If the transponder fails, CODE encoder appearance and operation are inhibited.

d) When showing an AR page, **VOX** appears when the selected line is an intercom, increases (CW rotation) or decreases (CCW rotation) the VOX threshold. If the device fails, VOX encoder appearance and operation are inhibited.

AR 9. #1 Encoder (➊)

1) On a PFD or MFD operating in Normal Mode, if the bottom area is showing an Audio/Radio page, scroll the encoder to change the selected Audio/Radio device volume and or mute function if applicable.

2) When showing an AR page, **MODE** appears when the selected line is a Transponder, scroll the transponder operating mode. If the transponder fails, MODE encoder appearance and operation are inhibited.

3) When showing an AR page, **VOL/MUTE** appears when the selected line is a VHF COM Transceiver (not the selected active transceiver), VHF NAV Receiver, ADF Receiver, DME Receiver, Audio-Only device or Marker Beacon Receiver increases (CW rotation) or decreases (CCW rotation) the volume level. When an audio controller is configured and not failed, push to toggle muting. If the selected device fails, VOL/MUTE is inhibited.

4) When showing an AR page, **VOL** appears when the selected line is an intercom or a VHF COM Transceiver (selected as the active transceiver) increases (CW rotation) or decreases (CCW rotation) the intercom volume level. If the selected device fails, VOL is inhibited for the intercom line (see AFM for details of specific configuration details).

Table AR-18: Top-Level Auto Pop-Up Function Descriptions

Note 1	Note 2	Precedence, Tile Legend, and Action
L1	**L5**	1) When showing AR page, **TX** appears when selected line is a VHF COM

Table AR-18: Top-Level Auto Pop-Up Function Descriptions

Note 1	Note 2	Precedence, Tile Legend, and Action
		transceiver or Audio-Only device not currently transmit enabled. Enables transmitting on the selected transmitter and unmutes the associated device. If audio controller fails, TX appearance and operations are inhibited. 2) When showing AR page, **HOLD** appears when selected line is a VHF NAV receiver and toggles the DME Hold function for the DME channel associated with the current NAV receiver equal to the current NAV receiver active frequency. **HOLD** requires the selected navigation receiver to be interfaced with a DME channel outputting a valid signal. If VHF NAV receiver fails, HOLD appearance and operation are inhibited. 3) When showing AR page, **MODE** appears when selected line is an ADF receiver toggles through ADF receiver modes ADF, BFO, and REC. If ADF receiver fails, MODE appearance and operation are inhibited. 4) When showing AR page, **VFR** appears when selected line is a transponder and places VFR code into standby code position. If transponder fails, VFR appearance and operation are inhibited. 5) When showing AR page, **PLT ISO** appears when selected line is an intercom with a Pilot Isolation mode and toggles mode of the intercom. When audio controller fails, PLT ISO

Table AR-18: Top-Level Auto Pop-Up Function Descriptions		
Note 1	**Note 2**	**Precedence, Tile Legend, and Action**
		appearance and operation are inhibited. 6) When showing AR page, **SENSE** appears when selected line is a Marker Beacon Receiver with adjustable sensitivity and toggles the sensitivity modes.
L2	**L6**	When showing AR page, **SMART MUTE** appears and toggles muting of all audio devices, which are not the transmit-enabled device, but does not mute intercom systems. If audio controller fails, backup volume level changes may only be performed if the connected device provides a native volume level change mechanism accessible via IDU communications. When a different device is transmit enabled, muting occurs on the next **SMART MUTE** button press.
L3	**L7**	When showing AR page when interfaced with a transponder, **IDENT** appears. Press to enable special position identification (“ident”) feature of the transponder. If transponder fails, IDENT appearance and operation are inhibited.
L4	**L8**	1) When showing any page, **RADIO** appears. Press to enable the radio page for control of audio and frequency control. 2) When showing AR page and a device with expanded AR page is selected, **EXP** appears. Press for AR Expand Page First-Level options. If selected device fails, EXP appearance and operation are inhibited.
	R5	When showing AR page, **UP Arrow** appears for moving select line in upward direction and disappears at the top line.

Table AR-18: Top-Level Auto Pop-Up Function Descriptions

Note 1	Note 2	Precedence, Tile Legend, and Action
R2	**R6**	1) When showing AR page and a transceiver is selected which is not currently enabled for transmit, **TX** appears. Press to enable selected device for transmit and un-mute the selected device. When interfaced audio controller fails, AR page omits **TX** and operation for the devices. 2) When showing AR page and a VHF Nav Receiver is selected, and a DME receiver is interfaced, and DME presents a valid signal, **HOLD** appears. Press to toggle DME Hold for the nav receiver and associated DME channel. Press to set hold frequency of the DME channel for current nav receiver equal to the nav receiver active frequency. DME HOLD feature is active until removed or DME Channel has failed. 3) When showing AR page, **DOWN Arrow** appears for moving select line in downward direction and disappears at the bottom line.
R3	**R7**	1) When showing AR page, **SWAP** appears when selected line is a device with ACTV and STBY frequencies, channels, or codes and toggles ACTV and STBY frequencies, channels, or codes. If device fails, SWAP appearance and operation are inhibited. 2) When showing AR page, **SPLIT TX** appears when selected line is an intercom and toggles the split transmit mode. If audio controller fails, SPLIT

Table AR-18: Top-Level Auto Pop-Up Function Descriptions		
Note 1	**Note 2**	**Precedence, Tile Legend, and Action**
		TX appearance and operation are inhibited.
R4	**R8**	When showing AR page, **EMERG** appears when selected line is a transponder and places emergency code (7700) into transponder standby code position and emergency frequency (121.500) into standby frequency positions for VHF Com frequency positions for the VHF Com Transceivers. When selected line is a VHF Com transceiver, performs same operation as stated above. If configured with UHF transceiver(s), press **EMERG** to place (243.000) into standby frequency position(s).

Note 1: Used when the function is tied to a page in the top area.

Note 2: Used when the function is tied to a page in the bottom area or tied to being “Transmit Enabled.”

Datalink

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D 1. Datalink Symbology

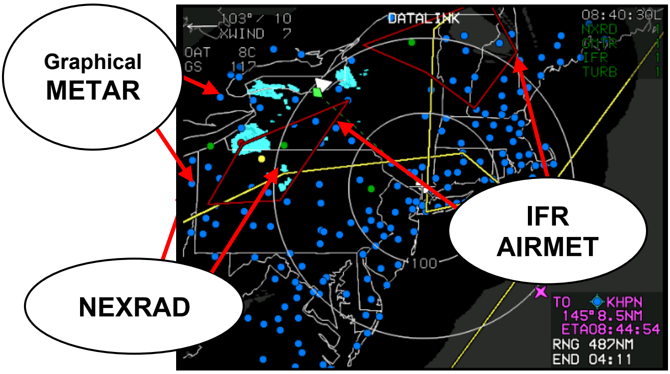


Figure D-1: Datalink Symbology

When individually selected, the ND displays and indicates status for Temporary Flight Restriction, NEXRAD radar, graphical METAR, and lightning ground strike data. When Temporary Flight Restriction data have not been completely downlinked, status is annunciated as the word “TFR” with an overlying red “X.” Only the following products received are supported and displayed.

Table D-1: WSI Inflight™ Data Products	
Temporary Flight Restriction Data	Available if included in user subscription
NEXRAD Radar Data	
Lightning Ground Strike Data	
Graphical METAR Data	Available if Textual METAR data is included in user subscription. Derived from Textual METAR data using EFIS algorithm.

NOTE:

Up to 300 Temporary Flight Restrictions may be displayed.

Temporary Flight Restrictions (TFRs) are displayed on the ND in correct relationship to the ownship symbol. NEXRAD Radar Data are displayed on the ND in correct relationship as colored regions of precipitation using the following convention.

Table D-2: Datalink NEXRAD Radar Data	
Color	**Meaning**
Gray Shading	Areas beyond limits of radar coverage or areas with missing data
Magenta	Rain >= 50dBZ
Red	Rain >= 45dBZ and < 50dBZ
Light Red	Rain >= 40dBZ and < 45dBZ
Amber (Yellow)	Rain >= 30dBZ and < 40dBZ
Green	Rain >= 20dBZ and < 30dBZ
Cyan	Snow >= 20dBZ
Light Cyan	Snow >= 5dBZ and < 20dBZ
Magenta	Mixed Precipitation >= 20dBZ (Area is distinguishable from rain >= 50dBZ by graphical context)
Light Magenta	Mixed Precipitation >= 5dBZ and < 20dBZ

Echo tops (vertical height of NEXRAD Radar Data returns) are displayed on the datalink screen in correct relationship to the ownship symbol. Echo tops are automatically decluttered at 400NM, 800NM, and 1,600NM screen ranges. Major echo tops (i.e., group of highest returns on the displayed datalink screen) are displayed as a large circle containing a readout of speed and a graphical arrow indicating direction of travel. The height of the major echo top, in hundreds of feet, is displayed to the right of the major echo top symbol, which is is color-coded and presents amplifying text as follows.

Table D-3: Datalink NEXRAD Echo Tops		
Severe Weather Condition	**Color**	**Amplifying Text**
Possible Hail	Light Cyan	“HAIL”
Confirmed Hail	Light Cyan	“HAIL+”
Mesocyclonic (Rotation Detected)	Red	“MESO”
Tornadic	Magenta	“TRNDO”

Minor echo tops are displayed as a small white circle with the height of the minor echo top, in hundreds of feet, being textually displayed to the left of the minor echo top symbol. The text size for the minor echo top symbol is smaller than for the major echo top symbol.

Graphical METARs are displayed on the datalink screen in correct relationship to the ownship symbol as a large color-filled circle in accordance with the following convention.

Table D-4: Datalink Graphical METARs

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

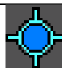
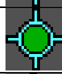
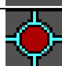
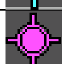
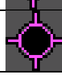
Table D-5: Graphical METARS (GMETARS) Screen Range

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-2: NRST Airport INFO

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-6: Graphical METAR Symbols	
Color	**Meaning**
Sky Blue 	Visual Flight Rules (VFR)
Green 	Marginal Visual Flight Rules (MVFR)
Amber (Yellow) 	Instrument Flight Rules (IFR)
Red 	Low Instrument Flight Rules (LIFR)
Magenta 	Less than Category 1 Approach Minimums
Black 	No Data

Graphical weather conditions data are displayed in the menu system “info” function as large colored squares per the following convention.

Table D-7: Datalink Graphical METAR Precipitation	
Color	**Meaning**
Sky blue	No significant precipitation
Green	Rain
White	Snow
Red	Hazardous weather
Right half gray	Obscuration to visibility
Small black square centered in large square	High wind
Black	No data

The following may be displayed on the datalink screen:

1) **Lightning ground strikes**: In correct relationship to the ownship symbol as an amber (yellow), small cross symbols.

2) **Convective SIGMET**: As magenta line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual convective SIGMETs. When viewing such text, the associated symbol flashes.

3) **Icing AIRMET and SIGMET**: As cyan line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual icing AIRMETs and SIGMETs. When viewing such text, the associated symbol flashes.

4) **IFR AIRMET and SIGMET**: As red line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual IFR AIRMETs and SIGMETs. When viewing such text, the associated symbol flashes.

5) **Turbulence AIRMET and SIGMET**: As amber (yellow) line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual turbulence AIRMETs and SIGMETs. When viewing such text, the associated turbulence AIRMET or SIGMET symbol flashes.

Winds and temperature aloft data are displayed on the datalink screen in correct relationship to the ownship symbol as a grid of black squares containing textual readouts of wind speed and temperature (in units determined by the Temp Units EFIS Limits setting) and a graphical arrow indicating wind direction. When winds and temperature aloft data are being displayed, soft tiles are present to allow the pilot to change the data altitude.

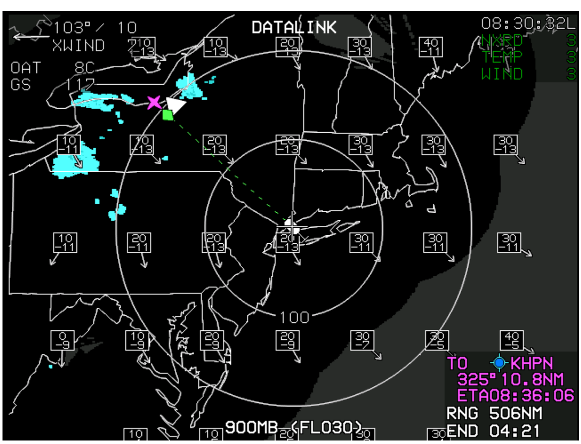
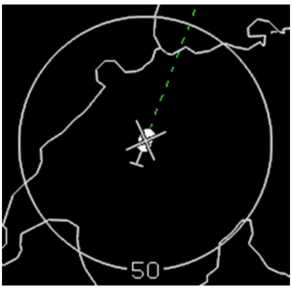


Figure D-3: Datalink Winds and Temperature Aloft

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.

D 1.1. Ownship Symbol



When not panning with the AHRS is in the DG mode, a “DG” indication appears to the 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 the pan mode, the ownship symbol is aligned with the aircraft heading.

Figure D-4: Rotorcraft FAR Part 27/29

D 1.2. Datalink Screen Legend

A datalink screen legend appears when selected by the pilot depicting symbology used for Graphical METARs, AIRMETs, SIGMETs, NEXRAD Radar with winter colors, Echo Tops, Temperatures Aloft, and Winds Aloft.

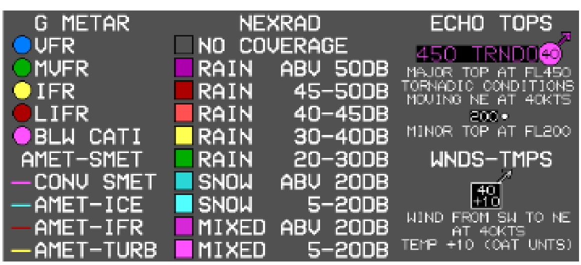


Figure D-5: WSI Datalink Screen Legend

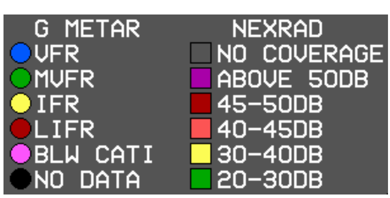


Figure D-6: ADS-B Datalink Screen Legend

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/Timers/Options

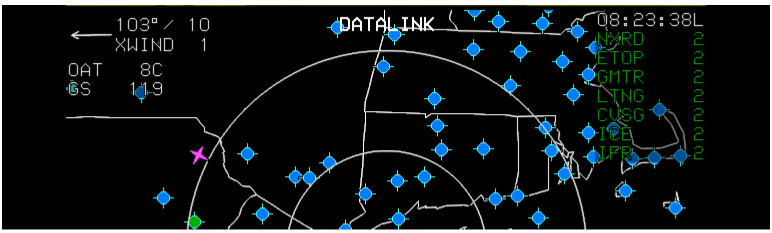


Figure D-7: Clock/Timers/Options

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

1) **Zulu Time or LCL Time**: As specified in Section 3 Display Symbology.

2) **Timer**: As specified in Section 3 Display Symbology.

3) **Datalink Temporary Flight Restriction Data Status**: When Temporary Flight Restriction Data has not been completely downlinked, status is annunciated as the word “TFR” with an overlying red “X.”

4) **Datalink Weather Status**: When status of NEXRAD radar, graphical METARs and lightning ground strike data are displayed as follows.

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
NEXRAD Radar Status:	
NEXRAD never completely downlinked	No Annunciation
NEXRAD downlinked within last 5 minutes and selected for display (weather radar, if installed, deselected from	“NXRD ##” drawn in green where ## is age in minutes.

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
display). "Show Full Sensor Status Flag" enabled.	NEXRAD Radar shown on display.
NEXRAD downlinked within last 5 minutes and deselected from display or weather radar, if installed, has been selected for display. "Show Full Sensor Status Flag" enabled.	"NXRD ##" drawn in green where ## is age in minutes. "NXRD ##" overlaid with green "X" NEXRAD Radar not shown on display.
NEXRAD not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display (weather radar, if installed, deselected from display). "Show Full Sensor Status Flag" enabled.	"NXRD ##" drawn in amber (yellow) where ## is age in minutes. NEXRAD Radar shown on display.
NEXRAD not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display or weather radar, if installed, has been selected for display. "Show Full Sensor Status Flag" enabled.	"NXRD ##" drawn in amber (yellow) where ## is age in minutes. "NXRD ##" overlaid with green "X" NEXRAD Radar not shown on display.
NEXRAD not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display (weather radar, if installed, deselected from display).	"NXRD ##" drawn in red where ## is age in minutes. NEXRAD Radar shown on display.
NEXRAD not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display or weather radar, if installed, has been selected for display.	"NXRD ##" drawn in red where ## is age in minutes. "NXRD ##" overlaid with green "X"

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
	NEXRAD Radar not shown on display.
NEXRAD not downlinked within last 75 minutes (timed-out)	"NXRD XX" drawn in red "NXRD XX" overlaid with red "X" NEXRAD Radar not shown on display.
Graphical METAR Status:	
METARS never completely downlinked	No Annunciation
METARS downlinked within last 5 minutes and selected for display. "Show Full Sensor Status Flag" enabled.	"GMTR ##" drawn in green where ## is age in minutes. Graphical METARs shown on display.
METARS downlinked within last 5 minutes and deselected from display. "Show Full Sensor Status Flag" enabled. "Show Full Sensor Status Flag" enabled.	"GMTR ##" drawn in green where ## is age in minutes. "GMTR ##" overlaid with green "X" Graphical METARs not shown on display.
METARS not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display. "Show Full Sensor Status Flag" enabled.	"GMTR ##" drawn in amber (yellow) where ## is age in minutes. Graphical METARs shown on display.
METARS not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display. "Show Full Sensor Status Flag" enabled. "Show Full Sensor Status Flag" enabled.	"GMTR ##" drawn in amber (yellow) where ## is age in minutes. "GMTR ##" overlaid with green "X" Graphical METARs not shown on display.

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
METARS not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display	"GMTR ##" drawn in red where ## is age in minutes. Graphical METARs shown on display.
METARS not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display. "Show Full Sensor Status Flag" enabled.	"GMTR ##" drawn in red where ## is age in minutes. "GMTR ##" overlaid with green "X" Graphical METARs not shown on display.
METARS not downlinked within last 75 minutes (timed-out) "Show Full Sensor Status Flag" enabled.	"GMTR XX" drawn in red "GMTR XX" overlaid with red "X" Graphical METARs not shown on display.
Lightning Ground Strike Status:	
Lightning Ground Strikes never completely downlinked.	No Annunciation
Lightning Ground Strikes downlinked within last 5 minutes and selected for display.	"LTNG ##" drawn in green where ## is age in minutes. Lightning Ground Strikes shown on display.
Lightning Ground Strikes downlinked within last 5 minutes and deselected from display. "Show Full Sensor Status Flag" enabled.	"LTNG ##" drawn in green where ## is age in minutes. "LTNG ##" overlaid with green "X" Lightning Ground Strikes not shown on display.
Lightning Ground Strikes not downlinked within last 5 minutes but downlinked within last 10 minutes and selected	"LTNG ##" drawn in amber (yellow) where ## is age in minutes. Lightning Ground Strikes shown on display.

Table D-8: Datalink NEXRAD Radar Status

Condition	Annunciation
for display. "Show Full Sensor Status Flag" enabled.	
Lightning Ground Strikes not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display	"LTNG ##" drawn in amber (yellow) where ## is age in minutes. "LTNG ##" overlaid with green "X" Lightning Ground Strikes not shown on display.
Lightning Ground Strikes not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display. "Show Full Sensor Status Flag" enabled.	"LTNG ##" drawn in red where ## is age in minutes. Lightning Ground Strikes shown on display.
Lightning Ground Strikes not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display. "Show Full Sensor Status Flag" enabled.	"LTNG ##" drawn in red where ## is age in minutes. "LTNG ##" overlaid with green "X" Lightning Ground Strikes not shown on display.
Lightning Ground Strikes not downlinked within last 75 minutes (timed-out). "Show Full Sensor Status Flag" enabled.	"LTNG XX" drawn in red "LTNG XX" overlaid with red "X" Lightning Ground Strikes not shown on display.

D 1.5. Datalink Screen Orientation

The datalink screen is always displayed in North-up orientation and has a boundary circle instead of a compass rose. "DATALINK" appears above the boundary circle, and, if not in pan mode, the ownship symbol aligns with aircraft heading.

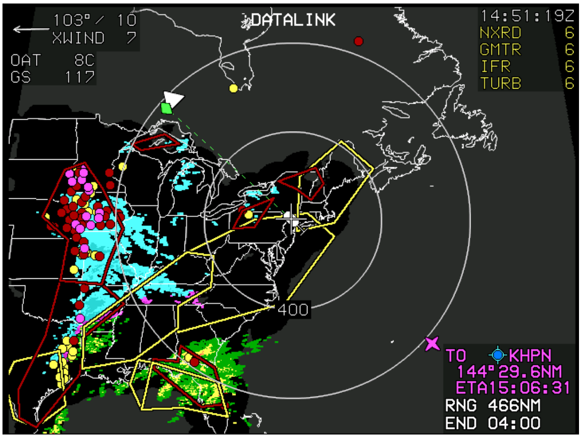


Figure D-8: Datalink

When selected, the following datalink screen ranges are available.

Table D-9: Datalink Screen Range Values	
Distance from Ownship to the 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

Figure D-9: Boundary Circle Symbol

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.

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). A top of descent symbol is shown, but it is not displayed when groundspeed is less than 30 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the boundary circle. A magenta, star-shaped waypoint pointer is displayed on the boundary circle at a point corresponding with the active waypoint. The waypoint pointer turns amber (yellow) in the event of GPS Loss of Navigation caution. Boundary circle symbols are not drawn, if the datalink screen is in pan mode.

D 1.7. 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, if selected, shows on the datalink 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 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. 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 and turn amber (yellow) in the event of a GPS Loss of Navigation caution.

The datalink 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

The datalink screen has a 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 ❶ (or ❷ as applicable) to pan north, south, east, and west. When pan mode is active, a line from the map center to the aircraft's current position is drawn, 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 Datalink Format (FORMAT) Menu

Upon selecting the MFD format menu when in the Datalink page, an option list appears with the following options:

1) **ROUTE ON/ROUTE OFF**: Toggles showing the active flight plan route on the Datalink page.

2) **PAN ON/PAN OFF**: Toggles Datalink page Pan Mode.

3) **AMET-SMET**: Only available when an AIRMET or SIGMET is within the Datalink page viewable area. Allows the pilot to view the text for the displayed AIRMETs and SIGMETs. While viewing the text for a particular AIRMET or SIGMENT, the border associated with the AIRMET or SIGMET flashes.

4) **DCLTR**: Only available when datalink weather products are available for display. Allows the pilot to select individual datalink weather products for display. Only those datalink weather products available for display appear in the selection box.

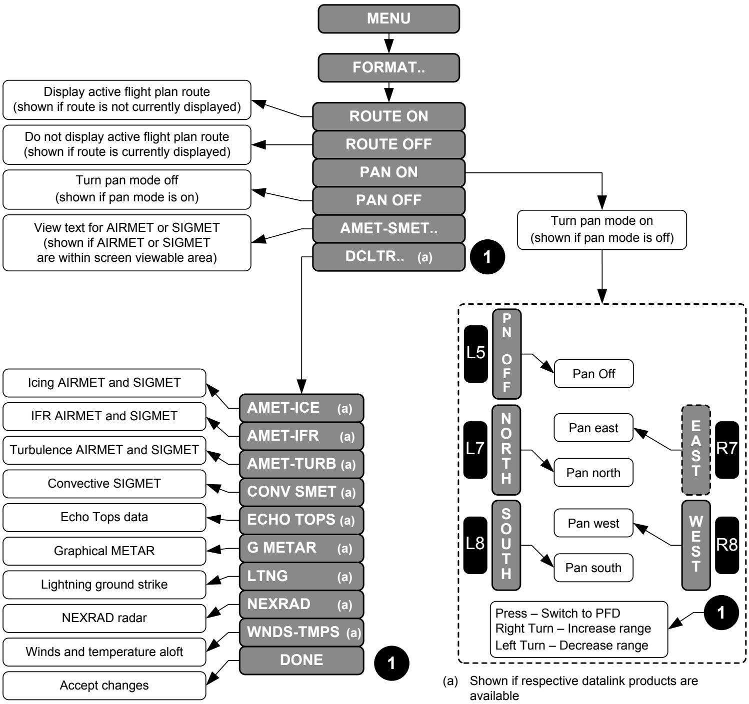
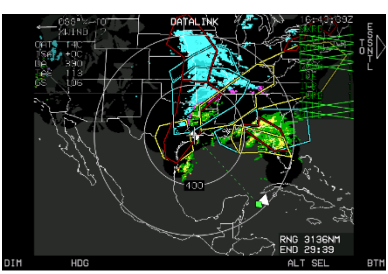


Figure D-10: MFD Datalink Format (FORMAT) Menu

D 2.1. MFD DATALINK Page (Step-By-Step)

1) Push ❶ or ❷ and scroll to **DATALINK** and push to enter.



2) Example shows MFD with DATALINK on bottom area.

3) Press **MENU (R1)** then **FORMAT (R8)** to format DATALINK page.

4) Scroll ❶ to **ROUTE OFF**, **PAN ON**, **AMET-SMET..**, or **DCLTR..** Push to enter.

Table D-10: Menu Synchronization

Menu Parameter	**Notes**
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Heading Bug	
True North Mode	
UTC Offset	
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.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
PFD Zoom Mode	
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.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note

Table D-10: Menu Synchronization	
Menu Parameter	**Notes**
	that this parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Datalink Page Settings	Independent between top and bottom 680 MFD areas
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.

Table D-11: Top-Level Auto Pop-Up Function Descriptions		
Note 1	**Note 2**	**Precedence, Tile Legend, and Action**
L1	**L5**	When showing Datalink Page with Pan Mode enabled, **PN OFF** appears. Press to disable Pan Mode. **RESET** has precedence over **PN OFF**.
L2	**L6**	1) When showing Datalink Page with Winds and Temperatures Aloft enabled, **UP** appears. Press to increase the Winds and Temperatures Aloft grid level. **UP** does not appear when the highest grid level is displayed. 2) When showing Datalink 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. **UP** has precedence over **WX**. 3) When showing ND Page with: (a) pan mode enabled; (b) information for the nearest highlighted waypoint being shown; and (c) airport weather

Table D-11: Top-Level Auto Pop-Up Function Descriptions		
Note 1	**Note 2**	**Precedence, Tile Legend, and Action**
		information present in the information block; **WX** allows the display of textual METAR and TAF data for the airport.
L3	**L7**	When showing Datalink Page with Pan Mode enabled, **NORTH** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.
L4	**L8**	When showing Datalink Page with Pan Mode enabled, **SOUTH** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.
R2	**R6**	1) When showing Datalink Page with Winds and Temperatures Aloft enabled, **DOWN** appears. Press to decrease the Winds and Temperatures Aloft grid level. **DOWN** does not appear when the lowest grid level is displayed. 2) When showing the Datalink Page with Pan Mode enabled, **INFO** or **HIDE** appears. Press to toggle the display of information for the nearest highlighted waypoint. Refer to the INFO Menu requirements for the amount and type of information presented. **DOWN** has precedence over **INFO/HIDE**.
R3	**R7**	When showing the Datalink Page with Pan Mode, **EAST** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.
R4	**R8**	When showing the Datalink Page with Pan Mode enabled, **WEST** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.

Note 1: Used when the function is tied to a page in the top area.

Note 2: Used when the function is tied to a page in the bottom area or tied to being "Transmit Enabled."

D 3. Active Flight Plan (ACTV) Menu Options

NRST APT (L2): With optional datalink, **WX LGND** and **EXPND WX** tiles are available at this level to show a weather symbol legend and highlighted result METAR and TAF text respectively.

D 4. Information (INFO) Menu

When airport weather information is presented in the information block, **WX LGND (L2)** appears to allow the display of an airport graphical METAR legend, and **EXPND WX (L3)** appears to allow the display of textual METAR and TAF data for the airport.

D 5. MFD Fault Display Menu

1) If WSI datalink is enabled, the datalink item indicates either loss of communications with the datalink receiver (DLNK X), loss of satellite lock (DLNK NO LOCK), or the current bit error rate or the datalink (DLNK BER ###). WSI datalink is mutually exclusive with ADS-B datalink.

2) 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). ADS-B datalink is mutually exclusive with WSI datalink.

D 6. MFD Page (PAGE) Menu

DATALINK: Shows the Datalink page.

Weather Radar

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WX 1. Weather Radar

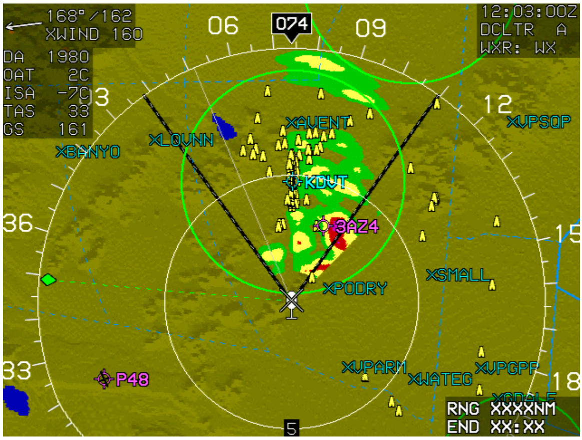

Figure WX-1: Weather Radar Image on ND

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 Panning 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. 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.

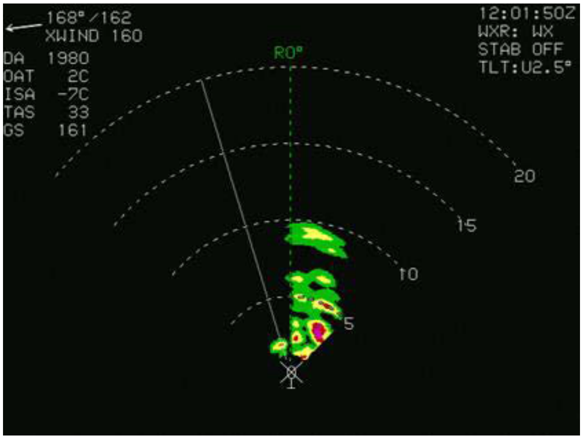

Figure WX-2: Radar Image in Arced Format

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 as in Figure WX-3.

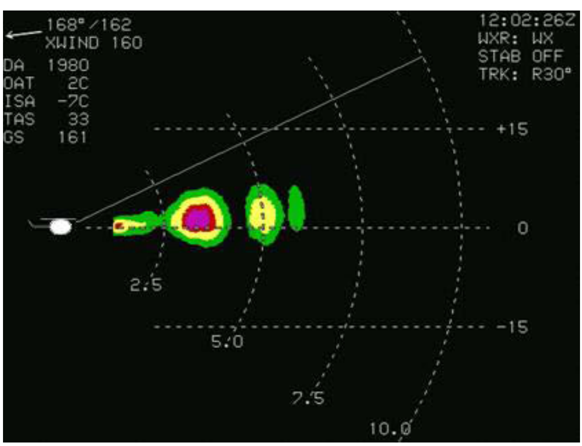

Figure WX-3: Radar Image in Profile Depiction

Pilot selection of the profile depiction is performed using a separate 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 the profile depiction and automatically disables profile depiction, if the pilot sets up the screens so no weather radar page is shown 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 automatically disables profile depiction, if the weather radar mode is set to off or standby via Radar Control Panel.

WX 2.1. Weather Screen Range

Weather screen range is pilot-selectable with selection made with either ➊ (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 the pilot 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 the profile depiction mode, there are also three horizontal altitude lines drawn relative to the aircraft’s altitude to help the pilot judge the vertical distance to the displayed weather radar returns. The center line is level with the ownship symbol to represent the aircraft’s altitude. The other two lines are equally spaced above and below the center line to represent altitude differences above and below the aircraft. The number of feet above and below the aircraft varies with the selected range to compensate for the radar scan width at the different ranges.

WX 2.2. Track Line

When the weather radar type is RDR-2000 or RDR-2100 and the horizontal depiction is being shown, a dashed track line appears emanating from the ownship symbol to the outer dashed arc. The value of the track line in whole degrees left or right of aircraft heading is displayed adjacent to the outer end of the track line.

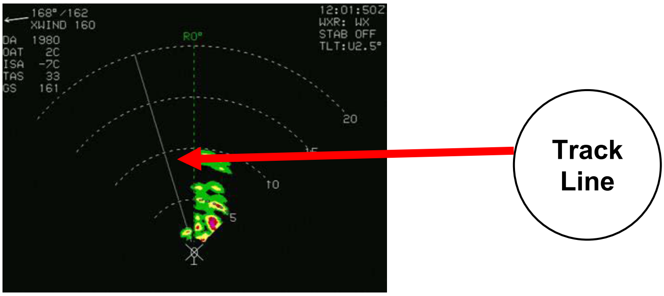

Figure WX-4: Radar Track Line

WX 2.3. Active Flight Plan Path/ Manual Course/ Runways

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.

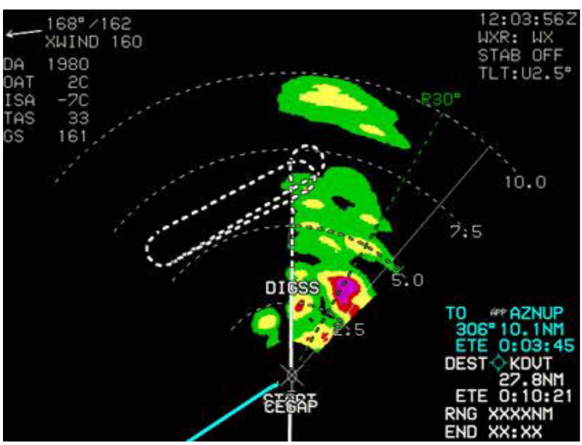

Figure WX-5: Radar Active Flight Plan

WX 2.4. Weather Radar Return Data

Weather radar return data are displayed on the weather radar screen in correct relationship to the ownship symbol as colored regions according to the value of the ARINC 453 3-bit range bins.

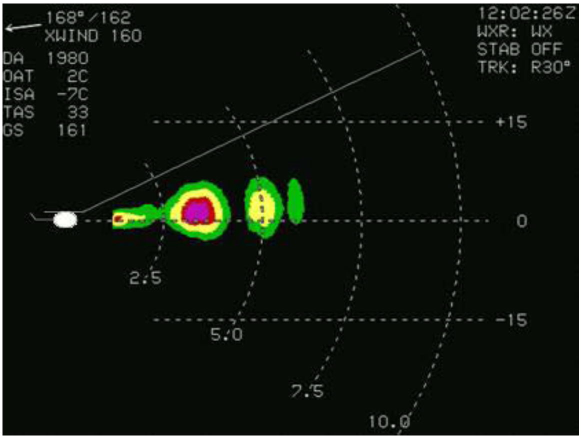

Figure WX-6: Radar Return Data

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	Amber (Yellow)	Mid-Level Weather or Mid-Level Ground Returns
011b	Red	Third-Level Weather Returns. Color is replaced with black when in MAP mode. MAP mode is encoded in ARINC 453 label 055 and 171 bits 27-29 as 010b.
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.

Table WX-2: Weather Radar Return Data

ARINC 453 3-Bit Range Bin	Color	Meaning
110b	Light Gray	Moderate Turbulence Returns
111b	White	Severe Turbulence Returns

The following weather radar-specific warnings appears in a conspicuous area adjacent to the weather radar return data so they do not conflict with the weather radar return data. Only one weather radar-specific warning appears at any given time, with the following order of precedence:

1) **WX ALRT**: Shown when a weather alert condition is active.

2) **TURB ALRT**: Shown when a turbulence alert condition is active. A turbulence alert condition is indicated by ARINC 453 label 055 Bit 14.

3) **STAB LIMIT**: Shown when the aircraft attitude has moved to a point where the weather radar antenna can no longer be effectively stabilized.

4) **ANT FAULT**: Shown when the weather radar antenna is temporarily dislodged by turbulence.

WX 2.5. Air Data and Groundspeed

Air data and groundspeed are displayed in the upper left corner of the weather radar screen as specified in Section 3 Display Symbology.

WX 2.6. Clock/Timers/Options

1) **Zulu Time or LCL Time**: Displayed as in Section 3 Display Symbology;

2) **Timer**: Countdown or count-up timer displayed as in Section 3 Display Symbology;

3) **Weather Radar Mode Annunciation**: As in Table WX-3.

Figure WX-7: Radar Clock/Timer/Options

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)	Weather radar mode annunciation is not overlaid with a red “X”; Weather radar mode is not standby or forced standby; and Weather radar indicates stabilization is off.
TGT ALERT (Target Alert)	Weather radar mode annunciation is not overlaid with a red “X”;

Table WX-4: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
	Weather radar mode is not standby or forced standby; Weather radar is presenting the horizontal depiction.
"TLT:UXX.X" or "TLT:AUTO" (TILT)	U = Up or Down (either U or D, but not both, may appear – use "U" for 0°); XX.X represents absolute value of the tilt angle in degrees truncated to the nearest tenth; "TLT:AUTO" is used where weather radar reports a value of -16°, representing automatic tilt. Weather radar tilt annunciation only appears when all following conditions are true: 1) Mode annunciation is not overlaid with a red "X"; 2) Mode is not standby or forced standby; and 3) Radar is not in vertical profile submode.
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: 1) Mode annunciation is not overlaid with a red "X"; 2) Mode is not standby or forced standby; and 3) Radar is in vertical profile submode (profile depiction).

Table WX-4: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
"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: 1) Mode annunciation is not overlaid with a red "X"; 2) Mode is not standby or forced standby; and 3) Mode is ground map.

WX 2.7. Fuel Totalizer/Waypoint Bearing and Distance Functions

Fuel totalizer, waypoint bearing, and waypoint distance are displayed in the lower right corner of the weather radar screen as specified in Section 3 Display Symbology.

Table WX-5: Menu Synchronization	
Menu Parameter	**Notes**
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
AHRS 1 and 2 mode and slewing values	
Fuel Totalizer Quantity	
VNAV Climb Angle	
Countdown Timer Start Time	

Table WX-5: Menu Synchronization

Menu Parameter	Notes
Countdown Timer Default Value	
Remote Tune Frequencies	
VNAV Descent Angle	
Decision Height Setting	Used when “Dual Decision Height Flag” is false.
Emergency and Minimum Fuel Settings	
Heading Bug	
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	
Settable V-Speeds	
VSI Bug Setting	
Crosslink Synchronization Status	
Audio-Radio device parameters	
G-Force Limit Parameters	
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.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
Navigation Source	
PFD Altitude (meters) Show Flag	

Table WX-5: Menu Synchronization	
Menu Parameter	**Notes**
Weather Radar Scale	Onside because range is controlled by the weather radar.
The following menu parameters are independent between displays. These are used to support non-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.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.
MFD Map Function Declutter Settings	Independent between top and bottom 680 MFD areas
MFD Show ETA Flag	

WX 3. MFD Page (PAGE) Menu

WX-RDR: Shows the Weather Radar page.

WX 4. MFD Fault Display (FAULTS) Menu

1) 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 any one of the following conditions is true:

    a) Loss of weather radar communication.

    b) Weather radar mode is OFF.

2) 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 any one 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 is enabled and the weather radar type is RDR-2000 or RDR-2100, an indication of radar control panel status (WXR RCP X or WXR RCP OK). Radar control panel status failed (WXR RCP X) indicates either loss of communication or a failure status using the same test as invalid data SSM for output labels 270, 271, 273, or 275.

Video

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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.

NO VIDEO IMAGE AVAILABLE: Displayed in white centered on the screen when no video signal is detected, the video input screen is black with the annunciation. To aid in diagnosing problems with undetected video signals, the following annunciations are displayed below this annunciation in white centered on the screen:

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

The pilot may set desired zoom levels from 1 (no pixel replication) to 10 in increments of 1.

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.

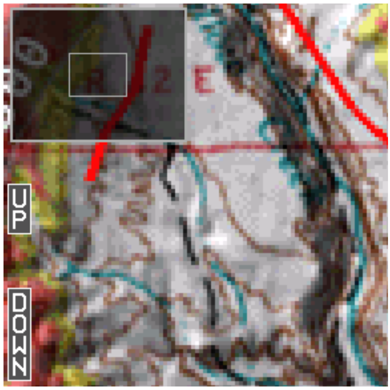

Figure V-1: Video Pan View

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.

V 1.3. Video Input Status Display

When selected, the following are optionally displayed in the upper right corner of the Video Input display:

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.

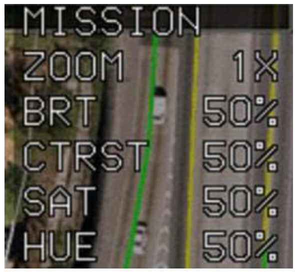

Figure V-2: Video Status

V 2. MFD Video Input Format (FORMAT) Menu

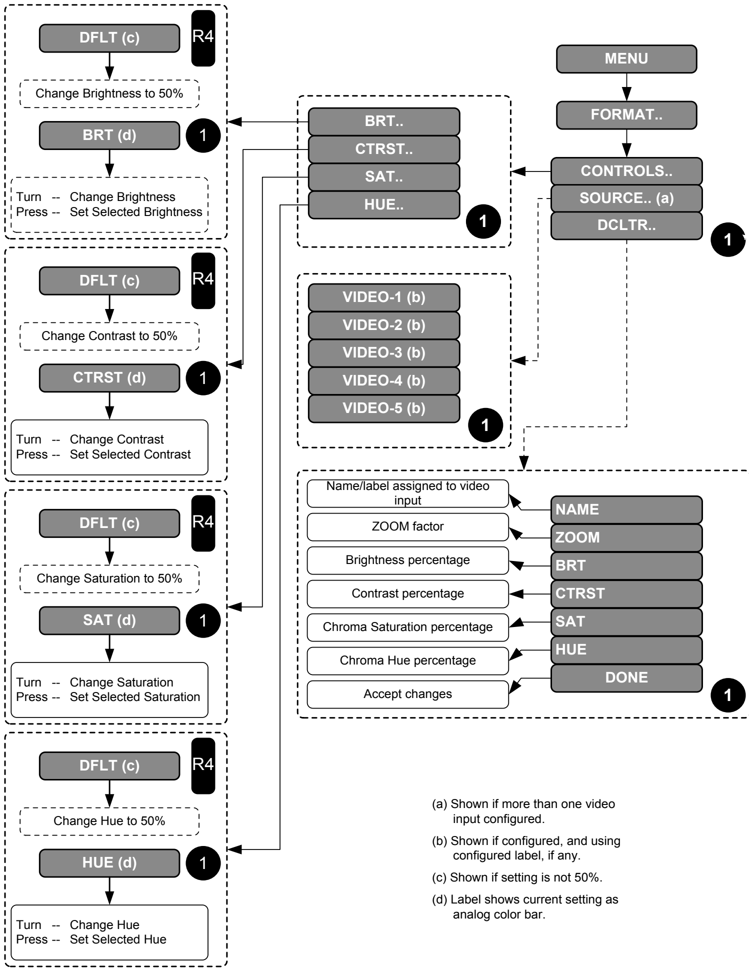

Figure V-3: MFD Video Input Format (FORMAT) Menu

Upon selecting the MFD format menu when in the Video Input page, an option list appears with the following options.

Table V-1: Video Input Controls		
Controls Settings	**Definition**	**Notes**
BRT	Adjust brightness setting for the current Video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting brightness to nominal default.
CTRST	Adjust contrast setting for current video input	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting contrast to nominal default.
SAT	Adjust chroma saturation (Color Intensity) setting for current video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting to nominal default value.
HUE	Adjust chroma hue (red-green balance) settings for current video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting to nominal default value.
SOURCE	Selection of optional video source.	Only available if more than one video input is enabled. Allows selected video input to be displayed.
DCLTR	Activates an option list allowing individual selection of which video input status settings are displayed.	a) NAME: (Video input label) b) ZOOM: (Current amount of image expansion) c) BRT: (Current brightness setting) d) CTRST: (Current contrast setting) e) SAT: (Current chroma saturation setting) f) HUE: (Current chroma hue setting)

V 3. IDU-680 Center Encoder Controls

Upon selecting MFD format menu when in the Video Input page, ❸ is a dedicated brightness control, and ❷ is a dedicated contrast control. Scroll to activate the **BRT** or **CTRST** menus.

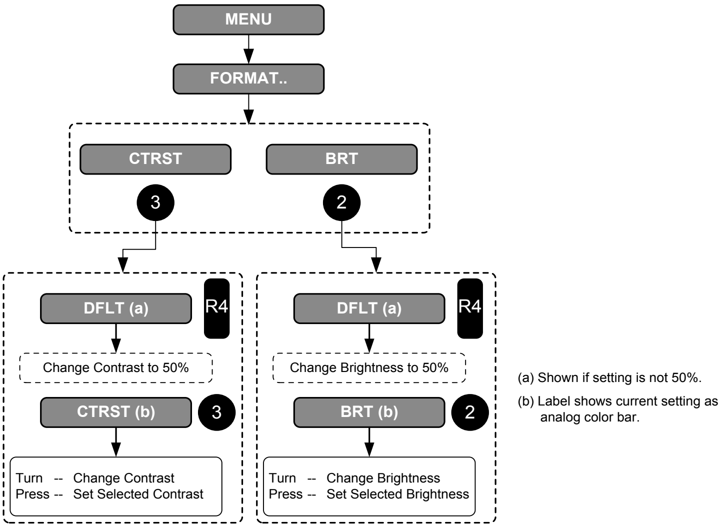

Figure V-4: IDU-680 Center Rotary Encoder Controls

Table V-2: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
AHRS 1 and 2 mode and slewing values	
Countdown Timer Start Time	
Countdown Timer Default Value	
Emergency and Minimum Fuel Settings	
Heading Bug	
VLOC OBS Settings	
Target Altitude Bug Setting	
Timer Starting Signal	
Traffic Filter Setting	
True North Mode	
UTC Offset	
Crosslink Synchronization Status	

Table V-2: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
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.	
MFD Selected Page	Independent between top and bottom 680 MFD areas. Note that this parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Independent between top and bottom 680 MFD areas. Note that map scale is transmitted onside to support weather radar range selection.
MFD Map Function Declutter Settings	Independent between top and bottom 680 MFD areas
MFD Video Page Settings	Independent between top and bottom 680 MFD areas with the exception of: • Selected Input • Brightness

Table V-2: Menu Synchronization

Menu Parameter	Notes
	• Contrast • Saturation • Hue (Note: the above are video hardware settings)

Table V-3: Top-Level Auto Pop-Up Function Descriptions

Note 1	Note 2	Precedence, Tile Legend, and Action
L2	**L6**	When showing Video Input Page with pan mode enabled, **UP** appears. Press to move up the section of the video image displayed in the full video image.
L3	**L7**	When showing Video Input Page with pan mode enabled, **DOWN** appears. Press to move down the section of the video image displayed in the full video image.
R2	**R6**	When showing Video Input Page with pan mode enabled, **LEFT** appears. Press to move left the section of the video image displayed in the full video image.
R3	**R7**	When showing the Video Input Page with pan mode enabled, **RIGHT** appears. Press to move the section of the video image displayed right in the full video image.

Note 1: Used when the function is tied to a page in the top area.

Note 2: Used when the function is tied to a page in the bottom area or tied to being “Transmit Enabled.”

V 4. MFD Page (PAGE) Menu

VIDEO: Shows the Video page.

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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 ground speed.

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 ±10° from the flight path marker or aircraft waterline, whichever is greater. The unusual attitude display appears when the aircraft pitch exceeds ± 30° or bank angle exceeds 65° (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 (°).

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 WSI or 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. Discretes 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.

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.

Hover Vector Display (Rotorcraft Only) – Display of hover drift in a rotorcraft installation when the helicopter is traveling less than 30 knots airspeed.

Inches of Mercury (inHg) – Unit of atmospheric pressure used in the United States. Named for the use of mercurial barometers which equate height of a column of mercury with air pressure.

Inhibit – Prevention of activity or occurrence. Examples are:

XFILL INHBT, TAWS INHBT, and TAS 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 navaids 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, GS MISCOMP, LOC MISCOMP, ATT MISCOMP, HDG MISCOMP, PLT MISCOMP, CPLT MISCOMP, GPS MISCOMP, IAS MISCOMP, RALT MISCOMP, and BARO MISCOMP.

NavData – Jeppesen's aeronautical database to navigate the global airspace system.

Navigation 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 ground speed 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.

Ownship – Principal eye-point; referring to icon of aircraft represented on display.

Pitch Limit Indicator – Appears when the aircraft (fixed wing only) 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 and 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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