Pilot Guide

GENESYS
AEROSYSTEMS

3D SYNTHETIC VISION EFIS

HIGHWAY-IN-THE-SKY NAVIGATION

GRAPHICAL FLIGHT MANAGEMENT SYSTEM

INTEGRATED AUDIO/RADIO MANAGEMENT

IDU-680 Version 8.0C Pilot Guide (Fixed Wing)

Pilot Operating Guide and Reference

Document 64-000093-080C

(Fixed Wing)

EFIS

Software Version 8.0C

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Section 1 Introduction

Revision Record

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	16. Revised reference for Active Flight plan. 3-107. 17. Revised reference for Clock and timers. 3-116. 18. Revised reference for Boundary circle symbol. 3-122. 19. Revised reference for Active flight plan. 3-123. 20. Revised reference for magnetic North. 3-124. 21. Added USR waypoint in Pan Mode. 3-124. 22. Revised reference for clock and timers. 3-131. 23. Changed IDU 680P to IDU-680 in two places 4-7. 24. Revised Note 5 to remove reference to rotorcraft. 4-11. 25. Added Note 22 as N/A for Fixed Wing Aircraft. 4-12. 26. Revised Waterline Symbol in Mode 1 as OK. 4-23. 27. Revised Waterline Symbol Mode 1 as OK. 4-25 and 4-27. 28. Revised INFO Menu for button location reference. 5-72. 29. OFF (R4) wording 5-83. 30. Changed IDU 680P to IDU-680 5-120. 31. Changed directions to reflect Scroll #1 Encoder. 7-27. 32. ILS Instrument approach instructions Press ACTV (L2) in bold. 7-30. 33. Press ACTV (L2) in bold 7-34. 34. Note: wording. 7-48. 35. Added “Aircraft altitude” as a bulleted item. 8-14 36. Removed Rotorcraft reference for example 9-9. 37. Complete new INDEX added Page 1–22.		

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1.1. Introduction

In the last two decades, aviation has become more and more complex; as a result, cockpit resources have followed the commercial carrier' 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 EFIS installed in this Airplane was conceived and designed as a "pilot-centered" system. While still highly automated, this type of system, common in other military tactical applications, presents the pilot with information necessary to make decisions about the flight and take the appropriate actions. A good example is the Highway-In-The-Sky (HITS). HITS allow 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, each pilot will fly with more precision, awareness, and confidence than ever thought possible.

1.2. EFIS /FMS description

Figure 1- 1: IDU-680 Input Identification

The IDU (Integrated Display Unit) is manufactured from machined, anodized aluminum and has 16 Keys 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.

There are four encoders along the bottom with the left encoder only controlling the backlighting intensity. This encoder will have a unique set of messages that are interpreted by the backlight controller for setting the backlight intensity.

The remaining three encoders going from right to left across the bottom of the bezel are designated Encoder 1, 2 and 3. References in Section 5 will refer to these as which encoder to push and or turn for desired outcomes. Between the two center Encoders on the bezel, a USB port with provisions for a slip indicator or blank housing act as a movable door. When this door is lifted, an optical switch will initiate the Ground Maintenance Mode necessary for gaining access to the maintenance program once a USB memory device (up to 4 GB) or keyboard is inserted.

The IDU bezel includes an ambient light sensor located on the front face to measure ambient light levels. This is used only to set backlight illumination levels. The Brightness control independently controls the panel lighting brightness and display lighting brightness. Panel lighting refers to the illumination of legends, knobs and keys (pressing and turning 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 can be controlled locally or remotely with a default state being with the local control.

1.3. Before You Fly Statement

Using the built in Demonstration Application, the EFIS can 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:

1) With power off, lift the USB Memory Flash Door. Insert a USB Flash Memory Storage Device in the IDU lower bezel.

Figure 1- 2: IDU-680 PFD and MFD

2) Power the system on and select the **RUN DEMONSTRATION / TRAINING APPLICATION** option using the Encoder #1 control knob (turn to scroll and push to enter).

1.4. Run Demonstrator / Training Application

The demonstrator program will automatically begin flying over Reno Nevada USA. The altitude will begin around 8,000’ MSL and may be changed with the use of the Menu and target altitude control. The airspeed will remain relatively constant but may be controlled through the use of 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 will have to be updated to match the area of the world navigation as anticipated.

All appropriate Navigation signals will be simulated, allowing for precision and non-precision instrument approaches found within the current Navigation database. All Obstructions will be presented on the displays which are found in the latest Obstruction database and all Caution, Warning and Advisory System aural and flags will be presented as appropriate during the simulated demonstration flights.

In addition to the Demonstrator program, a Windows based Simulator program is available to load on a personal computer for purposes of flying the Simulator exactly like the aircraft.

1.5. Windows Simulator

The Win Sim Simulator is an enhanced windows application entirely based on the EFIS code. It serves as a multi-purpose tool used for training pilots and provides features that can record and capture images. The Simulator has a bezel with simulated buttons and knobs that are responsive to mouse and external keyboard messages. Bezel graphics are derived from actual bezel design data and the Simulator presents an active display with 1:1 pixel correspondence to an actual IDU display. The audio output capability for Simulator is through Windows™ which matches with the audio functionality in the actual IDU. This Simulator simulates the functionalities of the IDU-680 which begins flight in Reno Nevada at approximately 7900’ MSL. There will be a Limits Editor and Simulators loaded at the time of the initial uploading of the Win Sim Simulator program. The PFD and MFD Simulators will appear as Desktop Icons on the computer.

Flight plans can be created, (on the MFD only) stored and activated in the exact same manner as done on the EFIS displays installed in the aircraft. This allows moving the Start point to anywhere in the world where loaded Nav data is present for practicing published procedures. All applicable Nav signals are simulated with Localizer signals found on VLOC1 and VOR signals found on VLOC2. Once the simulator start position has been moved from Reno Nevada, the aircraft will begin flying at approximately 7,900’ MSL intercepting the first leg at a 45° angle.

1.6. About this Guide

The operation of the Genesys Aerosystems Avionics EFIS and FMS is described in great detail and divided into 9 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 Warning, Caution and Advisory Table describing Annunciations for each category, where the Flag will appear and on which position of each display under identified conditions. *Use this section to gain better understanding of the system and learn terminology, abbreviations and what all the Caution, Advisory and Warnings mean. This is where a basic description of all control knob and button functions, coloring conventions are introduced with menu tile definitions…*

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 in alphabetical order.

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 680P displays with various Sensor failed conditions and resulting symbology. Examples of various configurations and display formats are used with specific tables showing affected functions affected.

Use this section for understanding 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 for understanding 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 will provide the basics necessary for flying a familiarization flight with this system. With a few simple steps, an Active Waypoint can be created and the view can 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 procedures, Published Instrument Approach Procedures and Standard Terminal Arrival Procedures. This section will describe how ATC clearances may often change and how the ACTIVE flight plan can quickly reflect these changes. Additionally, this section will define every example of the most popular of all published procedures with views of referenced Published procedures…

TERRAIN AWARENESS WARNING SYSTEM (Section 8)

This section contains a description of the TSO-C151b TAWS (All classes) functionality for this Fixed Wing aircraft with all configurations.

Use this section for understanding the TAWS 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 will define 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.

Use this section for understanding naming conventions used by the Navigation database provider, flight data recorded information format, 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 this index to look up key words and locate where at least one or more instances are used in the text.

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

genesys-support@genesys-aerosystems.com

or

genesys-support@s-tec.com

If you encounter problems with the operation of your Genesys Aerosystems EFIS, please complete and return the Service Difficulty Report in the Appendix section 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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List of Figures and Tables

2.1. Abbreviation and Acronyms

AC	Advisory Circular
AD	Airworthiness Directive
ADF	Automatic Direction Finder
A-D	Analog to Digital (converter)
ADAHRS	Air Data Attitude Heading Reference System
ADC	Air Data Computer
ADS-B	Automatic Dependent Surveillance-Broadcast
AFM	Aircraft Flight Manual
AFCS	Automatic Flight Control System
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AIRAC	Aeronautical Information Regulation and Control
AIRMET	Airmen's Meteorological Information
AMLCD	Active Matrix Liquid Crystal Display
ANSI	American National Standards Institute
APV	Approach with Vertical Guidance
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
CA	Course to Altitude
CD	Course to DME Distance

CDI	Course Deviation Indicator
CDTI	Cockpit Display of Traffic Information
CDR	Critical Design Review
CM	Configuration Management
COM	Communication
CPM	Company Project Manager
CPM	Computer Processor Module
CPU	Central Processing Unit
CR	Change Request
CR	Course to Radial Termination
CRC	Cyclic Redundancy Check
DA	Decision Altitude
D-A	Digital to Analog (converter)
DAICD	Digital Aeronautical Information CD
DAR	Designated Airworthiness Representative
DCN	Document Change Notice
DEM	Digital Elevation Model
DER	Designated Engineer Representative
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
EGPWS	Enhanced Ground Proximity Warning System
EIA	Electronics Industry Association
EICAS	Engine Indicating and Crew Alerting System
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
FA	Course from a Fix to Altitude
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FAWP	Final Approach Waypoint - same as FAF
FD	Course from a Fix to DME Distance
FDE	Fault Detection and Exclusion
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
FMEA	Fault Mode and Effects Analysis
FMS	Flight Management System
FPE	Floating Point Emulation

FPM	Feet per Minute
FSD	Full Scale Deflection
FTE	Flight Technical Error
FTP	Fictitious Threshold Point
GLS	GNSS Landing System
GND	Ground (potential)
GNSS	Global Navigation Satellite System
GPH	Gallons per Hour
GPI	Glidepath Intercept
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
HAL	Horizontal Alert Limit
HAT	Height Above Threshold
HFOM	Horizontal Figure of Merit
HPL	Horizontal Protection Level
HSI	Horizontal Situation Indicator
HUL	Horizontal Uncertainty Limit
IAP	Instrument Approach Procedure, also 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
IDU	Integrated Display Unit

IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
IO	Input/Output
IPV	Instrument Procedure with Vertical Guidance
ISR	Interrupt Service Routine
JAD	Jeppesen Aviation Database
JTAG	Joint Test Action Group (IEEE 1149.1 Standard)
K	Kilo=1000
KB	Kilobyte
KIAS	Knots Indicated Airspeed
KT	Knot - Nautical Mile per Hour
KTAS	Knots True Airspeed
LDA	Localizer-type Directional Aid
LED	Light Emitting Diode
LNAV	Lateral Navigation
LOC	Localizer
LOI	Loss of Integrity
LON	Loss of Navigation
LPV	Localizer with vertical performance
LRU	Line Replaceable Unit
LSB	Least Significant Bit or Byte
LTP	Landing Threshold Point
MAHP	Missed Approach Holding Point
MAHWP	Missed Approach Holding Waypoint - same as MAHP

MAP	Missed Approach Point
MASPS	Minimum Aviation System Performance Standard
MAWP	Missed Approach Waypoint - same as MAP
MB	Megabyte
MDA	Minimum Descent Altitude
MEMS	Micro Electro Mechanical System
MFD	Multifunction Display (an IDU with software for showing multiple display screens)
MM	Middle Marker
MOPS	Minimum Operational Performance Standard
MOT	Mark On Target
MSB	Most Significant Bit or Byte
MSL	Mean Sea Level
MSU	Magnetic Sensor Unit
MTBF	Mean Time Between Failures
NACO	National Aeronautical Charting Office
NAS	U.S. National Airspace System
NASA	National Aeronautics and Space Administration
NED	National Elevation Dataset
NIMA	National Imagery and Mapping Agency
ND	Navigation Display
NDB	Nondirectional Beacon
NI	Navigational Information
NM	Nautical Mile
NPA	Non-Precision Approach
OAT	Outside Air Temperature

OBS	Omnibearing Selector
OM	Outer Marker
OT	Other Traffic (Traffic Function)
PA	Proximate Advisory (Traffic Function)
PDA	Premature Descent Alert
PDR	Preliminary Design Review
PFD	Primary Flight Display (the display screen showing primary instrumentation -- can also refer to the primary IDU with software that only shows primary instrumentation)
PFDE	Predictive Fault Detection and Exclusion
PFI	Primary Flight Information
PIC	Peripheral Interface Controller
PLI	Pitch Limit Indicator
PN	Part Number
PRAIM	Predictive Receiver Autonomous Integrity Monitoring
PSAC	Plan for Software Aspects of Certification
PSCP	Project Specific Certification Plan
PSP	Partnership for Safety Plan
PTN	Problem Tracking Number
QA	Quality Assurance
QFE	Altimeter setting that provides height above reference point.
QM	Quality Management
QNE	Altimeter setting that provides pressure altitude readout
QNH	Altimeter setting that provides MSL altitude at a reporting point

RA	Resolution Advisory (Traffic Function)
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RBP	Remote Bug Panel
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
Rx	Receive
SA	Selective Availability
SAE	Society of Automotive Engineers
SAS	Software Accomplishment Summary
SBAS	Satellite Based Augmentation System
SCI	Software Configuration Index
SCMP	Software Configuration Management Plan
SCR	Software Conformity Review
SCS	Software Coding Standards
SDD	Software Design Document
SDP	Software Development Plan
SDS	Software Design Standards
SECI	Software Environment Configuration Index

SIGMET	Significant Meteorological Advisory
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
STAR	Standard Terminal Arrival Routes
STC	Supplemental Type Certificate
STP	Software Test Protocol
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
SYRD	System Requirements Document
TA	Traffic Advisory (Traffic Function)

TAFs	Terminal Aerodrome Forecasts
TAS	Traffic Advisory System
TAS	True Airspeed
TAWS	Terrain Awareness and Warning System
TCAD	Traffic Collision Alert Device
TCAS	Traffic Collision Alert System
TERPS	Terminal Instrument Procedures
TCH	Threshold Crossing Height
TD	Traffic Display
TFR	Temporary Flight Restriction
TIS	Traffic Information Service
TIS-B	Traffic information Service-Broadcast
TMS	Texas Instruments family of DSP processors
TQP	Tool Qualification Plan
TSO	Technical Standard Order
Tx	Transmit
UART	Universal Asynchronous Receiver-Transmitter
UIM	User Interface Module
USGS	United States Geological Survey
UTC	Universal Time Coordinated
VA	Heading to Altitude
VAL	Vertical Alert Limit
VD	Heading to DME Distance
VFOM	Vertical Figure of Merit
VFR	Visual Flight Rules

VHF	Very High Frequency
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Radio
VPL	Vertical Protection Level
VR	Heading to Radial Termination
VSI	Vertical Speed Indicator
VTF	Vectors to Final
VUL	Vertical Uncertainty Limit
WAAS	Wide Area Augmentation System
WGS84	World Geodetic System 1984

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 Displays and Multi-Function Displays. The Multi-Function Display can be configured to show a moving map, an HSI, terrain, traffic, datalink weather, radar, video or a dedicated EICAS (Engine Indicating and Crew Alerting System) displays.

At any given time, each system can 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.

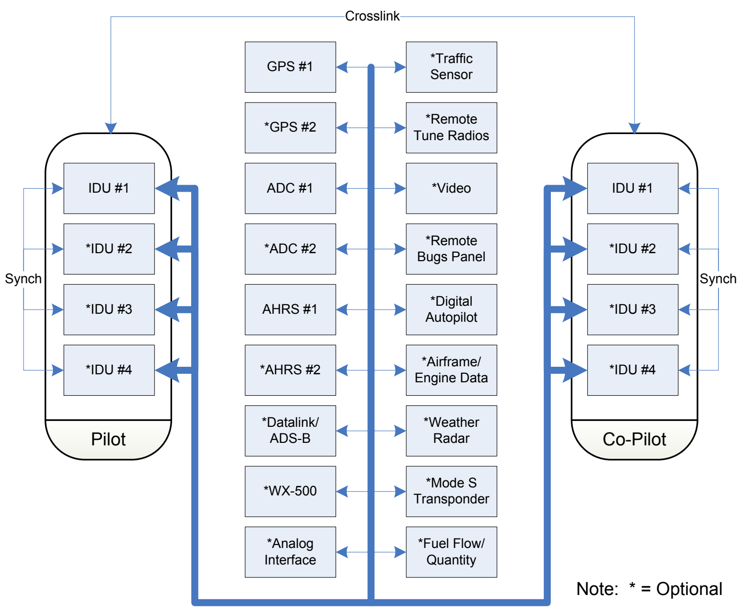


Figure 2-1: System Diagram

2.3. 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” that are mechanically attached to the CPU but have electrical isolation and redundancy. These modules may include:

- Integrated ADAHRS Sensor Module
- Integrated GPS/SBAS Sensor Module
- Serial Protocol Converters
- Video Format Converters

Data storage consists of up to 2 compact flash cards sufficiently sized to hold world terrain and navigational and obstruction databases. Because the receive ports of the IDU-680s are connected to the digital sensor modules in parallel, each IDU-680 is independent from all other IDU-680s. In an IFR installation, the software of the primary IDU-680 is configured so that only the primary screen Primary Flight Information (PFI) display top half plus Multi-Function display (MFD) bottom half can be displayed as seen on the next page.

Figure 2-2: Primary IDU-680 PFI on top half and ND on bottom half.

2.4. EICAS Display

The software of all other IDU-680s will be configured so that any screen display can be shown at any time. The only limitation to this rule is that 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. Shown below is an IDU 680 Multi-Function display with the Top Display area showing the EICAS and Bottom area configured to the MAP page.

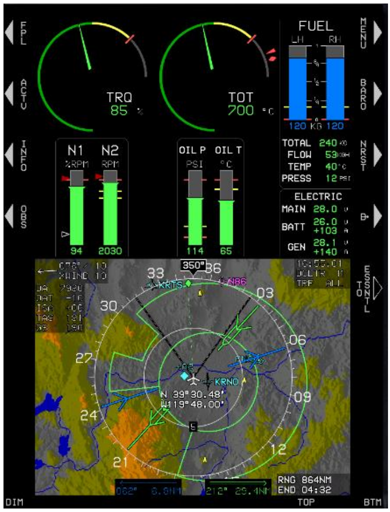


Figure 2-3: EICAS

2.5. PFD with EICAS

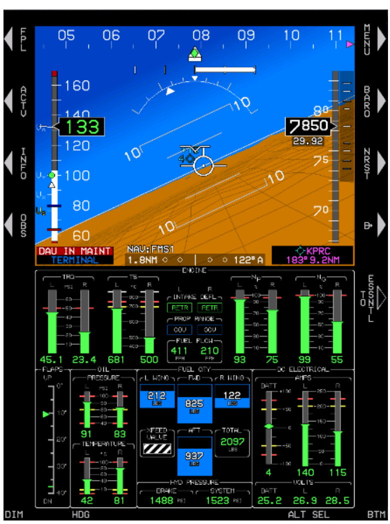


Figure 2-4: PFD with EICAS

2.6. HSI with MAP

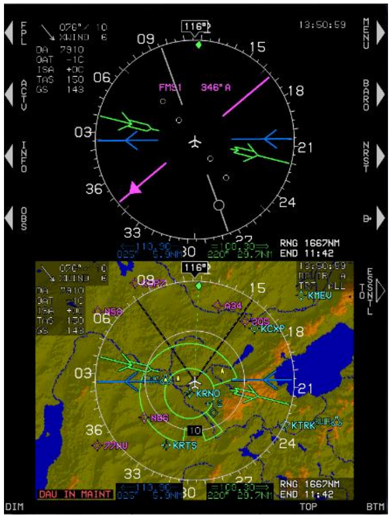


Figure 2-5: MFD with HSI and MAP

2.7. Color Conventions

The Genesys Aerosystems EFIS uses a consistent set of colors for displaying information on display. These colors are detailed as follows:

WHITE is 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).

CYAN is used for IFR navigation dataset items (airports with instrument approach procedures, VORs and Intersections).

MAGENTA is 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) and shades of gray when terrain is more than 2000 feet below the aircraft. The shade used is determined by the slope between adjacent terrain pixels in an increasing longitude direction.

GREEN is used 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 as shades of olive when within 2000 feet but below aircraft altitude. The shade used is determined by the slope between adjacent terrain pixels in an increasing longitude direction.

YELLOW is used to identify conditions that require immediate pilot awareness, and may require subsequent pilot action. Examples:

- Caution indications
- Altitude or heading alert
- Component failure indication
- Pitch limit indicator (low-speed awareness)
- Minimum altitude
- Airspeeds in yellow arc

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, and bodies of water on the moving map.

RED is used to indicate aircraft limitations, or conditions which require immediate pilot action. Examples:

- Warnings (airframe operation limits, terrain awareness)
- Pitch limit indicator (low speed awareness)
- Airspeeds in red arc.

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, i.e., airspeed, altitude and menu tiles on the PFD/MFD.

2.8. WARNING / CAUTION / Advisory System

The IDU has an integrated audio/visual warning system that monitors a wide variety of parameters and provides annunciations for conditions that demand pilot awareness. There are three categories of annunciations: **WARNINGS**, **CAUTIONS** and **ADVISORIES**. Warnings are displayed with red flags and an aural annunciation that repeats until the condition goes away or is acknowledged by the pilot. Cautions are displayed with yellow flags and a single aural annunciation. Advisories are displayed with blue flags and a single aural annunciation. Where time delay is referenced, it is the programmed delay in seconds prior to the annunciation appearing. The following table lists the annunciations that are provided by the IDU:

- **WARNINGS** Displayed with red flags and an aural annunciation that repeats until the condition goes away or is acknowledged by the pilot.
- **CAUTIONS** Displayed with yellow flags and a single aural annunciation.
- ADVISORIES Displayed with Black flags and blue letters with a single aural annunciation.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
ADC #1 Failure	Caution	ADC1 FAIL	Alert Tone	Only active in dual-ADC installation. Indicates no valid indicated airspeed, pressure alti-tude, or VSI received from ADC #1 for more than 1 second. No time delay.
ADC #2 Failure	Caution	ADC2 FAIL	Alert Tone	Only active in dual-ADC installation. Indicates no valid indicated airspeed, pressure alti-tude or VSI received from ADC #2 for more than 1 second. No time delay.
ADS-B Out Failure	Caution	ADS-B FAIL	Alert Tone	Enabled by ADS-B Out Fail Warning Limits setting. Mode-S Transponder indicates bad

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				ADS-B Out Status. 2 second time delay.
AHRS #1 Failure	Caution	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 time delay.
AHRS #2 Failure	Caution	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 time delay.
Radar Altimeter #1 Failure	Caution	RADALT1 FAIL	Alert Tone	Only active in dual-Radar

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				Altimeter installation. Indicates no radar altimeter reading received from Radar Altimeter #1 for more than 1 second. This annunciation will be displayed in Ground Mode also. Inhibited when Radar Altimeter value received from ARINC 429, except when SSM of Radar Altimeter message indicates Failure Warning. 2 second time delay.
Radar Altimeter #2 Failure	Caution	RADALT2 FAIL	Alert Tone	Only active in dual-Radar Altimeter in-

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				stallation. Indicates no radar altimeter reading received from Radar Altimeter #1 for more than 1 second. This annunciation will be displayed in Ground Mode also. Inhibited when Radar Altimeter value received from ARINC 429, except when SSM of Radar Altimeter message indicates Failure Warning. No time delay. Warning. 2 second time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
Power Supply Malfunction	Advisory	PLT1 PWR PLT2 PWR CPLT1 PWR CPLT2 PWR	Chime	Indicates one of the dual redundant power supplies within an IDU is not functioning correctly. Only active on the IDU-450s and IDU 680s. 1 minute time delay.
External Cooling Fan Fail	Caution	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 that the cooling fan is not rotating. 1 minute time delay.
Air Data Initializing	Advisory	ADC INIT	Chime	ADC not at full accuracy during warm-

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				up. No time delay.
Check Barometric Setting	Advisory	CHK BARO	Chime	Ascending through transition level: Altimeter not set to 29.92in. Hg or 1013mB. Descending through transition level: Altimeter set to 29.92in. Hg or 1013mB. Descent warning times out in 10 seconds. 2 second time delay. Disabled during QFE operation.
Minimum Altitude	Caution	--	"Minimums, Minimums"	Deviation from above to below minimum altitude bug. Causes minimum altitude readout

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				to turn yellow and flash. No time delay.
Selected Altitude Deviation	Caution	--	"Altitude, Altitude"	Deviation greater than 150' from selected altitude after capture. Altitude capture defined as being within 100' of altitude. 2 second time delay.
VNAV Altitude Deviation	Caution	--	"Altitude, Altitude"	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 being within 100' of altitude. 2

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				second time delay.
Heading Failure	Caution	NO HEADING	Alert Tone	No valid heading received from selected AHRS for more than 1 second. No time delay. Disabled if in MFD-only operation. Not shown if PFD heading scale is red-X'd (Red-X provides sufficient pilot cue).
Auxiliary Sensor	Caution	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. This message applies to the following

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				optional sensors: RS-232 TAS System ADS-B System WSI Datalink System WX-500 Lightning System Analog In-terface System Weather Radar Weather Radar Control Panel
Count-down Timer Chime	Advisory	--	Chime	Sounds chime when countdown timer reaches 00:00:00. No time delay.
Check Gear	Caution	CHECK GEAR	"Check Gear,	Activated if RG flag is set to 1, aircraft is

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
			Check Gear”	below 500’ AGL (air-planes), air-craft is de-scending, aircraft is below V_{FE}, and any landing gear is not down. 2 second time delay.
Check Range	Caution	CHECK RANGE	“Check Range, Check Range”	Less than 30 minutes buffer (at current groundspeed) between calculated range and distance to: 1) The last waypoint if it is active; or 2) The air-port if on a missed approach; or 3) Along-route dis-tance to destina-tion.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				Not activated in climbing flight. Not activated if below 60 knots groundspeed. 5 minute time delay.
Decision Height	Caution	--	“Deci-sion Height”	Deviation from above to below decision height bug. Causes decision height readout to turn yellow and flash. No time delay.
Free Mode	Advisory	AHRS DG	Chime	Activated DG mode if avail-able.
Flight Path Marker In-hibit	Advisory	FPM INHBT	Chime	Flight Path Marker inhibit function acti-vated through use of mo-mentary dis-crete input.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				No time delay.
GPS/SBAS Dead Reckoning Mode	Caution	DR ##.##	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.
GPS/SBAS LNAV Approach Mode	Advisory	LNAV APPR	Chime	GPS/SBAS in LNAV Approach Mode. No time delay.
GPS/SBAS LNAV/VNAV Approach Mode	Advisory	LNV/VNV APPR	Chime	GPS/SBAS in LNAV/VNAV Approach Mode. No time delay.
GPS/SBAS LP Approach Mode	Advisory	LP APPR	Chime	GPS/SBAS in LP Approach Mode. No time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
GPS/SBAS LPV Ap-proach Mode	Advisory	LPV APPR	Chime	GPS/SBAS in LPV Ap-proach Mode. No time delay.
GPS/ SBAS Failure	Caution	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.
GPS/ SBAS Loss of Integrity	Caution	GPS LOI	Alert Tone	GPS/SBAS loss of integ-rity caution. No time delay.
GPS/ SBAS Loss of Navigation	Caution	GPS LON	Alert Tone	GPS/SBAS loss of navi-gation cau-tion. No time delay.
Loss of Vertical Navigation	Caution	VERT LON	Alert Tone	Loss of verti-cal navigation caution. No time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
Automatic Waypoint Sequencing Suspended	Advisory	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.
GPS/ SBAS Terminal Mode	Advisory	TERMINAL	Chime	GPS/SBAS in Terminal mode. No time delay.
GPS/ SBAS VFR Approach Mode	Advisory	VFR APPR	Chime	GPS/SBAS in VFR approach mode. No time delay.
GPS/ SBAS	Advisory	VECTORS	Chime	GPS/SBAS in Vectors to

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
Vectors to Final IFR Approach Mode				Final Approach mode prior to sequencing FAWP. No time delay.
GPS/ SBAS Actual Navigation Performance	Advisory	ANP: ##.##	Chime	GPS/SBAS Actual Navigation Performance based upon current GPS/SBAS HPL.
GPS/ SBAS Manual Required Navigation Performance	Advisory	RNP: ##.##M	Chime	GPS/SBAS Manual Required Navigation Performance as set by user.
GPS/ SBAS Automatic Required Navigation Performance	Advisory	RNP: ##.##A	Chime	GPS/SBAS Automatic Required Navigation Performance as acquired from navigation database
GPS/SBAS #1 Failure	Caution	GPS1 FAIL	Alert Tone	Only active in dual-GPS/SBAS installation.

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				Indicates no valid message received from GPS/SBAS #1 for more than 5 seconds. No time delay.
GPS/SBAS #2 Failure	Caution	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.
IDU Overtemp	Caution	PLT1 OVRTMP PLT2 OVRTMP CPLT1 OVRTMP CPLT2 OVRTMP	Alert Tone	IDU core temperature greater than 95°C. 2 second time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
Level-off	Advisory	--	Altitude Alert Tone	Tone given when within the greater of 1000' or 50% of VSI from uncaptured selected or VNAV way-point altitude. Inhibited in approach procedures. No time delay.
Low Fuel Caution	Caution	LOW FUEL	"Fuel Low, Fuel Low"	A Low Fuel Warning is not active and one of the following conditions is true: 1) One of the Low Fuel Caution discrete inputs is active 2) One of the sensed fuel tank quantitie s is below its low fuel

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				caution threshold 3) Total aircraft fuel is below the pilot-set minimum fuel threshold. 1 minute time delay.
Low Fuel Warning	Warning	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 quantitie s is below its low fuel warning threshold

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				3) Total aircraft fuel is below the pilot-set emergency fuel threshold. 1 minute time delay.
Fuel Split Caution	Caution	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. Issues a caution if the difference exceeds the Fuel Split Caution Threshold. Only performed if the Fuel Split Caution Threshold is

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				non-zero and both left and right wing tank fuel is monitored and valid. 1 minute time delay.
Fuel Totalizer Mismatch Caution	Caution	TOTALZR QTY	Alert Tone	Compares the volume of sensed fuel to the fuel totalizer calculation. Issues a caution if the difference exceeds the Totalizer Mismatch Caution Threshold. Only performed if: 1) The Totalizer Mismatch Caution Threshold is non-zero; 2) The Fuel Totalizer is enabled;

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				3) The Unmonitored Fuel Flag is false; 4) The fuel totalizer has a valid value; and 5) The fuel levels are valid. 1 minute time delay.
Altitude Miscompare	Caution	ALT MISCOMP	Alert Tone	Only active in dual-ADC installation with neither ADC in failure condition. Indicates that pressure altitude difference between ADC's is beyond limits. 10 second time delay. Inhibit for 10 minutes after startup.

Table 2-1: Warnings, Cautions, and Advisories

Annunci-ation	Cat.	Flag	Aural Annun.	Condition
Attitude Miscom-pare	Caution	ATT MISCOMP	Alert Tone	Only active in dual-AHRS in-stallation with neither AHRS in failure con-dition. Indi-cates that pitch or roll difference between AHRS is beyond limits (6°). 10 second time delay. Inhibit for 10 minutes after startup.
Barometric Setting Miscom-pare	Advisory	BARO MISCOMP	Chime	Only active in dual-System (Pilot and Co-pilot) installation. Indicates mismatch of altimeter set-tings or altimeter modes between sys-tems. 10 second time delay. Baro settings are synchronized

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				when GPI #75 is enabled.
GPS/SBAS Miscom-pare	Caution	GPS MISCOMP	Alert Tone	Only active in dual-GPS/SBAS installation with neither GPS/SBAS in failure condi-tion. Indicates that position, track or groundspeed difference between GPS/SBAS units is beyond limits. 10 second time delay. Limits are as follows: Position: Enroute Mode 4NM Terminal Mode 2NM

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				Departure Mode .6NM IFR Approach Mode .6NM VFR Approach Mode .6NM Track: If groundspeed is greater than 30 kts, miscompare if difference is more than 4°. Groundspeed: 10 kts.
Glideslope Miscompare	Caution	GS MISCOMP	Alert Tone	Only active when two valid glideslopes are being received. Indicates that at least one glideslope is receiving a signal within 1 dot of center and difference

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				between glideslope signals is beyond limits (0.25 Dots). 10 second time delay.
Heading Miscompare	Caution	HDG MISCOMP	Alert Tone	Only active in dual-AHRS installation with neither AHRS in failure condition. Indicates that heading difference between AHRS is beyond limits (6°). 1 minute time delay. Inhibit for 10 minutes after startup.
Airspeed Miscompare	Caution	IAS MISCOMP	Alert Tone	Only active in dual-ADC installation with neither ADC in failure condition. Indicates that in-

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				dicated airspeed difference between ADC's is beyond limits. 10 second time delay. Inhibit for 10 minutes after startup. Limits are as follows: >= 100KIAS Δ4KIAS < 100KIAS Δ10KIAS
Localizer Miscompare	Caution	LOC MISCOMP	Alert Tone	Only active when two valid localizers are being received. Indicates that at least one localizer is receiving a signal within 1 dot of center and difference between localizer signals is beyond limits (0.25 Dots).

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				10 second time delay.
Radar Altitude Miscompare	Caution	RALT MISCOMP	Alert Tone	Only active in dual-radar altimeter installation with neither radar altimeter in failure condition. Indicates that radar altitude difference between radar altimeters is beyond limits. 10 second time delay. Limits are as follows: >= 500’AGL Δ14% 100 – 500’AGL Δ10% < 100’AGL Δ10’
IDU Miscompare	Caution	PLT MISCOMP	Alert Tone	Only active when fresh intra-system

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
		CPLT MISCOMP		monitor messages are being received. Indicates that a critical parameter being used by another display exceeds the miscompare thresholds when compared to the monitoring display. Compares the following critical parameters: • Attitude (Pitch and Roll) (use Attitude Miscompare logic) • Heading (use Heading Miscompare logic)

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				• Pressure Altitude (use Altitude Miscompare logic) • Indicated Airspeed (use Air-speed Miscom-pare logic) • Localizer (both in-puts) (use Lo-calizer Miscom-pare logic) • Glideslope (both inputs) (use Glideslope Mis-compare logic) • Radar Altitude (use

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				Radar Altitude Miscompare logic) • Latitude (Use GPS/SBAS Mis-compare logic) • Longi-tude (Use GPS/SBAS Mis-compare logic) • Track (Use GPS/SBAS Mis-compare logic) • Ground-speed (Use GPS/SBAS Mis-compare logic)

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				One second time delay.
Check IDU#	Caution	CHECK IDU#	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 that either: 1) the screen counter value has not changed in the last 1 second ± 0.1 seconds; or 2) the intra-system monitor message is not fresh

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				(i.e., no message received for longer than 1 second ± 0.1 second). The "#" parameter indicates which IDU is failing the check, either IDU1, IDU2, IDU3, or IDU4. No time delay.
Message Space Exceeded	Advisory	MORE-PRS MENU	None	Number of active messages exceeds 11. This advisory appears to guide the pilot in accessing the EXPAND CAS menu. No time delay.
TAWS FLTA Function	Caution	NO TAWS	Alert Tone	Indicates that aircraft is currently beyond

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
Inoperative				extent of terrain database or a failure condition exists that prevents the TAWS FLTA function from operating. Half second time delay.
OAT Sensor Failed	Caution	OAT SENSOR OAT1 SENSOR OAT2 SENSOR	Alert Tone	Indicates that OAT sensor has failed. Indicates that OAT sensor has failed. "**OAT SENSOR**" applicable to single ADC installation. "**OAT# SENSOR**" applicable to dual ADC installation. Indicates that OAT indication is invalid but other air data parameters are normal (i.e., air data is not Red-X'd).

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				Half second time delay.
Over-speed	Warning	OVER-SPEED	"Over-speed, Over-speed"	Indicated air-speed exceeds redline (V_{NE}/V_{MO}/M_{MO} as appropriate). Not used for rotorcraft due to possible confusion with rotor speed alarms. No time delay.
Parallel Offset	Advisory	PTK = ##	Chime	GPS/SBAS Parallel Offset path advisory. ## is nautical miles left ("L") or right ("R") of main path. No time delay.
True North Mode	Advisory	TRUE NORTH	Chime	True North mode input discrete is asserted and system is operating in True North mode. No time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
Radar Al-timeter	Caution	RADALT FAIL	Alert Tone	Only active in single-Radar Altimeter in-stallation. For analog radar altimeter, indicates that we are below 2000'AGL in Air Mode without a valid radar altimeter reading. For ARINC 429 radar altime-ter, indicates that an SSM of Failure Warning is being trans-mitted. 2 second time delay.
Same ADC Source	Caution	SAME ADC	Alert Tone	Only active in dual-System (Pilot and Co-pilot), dual-ADC installa-tion with good inter-System communica-tions and

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				neither ADC in failure condition. Indicates that both systems are operating from same ADC source. No time delay.
Same AHRS Source	Caution	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 that both Systems are operating from same AHRS source. No time delay.
Same EICAS Source	Caution	SAME EICAS	Alert Tone	Only active in dual-System (Pilot and Co-

Table 2-1: Warnings, Cautions, and Advisories

Annunci-ation	Cat.	Flag	Aural Annun.	Condition
				pilot), installation with good inter-System communica-tions. Indi-cates that both Systems are operating from the same EICAS data source for labels where dual sources are setup in the EICAS configuration file. No time delay.
Same GPS/SBAS Source	Caution	SAME GPS	Alert Tone	Only active in dual-System (Pilot and Co-pilot), dual-GPS/SBAS installation with good in-ter-System communica-tions and neither GPS/SBAS in failure condition. Indicates that

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				both Sys-tems are op-erating from same GPS/SBAS source. No time delay.
Same NAV Source	Caution	SAME NAV	Alert Tone	Only active in dual-System (Pilot and Co-pilot) with good inter-System com-munications. Indicates that 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 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
Same Radar Altimeter Source	Caution	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 that both Systems are operating from same radar altimeter source. No time delay.
SCC Card Failed	Caution	PLT1 SCC PLT2 SCC PLT3 SCC PLT4 SCC CPLT1 SCC	Alert Tone	Indicates that SCC card (Personality Module) could not be read upon power-up. This means that limits internal to the IDU are being used

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
		CPLT2 SCC CPLT3 SCC CPLT4 SCC		by the System. Only active on the ground.
Stall	Warning	STALL	"STALL STALL"	Activated above 100' AGL if indicated airspeed is below the higher of V_{S1} or V_{S1} corrected for G-load + 5 KIAS. Deactivated if stall-warning flag is set to 0. No time delay.
TAWS FLTA Caution	Caution	TERRAIN	"Caution, Terrain, Caution, Terrain"	Terrain cell within TAWS FLTA caution envelope. Half second time delay.
TAWS FLTA Warning	Warning	PULL UP	"Terrain, Terrain, Pull Up, Pull Up"	Terrain cell within TAWS FLTA warning envelope.

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				Half second time delay.
GPWS Mode 1 Caution	Caution	SINK RATE	"Sink Rate, Sink Rate"	Within GPWS Mode 1 caution envelope. Half second time delay.
GPWS Mode 1 Warning	Warning	PULL UP	"Pull Up, Pull Up"	Within GPWS Mode 1 warning envelope. Half second time delay.
GPWS Mode 2 Caution	Caution	TERRAIN	"Caution, Terrain, Caution, Terrain"	Within GPWS Mode 2 caution envelope. Half second time delay.
GPWS Mode 2 Warning	Warning	PULL UP	"Terrain, Terrain, Pull Up, Pull Up"	Within GPWS Mode 2 warning envelope. Half second time delay.
GPWS Mode 3	Caution	TOO LOW	"Too Low Terrain, Too Low Terrain"	Within GPWS Mode 3 envelope. Half second time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
GPWS Mode 4-1	Caution	TOO LOW	“Too Low Terrain, Too Low Terrain”	Within GPWS Mode 4 “Too Low Terrain” envelope. Half second time delay.
GPWS Mode 4-2	Caution	TOO LOW	“Too Low Gear, Too Low Gear”	Within GPWS Mode 4 “Too Low Gear” en-velope. Half second time delay.
GPWS Mode 4-3	Caution	TOO LOW	“Too Low Flaps, Too Low Flaps ”	Within GPWS Mode 4 “Too Low Flaps” envelope. Half second time delay.
GPWS Mode 5 Caution	Caution	GLIDE SLOPE	“Glide Slope, Glide Slope ”	Within GPWS Mode 5 caution envelope. Half second time delay.
GPWS Mode 5 Warning	Warning	GLIDE SLOPE	“Glide Slope, Glide Slope ”	Within GPWS Mode 5 warning envelope. Half second time delay.

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
GPWS Mode 6	Advisory	--	"Five Hundred"	Descending through 500' AGL advisory. Armed upon climbing through dead-band value above 500' AGL. Half second time delay.
Obstruction Caution	Caution	OBSTRUCTION	"Caution, Obstruction, Caution, Obstruction"	Obstruction within TAWS FLTA caution envelope. Half second time delay.
Obstruction Warning	Warning	OBSTRUCTION	"Warning, Obstruction, Warning, Obstruction"	Obstruction within TAWS FLTA warning envelope. Half second time delay.
TAWS PDA	Caution	TOO LOW	"Too Low Terrain, Too	Within TAWS PDA envelope. Half

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
			Low Terrain”	second time delay.
TAWS Inhibit	Advisory	TAWS INHBT	Chime	TAWS inhibited through use of discrete input. No time delay.
TAWS FLTA Automatic Inhibit (Normal Operation)	Advisory	FLTA INHBT	Chime	Shown when the FLTA function is automatically inhibited during normal operation. The “NO TAWS” caution and “TAWS INHBT” advisory have priority over this message. No time delay.
TAWS Glideslope Cancel	Advisory	TAWS GS CNX	Chime	TAWS glideslope cancel (GPWS Mode 5) activated through use of discrete input. No

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				time delay. Note: GS Cancel an-nunciation was not being inhibited for Class B and C TAWS. The GS Cancel annunciation feature is for class A TAWS only.
Traffic Au-ral Inhibit	Advisory	TAS INHBT	Chime	TAS aural in-hibited through acti-vation of TCAS/TAS Audio Inhibit discrete input. No time delay.
Traffic Caution	Caution	TRAFFIC	“Traffic, Traffic”	Traffic Advi-sory. Not given if own aircraft below 400’ AGL. Not given if target is below 200’AGL (ground tar-get). Audio not

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				generated with TCAS-II system. No time delay.
Traffic Warning	Warning	TRAFFIC	"Traffic, Traffic"	Resolution Advisory. Not given if own aircraft below 400' AGL. Not given if target is below 200'AGL (ground target). Audio not generated with TCAS-II system. No time delay.
Crossfill Armed	Advisory	XFILL ARM	Chime	Only active in dual-System (Pilot and Co-pilot) with good Inter-System communications and crossfill not inhibited. Indicates that Systems are not synchronized and synchronization function

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				is available. No time delay.
Crossfill Failed	Caution	XFILL FAIL	Alert Tone	Only active in dual-System (Pilot and Co-pilot). Indicates lack of inter-System communications. 2 second time delay. Inhibit for 30 seconds after startup.
Crossfill Inhibited	Advisory	XFILL INHBT	Chime	Only active in dual-System (Pilot and Co-pilot) with good Inter-System communications. Indicates that crossfill is manually inhibited through use of discrete input. No time delay.
TCAS Failed	Caution	TCAS FAIL	Alert Tone	Only active with ARINC735A-

Table 2-1: Warnings, Cautions, and Advisories

Annunciation	Cat.	Flag	Aural Annun.	Condition
				1 TCAS-II, TCAS-I or TAS system. Indicates lack of communications with system or failure indication from system. No time delay.
TCAS Standby	Advisory	TCAS STBY	Chime	Only active with TCAS-II system. Indicates that system is either: (1) in standby; or (2) executing functional test in flight. No time delay.
TCAS TA Only Mode	Advisory	TA ONLY	Chime	Only active with TCAS-II system. Indicates that TCAS-II system is unable to display resolution advisories.

Table 2-1: Warnings, Cautions, and Advisories				
Annunciation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				No time delay.
TCAS Test Mode	Advisory	TCAS TEST	Chime	Only active with TCAS-II system. Indicates that system is in functional test on ground. No time delay.
VNAV Available	Advisory	VNAV AVAIL	Chime	Only active with Intellif-light 1950. Indicates that VNAV guidance is available but not currently in use by the autopilot. Pressing the “VNV” button on the Mode Control Panel will engage VNAV mode.
Autopilot Disconnect	Advisory	--	“Autopilot Disconnect”	Only active with Intellif-light 1950. Aural message given when the autopilot servos

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				disengage for any reason.
Autopilot Failure	Advisory	--	"Auto-pilot Failure"	Only active with Intelliflight 1950. Aural message given when an autopilot failure is detected.
Trim in Motion Down	Caution	TRIM MOTION▼	"Trim in Motion"	Only active with Intelliflight 1950. Pitch trim running for more than a preset amount of time in the DOWN direction. The amount of time is part of the aircraft limits.
Trim in Motion Up	Caution	TRIM MOTION▲	"Trim in Motion"	Only active with Intelliflight 1950. Pitch trim running for more than a preset amount of

Table 2-1: Warnings, Cautions, and Advisories				
Annunci-ation	**Cat.**	**Flag**	**Aural Annun.**	**Condition**
				time in the UP direction. The amount of time is part of the aircraft limits.
Check Trim Down	Caution	CHECK TRIM▼	“Check Pitch Trim”	Only active with Intellif-light 1950. Pitch is miss-trimmed for more than 3 continuous seconds (i.e., trim is not re-sponding). DOWN trim is needed.
Check Trim Up	Caution	CHECK TRIM▲	“Check Pitch Trim”	Only active with Intellif-light 1950. Pitch is miss-trimmed for more than 3 continuous seconds (i.e., trim is not re-sponding). UP trim is needed.

The volume of aural annunciations are adjusted according to severity as follows:

WARNINGS	= Full Volume set into aircraft limits
CAUTIONS	= 80% of volume set into aircraft limits
ADVISORIES	= 60% of volume set into aircraft limits

Active aural annunciation will be immediately muted by pressing the audio mute switch.

Flags will be visually prioritized so that active warning flags are displayed above active caution flags, which are displayed above active advisory flags. Within categories, active flags will be stacked in chronological order so that the most recent annunciation appears on top. Warning flags will flash at 2Hz until acknowledged by pressing the audio mute switch. Caution flags will flash at 1 Hz until acknowledged by pressing the audio mute switch. Only the highest priority (in criticality and recency), unacknowledged aural annunciation will be played at any given time. In addition, to further minimize cockpit confusion, certain of the above annunciations are grouped and prioritized so that only one annunciation is active. Annunciations prioritized in this manner will be as follows (higher in list = higher priority):

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

In addition, flags will be decluttered from all IDUs which are not “transmit enabled”. Flags will only appear on these IDUs if they are IDU-specific (i.e., **IDU MISCOMP, CHECK IDU** #, **EFIS COOL**, **IDU POWER**, or **SCC FAIL**).

Flags and custom CAS messages will be logged in non-volatile memory at 1Hz in ASCII, comma delimited format. Active logging will be to a file named “caslog00.csv” (note that because of the *.csv file extension, this file can be directly opened by Microsoft Excel and similar spreadsheet software). In addition, data from the previous four flights will be kept in files “caslog01.csv” through “caslog04.csv.” Upon system start, the existing “caslog00.csv” through "caslog03.csv" files will be renamed "caslog01.csv" through "caslog04.csv" and "caslog00.csv" will be 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 will be logged. Only custom CAS messages with valid "CAS Log File Text" parameters (i.e., not an empty string) will be 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 will be written as follows:

Table 2-3: Log File Values

Category	**Value**
NORMAL	0
ADVISORY	1
CAUTION	2
WARNING	3

2.9. Database and Software Updates

Navigation and Obstruction database

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. This will expose the USB port.

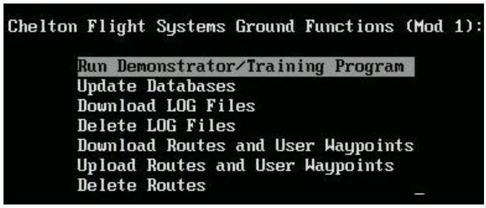


Figure 2-6: Ground Maintenance page

2.9.1. 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

The EFIS Software and Terrain Database are unscheduled and or on-condition and covered under Service Bulletin.

The Jeppesen Navigation and Obstruction database can be accessed through www.jeppesen.com or 1-(800)-621-5377 or (303) 799-0909 to place the order for the correct database.

There are three types of navigation databases that can 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 Key card.

Note:

Maximum USB memory Key card is 4GB.

Caution:

Failure to update the EFIS with the correct Nav database will cause the IDU to remain in continual reboot mode and will not allow any display page to appear.

Caution:

Always install a valid USB Memory Device in the IDU prior to activating any Ground Maintenance Function. Operation of the Ground Maintenance Functions 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. Not all countries have obstruction databases available.

Once the navdata database (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. Turning power on will gain access to the GMF page. Scroll to highlight "**Update Databases"** and push the #1 encoder to enter. Once each database is loaded, the user will be prompted to press any key to continue to complete the process. Once both databases have successfully been uploaded, power the IDU down and remove the USB memory device and lower the USB door. Repeat this process for each IDU installed in the aircraft.

In addition to the Demonstrator/Training Program, a Windows based simulator program is available to load on a personal computer for purposes of flying the simulator exactly like the aircraft.

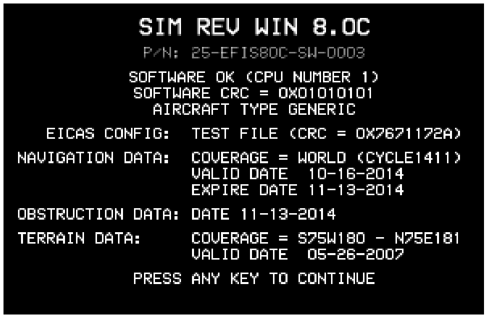


Figure 2-7: IDU 680 Start up screen

Once each IDU has been updated, Power up the entire EFIS system in normal flight mode and verify that 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.

The data itself is verified by a Cyclic Redundancy Check (CRC) self-test at every step of the process, thereby ensuring that the data installed into the system has not been corrupted at any point during the process.

The IDU will provide 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 en route and terminal area charts;
4) All airways shown on en route charts, including all waypoints, intersections and associated RNP values (if applicable). Airways will be retrievable as a group of waypoints (so 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 will be retrievable as a procedure (so that 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. The LNAV approach procedure 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, will be retrievable as a procedure (so that 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 will be 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 will result 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 will be uniquely identified as such to provide proper approach mode operation.

2.9.2. Terrain Database Update

The IDU 680P contains the entire World Terrain Database and is updated on an as-needed basis. Terrain database updates are performed as required and will be updated as described in a Service Bulletin.

2.10. Run Demonstrator/Training Program

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

2.11. IDU Initialization

The hardware, including file system, IO, and graphics, will be initialized. Immediately after graphics initialization, a logo screen with the text "**INITIALIZING**" will be displayed. The logo screen includes the Genesys Aerosystems logo, the software version number and the software part number. The software version number delineates: (1) major revision number (i.e., "8.0"); and (2) minor revision letter (i.e., "A"). The software version number and software part number will be shown as follows:

Version Number	**Part Number**
Rev 8.0C	25-EFIS80C-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 then read aircraft configuration from its personality module and, in the this case of a multi-screen installation with a #1 IDU, will transmit 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 will save the transmitted configurations to flash drive storage.

Aircraft parameters (latitude, longitude, altitude) as they existed prior to the last system shutdown will be read to initialize the system. This is done to get 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 will re-initialize to default values. Otherwise, aircraft settings as they existed prior to the last system shutdown will be used to initialize the system with the exception of the following default values:

1) Active flight plan structure and associated values are cleared.
2) Timers are turned off.
3) Minimum altitude setting is turned off.
4) FMS OBS setting is set to automatic.
5) VOR / LOC 1 OBS setting is set to 360°.
6) VOR / LOC 2 OBS setting is set to 360°.
7) Parallel offset is set to 0 NM.
8) Airspeed bug is turned off.
9) Target altitude bug is turned off.
10) Vertical speed bug is turned off.
11) HSI navigation source is set to FMS.
12) Heading bug is set to 360º (Intelliflight 1950 enabled) or turned off and Intelliflight 1950 disabled)
13) Datalink and map panning modes are set to off.
14) PFD zoom mode is set to off.
15) Manual RNP is set to off.
16) PFD skyway is set to on.
17) V-speeds are cleared.
18) RDR-2000/2100 scale is initialized to 80NM
19) Crosslink is initialized to on.
20) G-Force telltales are automatically reset unless they exceed G-Limits.

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

If booting on the ground, the following actions will happen:

1) A logo screen with the words “**TESTING**” will be displayed.

2) CRC-32 values for application executable, limitations files, navdata files, obstruction files, and terrain header files will be checked.

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

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

5) The application will search for the nearest airport and activate its runways for display.

6) The application will autoset the altimeter based upon the terrain elevation at the startup point.

7) A logo screen displaying database versions and validity dates will be displayed with the message "**PRESS ANY KEY TO CONTINUE**."

8) If all critical sensors (GPS, ADC and AHRS) are in normal condition, the display screens will be shown immediately. The #1 IDU will initialize to the PFD screen. Other IDUs will initialize to the MFD.

9) If any critical sensor is not in normal condition, a logo screen with a 2 minute countdown timer will be shown.

10) The display screen will be shown at the earliest of:

    a) When 2 minutes has elapsed;

    b) When the user presses any key to escape the startup countdown;

    c) When all critical sensors are in normal condition. The #1 IDU will initialize to the PFD screen Normal Mode (PFD on top, MFD on bottom).

    d) Other IDUs: If EICAS is configured, CPU#2 initializes to EICAS on top and MFD on bottom. All other CPU's initialize to MFD on top and MFD on bottom.

11) On the CPU#0 or #2 with fuel totalizer functions enabled, the fuel set menu will be activated to remind the user to set the fuel totalizer quantity

If booting in the air, the following actions will happen:

1) A logo screen with the words “**QUICK START**” will be displayed.

2) The bit result file created during the last ground boot will be checked. If the bit result file indicates a failure, the program will exit with an error message. If the bit result file indicates passage, the program will continue.

3) The display screens will initialize as follows:

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

   b) Other CPU’s: If EICAS is configured, CPU#2 initializes to Primary EICAS on top and MFD on bottom. If EICAS is not configured, CPU #2 initializes to MFD on top and MFD on bottom. All other CPU’s initialize to MFD on top and MFD on bottom.

2.11.1. Application software Air Mode and Ground Mode

Numerous symbology elements change behavior depending upon whether the aircraft is on the ground or in flight. This is referred to as Air Mode and Ground Mode. Note that this determination is separate from the system initialization modes.

This parameter will be 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, then Ground Mode is set when indicated airspeed is 40 knots and AGL altitude is less than 75 feet.

b) If airspeed is invalid but AGL altitude is valid, then 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

Table of Contents

List of Figures and Tables

Introduction

In an IFR installation, the software of the primary IDU-680 will be configured so that only the primary screen (Primary Flight Information display top half plus Multifunction Display bottom half) can be displayed. The software of all other IDU-680 displays will be configured so that any screen display can be shown at any time. The only limitation to this rule is that where IDU-680 displays are configured as a primary display of engine information; at least one of the Multi-Function display areas must show the engine display.

The following sections detail the symbology used on the PFD IDU-680 in Normal and Essential modes and the MFD IDU-680 in Normal and Essential modes. Not all combinations of possible views are represented.

Application Software Air Mode and Ground Mode

Numerous symbology elements change behavior depending upon whether the aircraft is on the ground or in flight. This is referred to as Air Mode and Ground Mode. Note that this determination is separate from the system initialization modes described in section 2. 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, then Ground Mode is set when indicated airspeed is less than 40 knots AND AGL altitude is less than 75 feet.

   b) If airspeed is invalid but AGL altitude is valid, then Ground Mode is set when AGL altitude is less than 75 feet.

   c) Under any other circumstance, Air Mode is set by default.

3.1. IDU 680 PFD Display (Normal Mode)

Figure 3-1: PFD in Normal Mode

3.1.1. IDU 680 PFD Display (Essential Mode)

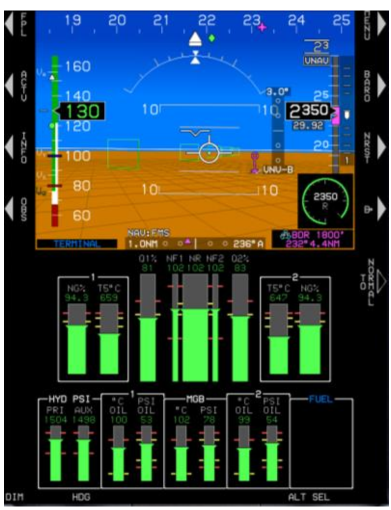


Figure 3-2: PFD in Essential Mode with EICAS configured

3.1.2. IDU 680 PFD Display (Basic Mode)

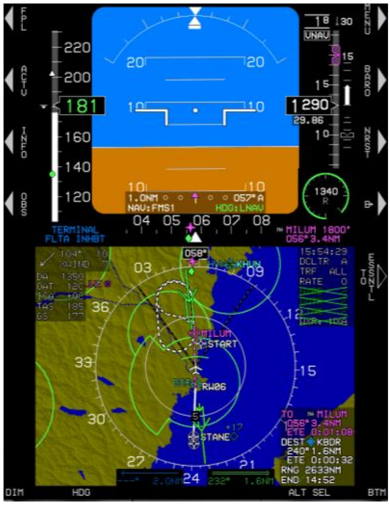


Figure 3-3: PFD in Basic Mode

The PFD can display a Basic Mode by enabling through a mode selection. Basic Mode will use a traditional attitude display with the airspeed, altitude and heading scales appearing in blacked-out areas in a "Basic-T" arrangement and will be disabled while Unusual Attitude Mode is active.

The following list of features is no longer present when the Basic mode is displayed:

- Atmospheric perspective
- Terrain rendering
- Obstruction rendering
- Flight Path Marker
- Availability of Bank Scale option
- Airport Runways

3.1.3. IDU 680 MFD Display (Normal Mode)

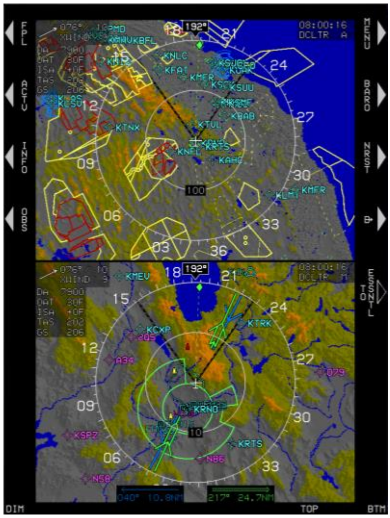


Figure 3-4: MFD in Normal Mode with MAP page displayed on Top and Bottom

3.1.4. IDU 680 MFD Display (Essential Mode)

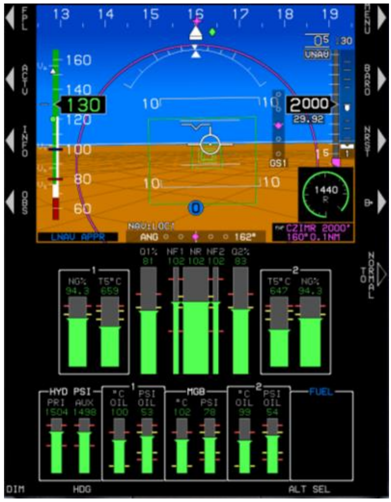


Figure 3-5: MFD in Essential Mode with EICAS configured

3.1.5. MFD in Normal Mode

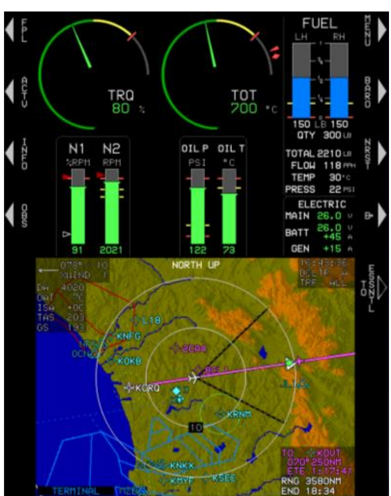


Figure 3-5a: MFD in Normal Mode

3.2. Menu Functions

On the IDU-680, Soft menu functions are used at both levels and are annunciated in a dedicated, blacked-out area in the screen periphery. 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 3-6: Menu Functions

Soft menu function tiles will appear next to the appropriate IDU key or adjacent to one of the rotary encoders when use of that encoder is appropriate.

Figure 3-7: Encoder Functions

Selection lists that are too long to be presented in the space available will provide an indication of location within the list. Whenever the menu system is beyond the top-level, an “**EXIT**” tile will appear adjacent to the top right pushbutton to provide one touch escape to the top-level. Whenever a soft menu level is deeper than the first-level, a “**BACK**” tile will appear adjacent to the top left pushbutton to provide a method of regressing through the menu system by one level.

3.2.1. Selecting BARO

Enter the BARO mode by pressing the **BARO** button and viewing the Inches of Mercury or Millibars value in the lower right corner. Scrolling the right encoder clockwise increases the QNH and counter clockwise decreases the QNH. Push #1 encoder to enter the new value.

Figure 3-8: Selecting BARO

The altimeter setting is displayed immediately below the altitude readout box and digitally displays the altimerter setting in either inches of mercury (IN HG) or Millibars (MBAR) according to the pilot-selected units. Immediately below the altimeter setting, the mode is annunciated as QFE operations otherwise, no mode is annunciated.

Note the following definitions:

QFE: Barometric setting that results in the altimeter displaying height above a reference elevation (i.e., airport or runway threshold).

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

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

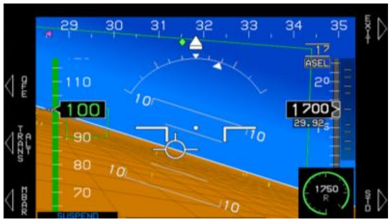


Figure 3-9: Altimeter Setting

Figure 3-10: Altimeter QFE

3.2.2. Selected Altitude Sub-mode (Target Altitude)

When in selected altitude sub-mode, the altitude scale has a user-settable target altitude bug that geometrically interacts with the altitude box pointer. The target altitude bug setting is limited to -1000 feet at the low end, 50,000 at the high end and is annunciated above the altitude scale as seen above with a resolution of 100 feet.

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

The target altitude bug setting annunciation will be colored white and the target altitude bug will be hollow-white when in a climb or descent mode.

The target altitude bug setting annunciation will be colored green and will flash while the target altitude bug will be a filled-white during altitude hold capture.

Figure 3-11: Target Altitude Bug (Vertically integrated)

When not vertically integrated with an autopilot; the target altitude bug setting annunciation will be colored white and the target altitude bug will be filled-white at all times.

Figure 3-12: Target Altitude Bug (Not vertically integrated)

3.2.3. VNAV Sub-mode

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

When in VNAV sub-mode, the altitude scale will show the active waypoint VNAV altitude (if it exists) with a bug symbol that geometrically interacts 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 the abbreviation “VNAV” to indicate that it is the setting for the VNAV altitude sub-mode. Note that 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 can be used either 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.

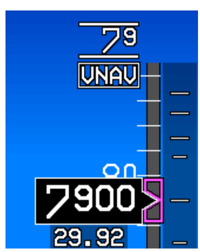


Figure 3-13: VNAV Sub-Mode (Not vertically integrated)

When vertically integrated with an autopilot:

The VNAV altitude bug setting annunciation will be colored green and the VNAV altitude bug will be a filled-magenta when in altitude hold mode.

The VNAV altitude bug setting annunciation will be colored green and will flash while the VNAV altitude bug will be a filled-magenta during altitude hold capture.

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

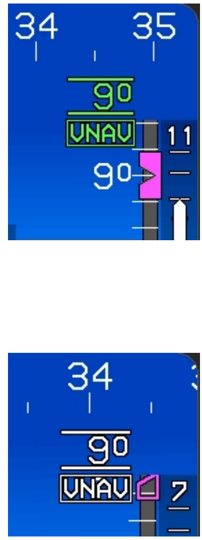


Figure 3-14: VNAV Sub-Mode (Vertically Integrated)

When the VNAV altitude or target altitude differs from aircraft altitude to the extent that the associated bug would be off-scale, the associated bug will appear to be "parked" in the direction of the difference with half of the associated bug visible as seen in the example above.

3.2.4. Altitude Display (VNAV Tile)

When enabled for performing VNAV with a manually selected Altitude entered, a **VNAV** tile appears for "one-touch" engagement of VNAV.

Figure 3-15: Altitude Display (VNAV Tile)

3.2.5. Altitude Display (Metric units)

User-selectable altitude values can be presented in metric units with a resolution of 10 meters as depicted.

Figure 3-16: Altitude Display (Metric Units)

3.3. PFD Symbology

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

Figure 3-17: PFD Symbology

3.3.1. Minimum Altitude

Figure 3-18: Minimum Altitude

When a minimum altitude is selected (in 10-foot increments), a bug in the form of a bold yellow bar is displayed in the appropriate position on the altitude tape and below in yellow.

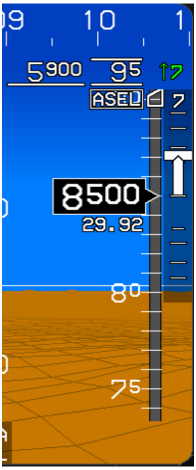
The minimum altitude setting is indicated above the altitude tape with a line drawn below. In this example 6000' MSL is set.

It is possible to use Minimum and Target altitude / VNAV altitude bugs simultaneously.

Audible Annunciation

When a minimum altitude is set, descending from above to below, causes an Aural annunciation of "Minimums, Minimums" aural annunciation and the minimum altitude to turn yellow and begin to flash.

3.3.2. Vertical Speed Indicator:



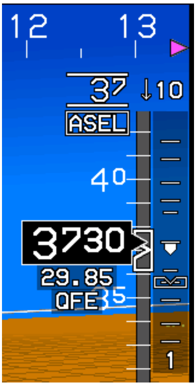
A vertical speed indicator ("VSI") is located to the right of the altitude box. The VSI is depicted as a "worm" format and provides an analog and digital representation of VSI in feet per minute.

Figure 3-19: VSI

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 The background of the VSI will function as an RA display with green and red colored regions to provide RA maneuver guidance.
Without TCAS-II	±3,000 FPM	±500, ±1,000, ±2,000, and ±3,000 FPM

The VSI worm will grow in proportion to the square root of the vertical speed such that 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. Readouts of vertical speed rounded to the nearest

100 feet per minute will appear above the VSI scale (for climbs) or below the VSI scale (for descents).



The User-selectable VSI bug setting in this example is set to 1000 FPM descent rate and has a resolution of 100 FPM

Figure 3-20: VSI Bug

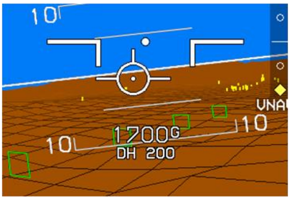
The vertical speed bug can be used either as a visual reference or, when vertically integrated with an autopilot (either fully integrated or partially integrated through use of the vertical mode discrete input), as a control parameter for climbs or descents. It is mutually exclusive with the airspeed bug.

When vertically integrated with an autopilot, the VSI bug setting annunciation becomes Green in color with the speed bug filled-white when in VSI climb or descent mode. Otherwise, the VSI bug setting will be colored white and VSI bug will become hollow-white.

When not vertically integrated with an autopilot, the vertical speed bug setting annunciation will be colored white and the vertical speed bug filled-white at all times.

Figure 3-21: VSI Bug (Vertically Integrated)

3.3.3. Normal AGL Indication



Normal AGL indication with DH 200 displayed below

Figure 3-22: Normal AGL Indication

AGL altitude can be 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 described below. These are mutually exclusive of each other and driven by whatever AGL altitude source which would be used for a TAWS system and will not be displayed when the source is invalid.

A source indication will appear to designate the source for either format as follows in this order of hierarchy:

- "**R**" = Radar altitude.
- "**G**" = GPS/SBAS geodetic height less database ground elevation.
- "**B**" = Barometric altitude less database ground elevation.

AGL indication designed behavior to avoid jumpiness:

Table 3-2: AGL Indication to Avoid Jumpiness

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

AGL altitude will not be displayed in either format when it is greater than the radar altimeter maximum valid altitude and will not be displayed when it is invalid. Additionally, The AGL indication will include a display of the currently set decision height. The display of decision height will turn yellow and flash when the aircraft descends below decision height from above. This is accompanied by "**Decision Height**" aural annunciation and decision height readout to turn yellow and flash.

3.3.4. Analog AGL Indication:

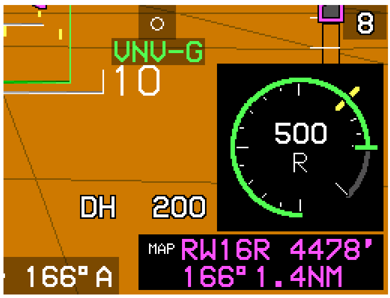


Figure 3-23: Analog AGL Indication

A user selected analog AGL indication can be displayed in the lower right corner of the PFD above the active waypoint identifier as seen above 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.

Table 3-3: Analog AGL Indicator			
Analog AGL Indicator Markings 0-1000 Feet		**AGL**	**Scaling**
0-100 Feet	100 Feet-1000 Feet	0' AGL	6 O'clock
Linear	Logarithmic	50' AGL	9 O'clock
		100' AGL	12 O'clock
		200' AGL	1:30
		500' AGL	3 O'clock

Table: 3-4: Analog AGL indicator markings		
	Major Tick Marks	**Minor Tick Marks**
0’	X	
10’		X
20’		X
30’		X
40’		X
50’	X	
60’		X
70’		X
80’		X
90’		X
100’	X	
200’		X
300’		X
400’		X
500’	X	
1000’	X	

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.

3.3.5. Decision Height

The analog AGL indication includes a display of the currently set decision height to the left of the indication along with a yellow radial line on the circular tape. The display of decision height will turn yellow and flash when the aircraft descends below decision height from above and when below decision height, the circular tape and digital readout will be yellow. This is accompanied by a “Decision Height” aural annunciation and decision height readout to turn yellow and flash.

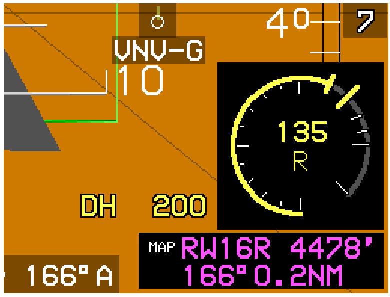
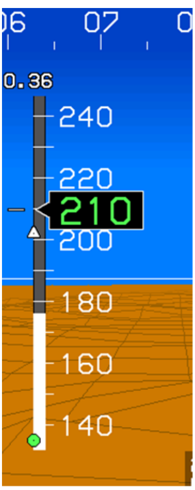


Figure 3-24: Decision Height

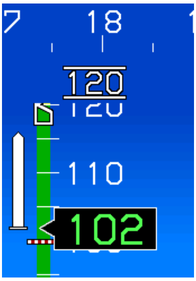
3.3.6. Airspeed Display



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

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

Figure 3-25: Airspeed Display



An airspeed trend vector is calculated along the aircraft longitudinal axis and displayed in a “Worm” format to provide an analog representation of the indicated airspeed that will be achieved in 10 seconds instantaneous longitudinal acceleration rate is maintained along the velocity vector.

The User-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 would be off scale, the bug will appear to be “parked” as in this example.

Figure 3-26: Airspeed Trend

Table 3-5: Airspeed Bug Limits

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

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 colored white.
Airspeed Bug	Filled-white at all times.	Filled-white when in airspeed climb or descent mode otherwise hollow-white.

The airspeed scale background and readout for Part 23 airplanes has coloration as follows:

- If in Air Mode, a red low-speed awareness area from the bottom of the scale to V_{s0}. The airspeed readout is red in this area.
- If in Ground Mode, a gray area from the bottom of the scale to V_{S0}. The airspeed readout is gray at 0 (indicating “dead” airspeed) but otherwise white in this area.
- If a valid V_{FE} exists, a white flap-operating area from V_{S0} to V_{FE}. The airspeed readout is white in this area.
- For aircraft without a V_{MO}/M_{MO}:
    - A green safe-operating area from V_{S1} to V_{NO}. The airspeed readout is green in this area.
    - A yellow caution area from V_{NO} to V_{NE}. The airspeed readout is yellow in this area.
    - A red high-speed awareness area from V_{NE} to the top of the scale. The airspeed readout is red in this area.

- For aircraft with a V_{MO}/M_{MO}:
  - A gray safe-operating area from V_{FE} (if it exists) or V_{S0} to V_{MO}/M_{MO}. The airspeed readout is green in this area.
  - A red high-speed awareness area from the lower of V_{MO} or M_{MO} to the top of the scale. The airspeed readout is red in this area.

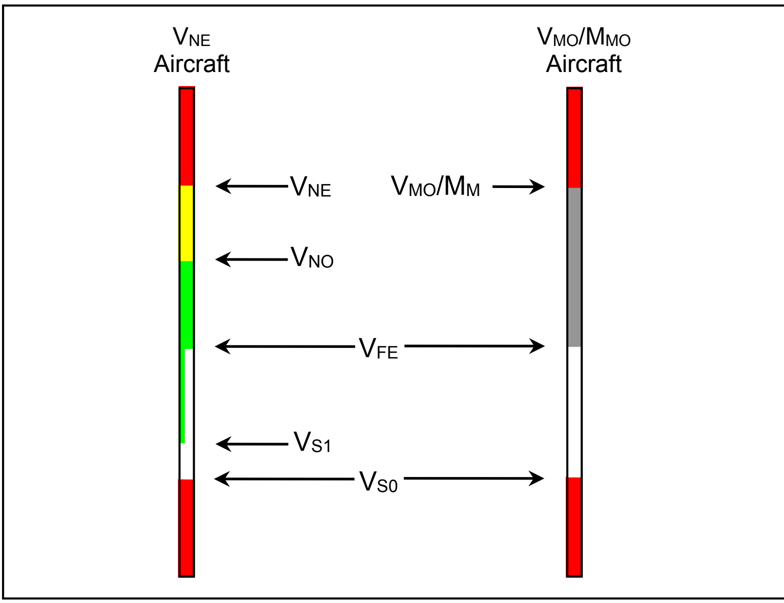


Figure 3-27: Airspeed Scale FAR Part 23

The airspeed scale background for Part 25 airplanes (Part 25 “Airspeed Scale Type,”) will have colored regions as follows:

The airspeed scale background and readout for Part 25 airplanes will have coloration as follows:

1) If in Air Mode with a pilot-input V_{REF} value:

   a) A red low-speed awareness area from the bottom of the scale to G-compensated 1.1 x V_{S0}. Note that V_{s0} is calculated by dividing the pilot-input V_{REF} by 1.23. The airspeed readout is red in this area.

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

c) If a valid V_{FE} exists, a white flap-operating area from G-compensated 1.2 x V_{S0} to V_{FE} and a gray normal-operating area from V_{FE} to the lower of V_{MO} or M_{MO}. The airspeed readout is white in the flap-operating area and green in the normal-operating area.

d) If a valid V_{FE} does not exist, a gray normal-operating area from G-compensated 1.2 x V_{S0} to the lower of V_{MO} or M_{MO}. The airspeed readout is green in this area.

2) If in Ground Mode or without a pilot-input V_{REF} value:

a) If a valid V_{FE} exists, a white flap-operating area from the bottom of the scale to V_{FE} and a gray normal-operating area from V_{FE} to the lower of V_{MO} or M_{MO}. The airspeed readout is gray at 0 (indicating "dead" airspeed) but otherwise white in the flap-operating area and green in the normal-operating area.

b) If a valid V_{FE} does not exist, a gray normal-operating area from the bottom of the scale to the lower of V_{MO} or M_{MO}. The airspeed readout is gray at 0 (indicating "dead" airspeed) otherwise white below 60 and green at or above 60 in this area.

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

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

1) If pilot-input VREF is valid, a white VS marking at the aircraft's 1-G VSO or a yellow VS marking at VSO corrected for G-loading, whichever is higher. Note that VSO is calculated by dividing the pilot-input VREF by 1.23

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

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

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

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

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

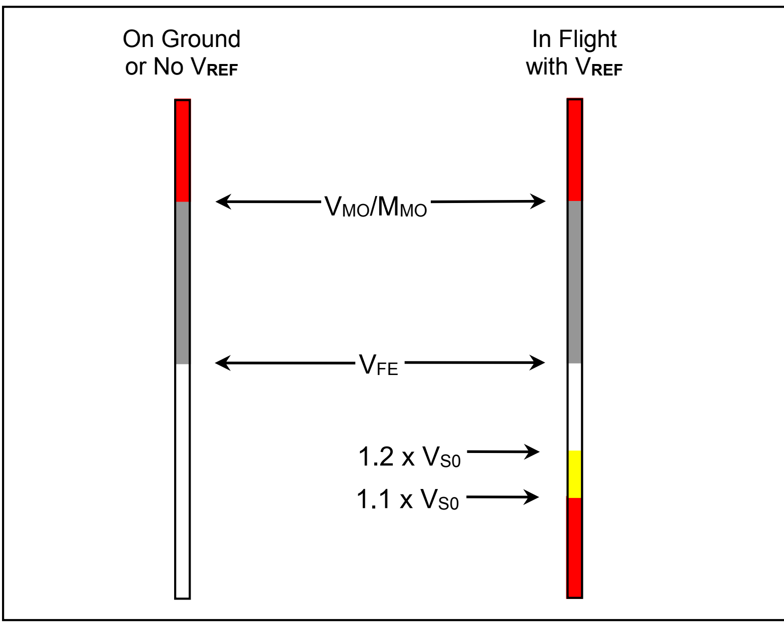


Figure 3-28: Airspeed Scale FAR part 25

3.3.7. Airspeed Display (With EFIS-Coupled)

Airspeed descent to 7,500’ with Green color and filled airspeed

Figure 3-32: Airspeed Display (With EFIS-Coupled)

3.3.8. Heading Display

Figure 3-33: Heading Display

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 that, at an aircraft roll angle of zero, they approximately conform to the three-dimensional PFD background. The heading scale includes a triangular white heading pointer aligned with the longitudinal axis of the aircraft and if the slip indicator flag is enabled, the heading pointer incorporates a dampened integral slip indicator responsive to lateral (Y-axis) G-force (the slip indicator is the white rectangular part of the heading pointer).

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 will be drawn at the limit of the heading scale in the direction of the displacement and the aircraft track value will be displayed in a solid green box above the track pointer. The track pointer will not be displayed when indicated airspeed is in the noise range (when indicated airspeed or groundspeed is less than 30 KIAS).

The heading scale has a user-settable heading bug symbol that is designed to geometrically interact with the heading pointer. When the heading bug is set, the heading bug value will be 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 will be drawn halved at the limit of the heading scale in the direction of the displacement and the heading bug value will be displayed in a white bordered black box above the heading bug symbol as seen below.

Figure 3-34: Heading Bug displaced

When an active waypoint exists, the heading scale will include a magenta, star-shaped waypoint pointer at a point that corresponds with the active waypoint and when the waypoint pointer is displaced from aircraft heading beyond the boundaries of the PFD screen, the waypoint pointer will be 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 above. The waypoint pointer and shortest direction of turn indications will turn yellow in the event of GPS Loss of Navigation caution.

3.3.9. Pitch Scale

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

The pitch scale has increments every 5° with major increments and pitch scale labels every 10° and increments equally spaced to approximately conform to the three dimensional PFD background. Pointer bars at the ends of each major increment indicate the direction to the horizon. Pitch scale increments automatically declutter to present the fewest possible increments needed to unambiguously display pitch attitude. The pitch scale will terminate with a zenith symbol (small white circle) at +90°, and a nadir symbol (small white circle with “+”) at -90°.

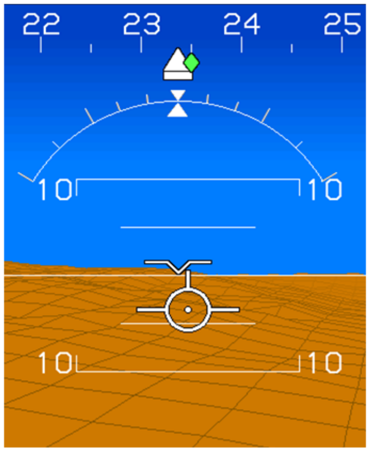


Figure 3-35: Pitch Scale

3.3.10. Pitch Limit Indicator

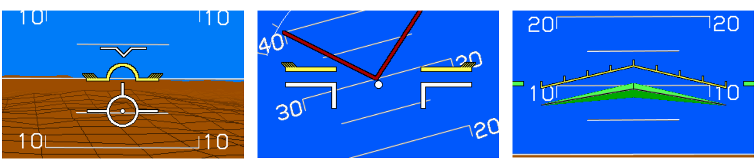


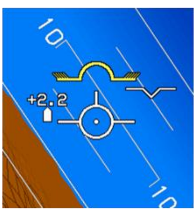
Figure 3-36: Pitch Limit Indicator

A yellow feathered pitch limit indicator symbol appears at 20 knots indicated airspeed above stall speed. Stall speed will be defined as follows:

Table 3-7: Yellow Pitch Limit Indicator appearance limits	
FAR Part 23 airplanes- 1-G V_{S1}or V_{S1} corrected for G-loading	Part 25 airplanes- if pilot-input V_{REF} is valid, the higher of the aircraft's 1-G V_{S0} or V_{S0} corrected for G-loading where V_{S0} is calculated by dividing the pilot-input V_{REF} by 1.23.

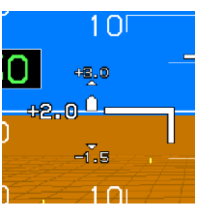
The pitch limit indicator will be a “feathered” symbol modified to work with either the Flight Path Marker or the Large Aircraft Symbol Reference Marks (Basic Mode or Unusual Attitude Mode). The pitch limit indicator first appears above the applicable reference symbol (either the Flight Path Marker of the Large Aircraft Symbol Reference Marks) and will converge upon the applicable reference symbol as indicated airspeed decreases. At 5 knots indicated airspeed above stall speed, the pitch limit indicator becomes red and merges with the applicable reference symbol at stall speed and continue moving downward as indicated airspeed further decreases.

3.3.11. G-Force and Fast/Slow Indicator



A G-Force indicator appears in the normal mode as depicted or next to the Large Aircraft Symbol Reference Marks (Basic Mode or Unusual Attitude mode) when difference between G-Force and 1-G is greater than 0.3 Gs.

Figure 3-37: G-Force Indicator



Positive telltales appear whenever G-force exceeds 2 .5G

Negative telltales appear whenever negative G-force is less than -0.5G.

Telltales appear full-time within G-indication area and are removed when AOA Fast/Slow replaces G-indicator.

Figure 3-37a: G-Force Indicator telltale indications

Note:

A “RESET G” option has been added to the PFD declutter menu. When pressed, this resets the telltales to 0 unless the aircraft G-limits have been exceeded. If the G-limits have been exceeded, a

Ground Maintenance Function option is available to reset exceedance on the ground only.

When the landing gear is down and the EFIS is receiving a valid Flight Director Fast/Slow label, the G-Force indicator is replaced by a Fast/Slow indicator which has a “worm” format providing an analog representation of deviation from a target angle of attack.

The Fast/Slow indicator worm grows in the “**F**” direction with angles of attack lower than the target and grows in the “**S**” direction with angles of attack higher than the target and is decluttered when on the ground.

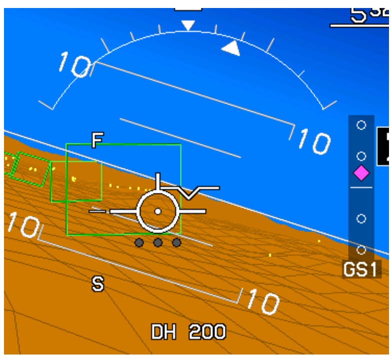


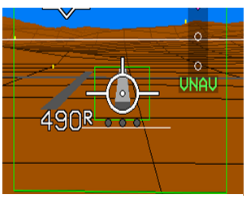
Figure 3-38: Fast Slow Indicator

3.3.12. Basic Mode

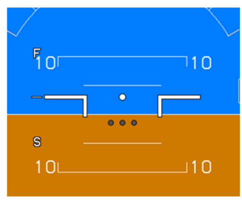
Figure 3-41: Basic Mode

The following list of features is no longer present when the Basic mode is displayed:

- Atmospheric perspective
- Terrain rendering
- Obstruction rendering
- Flight Path Marker
- Availability of Roll Pointer option
- Availability of Bank Scale option
- Airport Runways
- Landing Gear Indication



Normal Mode Landing Gear Indication



Basic Mode Landing Gear Indication

Figure 3-42: Landing Gear Indication

The PFD will display landing gear as shown above in the Normal Mode and Basic modes.

3.3.13. Unusual Attitude Mode

Figure 3-43: Unusual Attitude Mode

The PFD has an Unusual Attitude Mode and be enabled when pitch attitude exceeds +30° or -30° or bank angle exceeds 65°. Once enabled, the Unusual Attitude Mode remains engaged until pitch attitude returns to within 5° of the horizon and bank attitude returns to within 10° of the horizon. Recovery chevrons, tied to the 30° and higher pitch scale indications (both positive and negative), appear to aid in unusual attitude recovery.

Note:

The 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:

- Terrain and Obstruction rendering
- CDI
- VDI
- Flight Path Marker
- Highway in the Sky boxes
- Atmospheric perspective
- Analog and Digital AGL indication
- Active Waypoint symbology
- Mini Map
- Traffic thumbnail
- If in the Basic Mode, the PFD reverts to the Normal Mode
- If in Zoom mode FOV, the PFD reverts to normal FOV
- Runways

3.3.14. PFD Background

The PFD has a three-dimensional 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 40NM 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 can be 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 will be automatically selected.

The terrain and obstruction rendering use hidden surface removal techniques while terrain/sky rendering use atmospheric perspective techniques. Terrain with obstruction rendering are collectively user-selectable which allows the user 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 will decouple from the pitch scale at high pitch angles so that a sliver of the blue-brown boundary line always remains visible to give guidance to the horizon.

Figure 3-44: Airplane PFD Terrain and Obstructions

The terrain ahead of the aircraft is shown conformally with the artificial horizon, in the correct scale and perspective for the aircraft's current position and altitude. Worldwide terrain coverage is provided in each IDU and is shown with a resolution of 24 arc seconds (approximately 2,400 feet).

Terrain is displayed ahead of the aircraft using a grid, and simulates "atmospheric perspective" (the terrain lines fade into the background "ground" color as they recede into the distance). This enhances the three-dimensional 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.

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 three-dimensional 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 will be a conventional blue over brown attitude display presentation without atmospheric perspective. Additionally, terrain can be deselected on the PFD and retained on the ND MAP display as seen below.

WARNING:

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

Figure 3-45: 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 yellow lines. Obstructions are conformal in both location and size and only shown in conjunction with terrain regardless of altitude. Obstructions which represent a collision hazard are annunciated aurally and with a caution or warning flag.

All of the vertical yellow lines in the Figure 3-46 are obstructions near the airport.

Audible Annunciation

Towers, antennas, and obstructions that represent a collision hazard cause an annunciation of “Obstruction” and Aural Annunciation of “Caution Obstruction”.

Note:

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

3.3.15. Flight Path Marker (Velocity Vector)

Figure 3-46: Flight Path Marker

At low speed and in flight (indicated airspeed <45 KIAS), the flight path marker is removed and replaced with Large Aircraft Symbol Reference Marks. This is due to the difficulty of generating a useable flight path marker at extremely low speeds.

The PFD flight path marker appears at a location on the background so as to coincide with the aircraft's actual flight path as projected upon the outside world. The flight path marker is laterally displaced parallel to the horizon with respect to the center of the display to account for the difference between aircraft track and heading, and is vertically displaced perpendicular to the horizon to account for aircraft climb or descent angle. Because the flight path marker is used in conjunction with a three-dimensional background, the flight path marker utility normally associated with a HUD is achieved.

Table 3-8: Flight Path Marker behavior	
	Crab Angle
Cage (Become laterally centered on the display)	When exceeding 15° (In Wide FOV) or 7.5° (narrow FOV mode)
Uncage (Resume lateral floating)	When returning below 13° (wide FOV mode) or 6.5° (narrow FOV mode)
Flight path marker movement is dampened by reference to aircraft pitch and heading so as not to deviate from pitch or heading at a rate greater than 1°/sec.	

When caged, a flight path marker "ghost" will be displayed at the flight path marker's proper lateral location. When the location of the ghost is displaced to the extent that it would interfere with heading, altitude or airspeed indications, the ghost will be removed from the display. The flight path marker will not be shown in Basic Mode and in the Unusual Attitude Mode, it disappears to allow the user to concentrate on the Large Aircraft Symbol Reference Marks for unusual attitude recovery. In reversionary mode 1 (GPS failure), the flight path marker will change to a light gray color after 1 minute to indicate degraded performance. Flight path marker at low speed (indicated airspeed < 30 KIAS) behavior further depends upon whether the aircraft is in flight or on the ground. (See Airspeed Display section for further details)

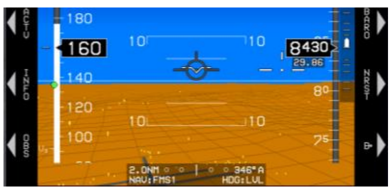


Figure 3-46a: Flight Path Marker Ghost

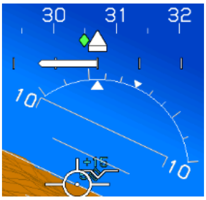
3.3.16. Bank Angle Scale

The Bank Scale and Roll Pointer are centered upon the Large Aircraft Symbol Reference Marks in Basic or Unusual Attitude Modes.

Figure 3-47: Bank Angle

When bank angle scale decluttering is selected; a 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 will be 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.

3.3.17. Turn Indication



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

Figure 3-47a: Turn indication

3.3.18. Timer Indication

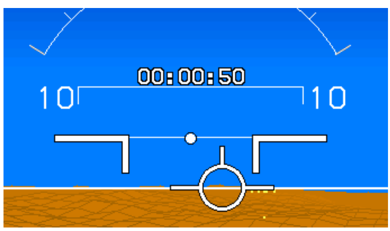


Figure 3-48: Timer

A countdown or count-up timer can be displayed above the Fight Path Marker or Large Aircraft Symbol Reference Marks when selected by the pilot. The format of the time is “hh:mm:ss” (hours, minutes, seconds)

3.3.19. Marker Beacon Symbology

Marker beacons data that is acquired from the Navigation Receiver will be displayed on the PFD and disabled when the selected NAV source is FMS.

Valid marker beacon signals will cause circular indicators with appropriate coloring and markings to be displayed in the lower central portion of the PFD (shown below):

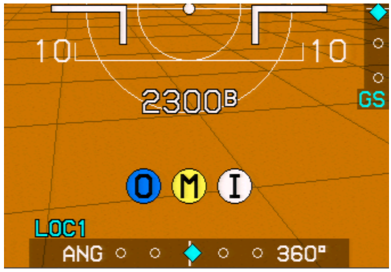


Figure 3-49 Marker Beacons

3.3.20. Flight Director Symbology (FD1 Single Cue)

The Flight Director Symbology is pilot-Selectable through controls on the IDU or through controls of 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 the 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 will occur relative to the location of the waterline symbol or Large Aircraft Reference Marks.

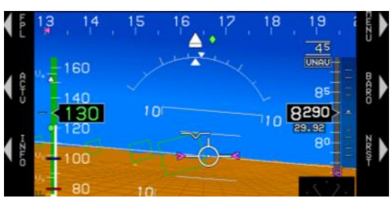


Figure 3-50: Flight Director FD1 Single Cue

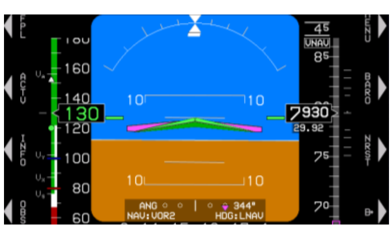


Figure 3-51: Flight Director FD1 (Basic Mode)

3.3.21. Flight Director Symbology (FD2 Dual Cue)

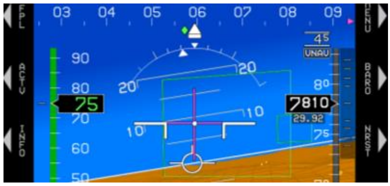


Figure 3-52: Flight Director FD2 (Normal Mode)

Figure 3-53: Flight Director FD2 (Basic Mode)

3.3.22. Course Deviation Indicator

Figure 3-54 Course Deviation Indicator

Table 3-9: CDI Behavior and Color	
CDI Pointer and condition	**Color or behavior**
Full Scale Deflection	FLASH
When Slaved to GPS/SBAS	Scale will be 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)	YELLOW
Normal Conditions	Magenta

Table 3-9: 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

3.3.23. 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 will be annunciated immediately below the CDI as follows:

- NAV: **FMS1**
- NAV: **FMS2**
- NAV: **VOR1**
- NAV: **LOC1**
- NAV: **BC1** (annunciated instead of LOC1 when course error exceeds 105°)
- NAV: **VOR2**
- NAV: **LOC2**
- NAV: **BC2** (annunciated instead of LOC2 when course error exceeds 105°)

3.3.24. Heading/Roll-Steering sub-mode

Immediately to the right of the selected navigation source annunciation appears the heading/roll-steering sub-mode annunciation and will display either:

- HDG: **LVL** (Wing-Leveling Sub-Mode Guidance)
- HDG: **LNAV** (LNAV Sub-Mode Guidance)
- HDG: **BUG** (Heading Bug Sub-Mode Guidance)
- HDG: **---** (Failure Sub-Mode)

3.3.25. Vertical Deviation Indicator

Table 3-10: Vertical Deviation Indicator Behavior

Source (Below the 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 will be valid if: On VNAV descent segments when approaching the Top of Descent point so as to provide descent anticipation as long as the following are true: • On VNAV descent segments; OR • If the vertical deviations on VNAV level segments option is enabled, on VNAV level segments; OR • If the vertical deviations on VNAV level segments option is disabled, when approaching the Top of Descent point so as to provide descent anticipation; Providing: • The aircraft is within 2NM or twice the full scale deflection for the mode of flight	Magenta

Table 3-10: Vertical Deviation Indicator Behavior		
Source (Below the VDI)	**Behavior / Condition**	**Pointer Color**
	(whichever is greater) of the lateral navigation route; AND • The aircraft is in TO operation relative to the active VNAV waypoint (i.e., taking into account VNAV offsets); AND • 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 Yellow

The vertical deviation indicator will disappear in Unusual Attitude Mode.

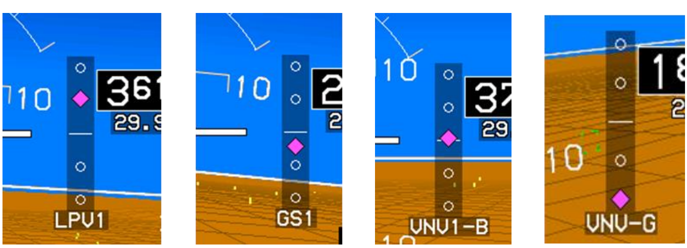


Figure 3-55: Vertical Deviation Indicator

- **LPV1:** When descending on the final approach segment in LPV mode.
- **LPV2:** When descending on the final approach segment in LPV mode.
- **VNV1-G:** When descending on the final approach segment in LP, LNAV/VNAV, LNAV or RNP modes when using GPS VNAV.
- **VNV2-G:** When descending on the final approach segment in LP, LNAV/VNAV, LNAV or RNP modes when using GPS VNAV.
- **VNV1-B:** Default FMS barometric VNAV mode.
- **VNV2-B:** Default FMS barometric VNAV mode.
- **GS1:** When valid Glideslope receiver #1 is received.
- **GS2:** When valid Glideslope receiver #2 is received.

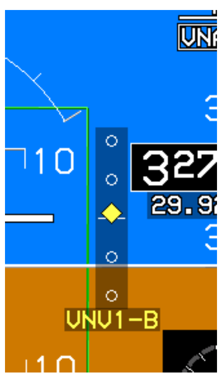
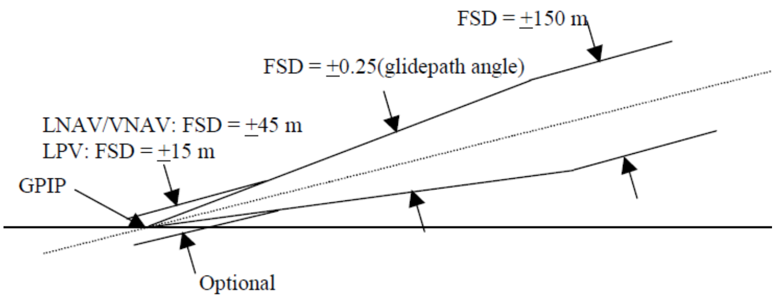


Figure 3-56: Vertical Deviation Indicator color during GPS/SBAS LON or VLON

The linear vertical scale limits of the VDI for LNAV/VNAV and LPV approaches are shown below in Fig 3-56a.



Note: Offset conical vertical deviation reference surface and hyperboloid surface are not depicted.

Figure 3-56a: Vertical Deviation Linear deviation

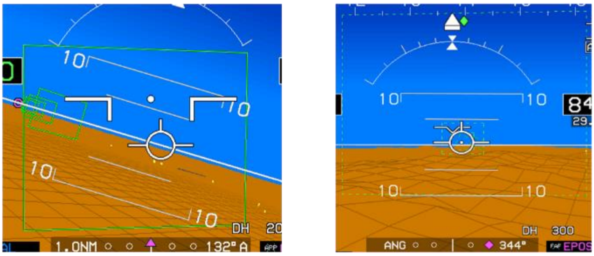
3.3.26. Vertical Deviation Indicator (EFIS Coupled)

Figure 3-57: EFIS Coupled Vertically with Glideslope Mode engaged

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 will be annunciated in green to indicate that the autopilot is vertically coupled to the selected vertical navigation source.

Otherwise, the selected vertical navigation source will be annunciated in white.

3.3.27. Highway in the Sky/Skyway



Coupled **Uncoupled**

Figure 3-58: Highway in the Sky

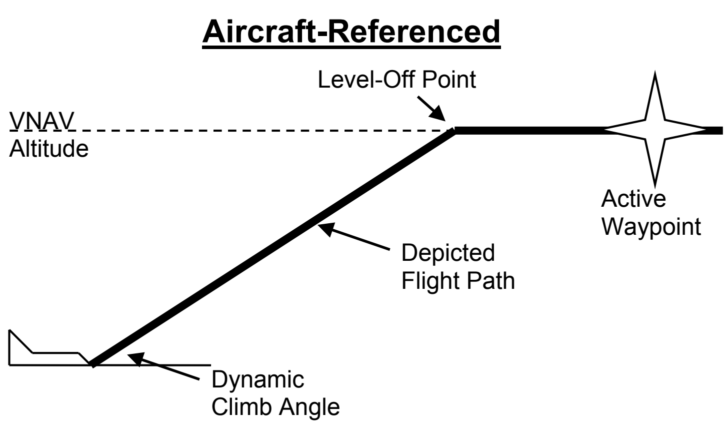
When not decluttered, the PFD can display the active navigation route or manual OBS course in a three-dimensional manner using a series of skyway boxes which are a series of perspective objects overlying the flight plan route at a desired altitude providing lateral and vertical guidance. The skyway boxes conform to the VNAV requirements of GPS/SBAS receiver requirements (TSO-C-146C). The top and bottom sides 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 will be 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. The skyway boxes are drawn using the hidden surface removal techniques of the terrain and obstruction rendering such that a skyway box behind terrain will appear to be so. The skyway boxes will disappear in Basic Mode and Unusual Attitude Mode. In reversionary mode 1 (GPS failure), the skyway boxes will disappear after 1 minute to indicate degraded navigation performance.

Table 3-11: Highway In the Sky Configuration			
Type HITS lines	**Fully Integrated Autopilot**	**Partially Integrated Analog Autopilot** (Through use of HDG Mode and or NAV/APR mode discrete inputs)	**Un-integrated Autopilot** **Or** **No Autopilot**
Dashed	Not coupled to Skyway	Not coupled to Skyway	
Solid	Coupled to Skyway	Coupled to Skyway Either autopilot is in HDG mode with LNAV heading/roll-steering sub-mode engaged or autopilot is in NAV/APR mode with the FMS, FMS1 or FMS2 as the currently selected navigation source.	Always Solid

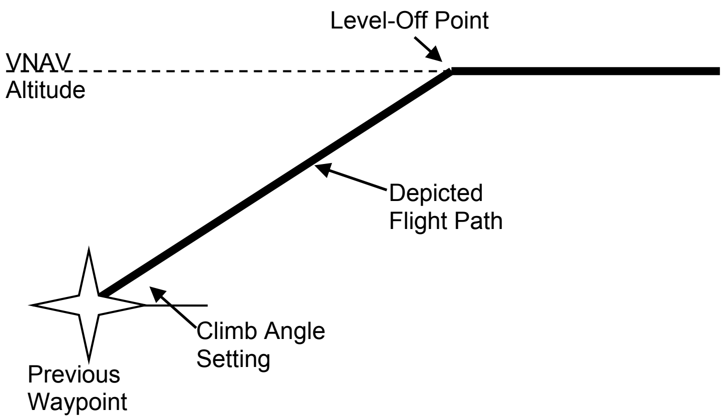
Skyway box altitude is controlled by VNAV altitude, aircraft altitude, aircraft climb performance and climb/descent angle setting. If no VNAV altitude is set, then the skyway boxes will describe the desired lateral flight path of the aircraft at the aircraft's current altitude.

With a VNAV altitude set, the boxes provide both lateral and vertical guidance. Climb and descent angle settings can be controlled individually with a resolution of 0.1°. VNAV will be 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 automatically computed by the system using “look-ahead” rules. When “look-ahead” finds a further VNAV altitude constraint above the previous VNAV altitude constraint (i.e., climb commanded), then an automatic VNAV altitude will be 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), then an automatic VNAV altitude will be calculated for the waypoint based upon a descent to reach the VNAV altitude constraint at the associated waypoint using the descent angle setting. If no further VNAV altitude constraints are found, then the automatic VNAV altitude is set to the last valid VNAV altitude constraint.

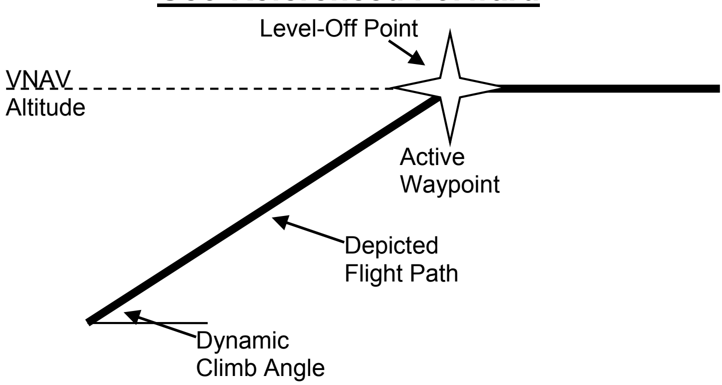
When a VNAV climb is desired, the boxes will be drawn at a vertical position that is the higher of: (a) the dynamic climb angle emanating from the aircraft's present position (aircraft-referenced); (b) the dynamic climb angle emanating from the next waypoint VNAV altitude (geo-referenced forward); or (c) the climb angle setting emanating from the previous waypoint VNAV altitude (geo-referenced backward). The geo-referenced backward calculation will only be 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. Due to the fact that five boxes are shown, the level-off depiction becomes an anticipatory cue for the pilot. Climb guidance is depicted below:



Geo-Referenced Backward



Geo-Referenced Forward



When a VNAV descent is desired, boxes will be drawn with a zero angle until reaching a descent point. Further boxes will be drawn downward at an angle corresponding to the descent angle setting. The descent point will be 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 will be defined as follows:

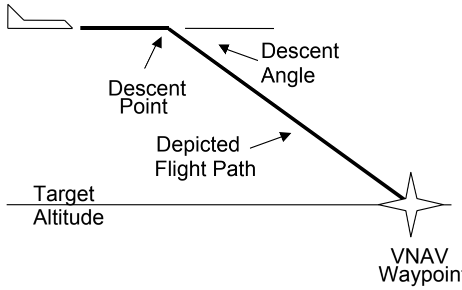
Table 3-12: Final Segment of IFR Approach, Descent Angle and VNAV Waypoint

Condition	VNAV Waypoint Definition	Descent Angle Definition
IFR Approach with valid Final Approach Segment data block	Glide Path 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	The steepest descent angle based upon straight lines from the Final Approach Fix and subsequent Intermediate Waypoints to Missed Approach Point location and altitudes.

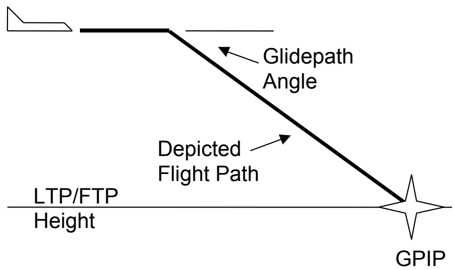
On the final approach segment of a VFR approach procedure, the higher of the descent angle setting or 3° will be used.

Due to the fact that five boxes are shown, the descent point depiction becomes an anticipatory cue for the pilot. Descent guidance is depicted below:

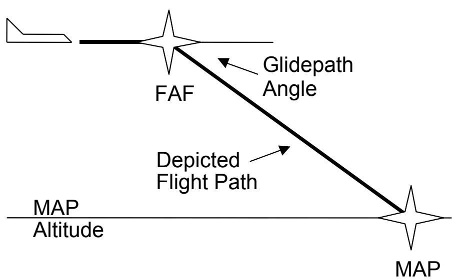
<u>Normal Descent</u>



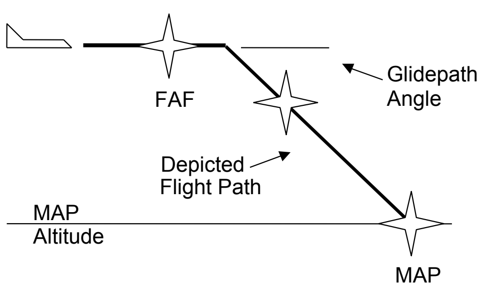
<u>Final Approach Segment Descent w/FAS Data Block</u>



Final Approach Segment Descent w/o FAS Data Block or Intermediate Waypoints



Final Approach Segment Descent w/o FAS Data Block with Intermediate Waypoint



The above scheme was chosen to create an easily understood, yet safe, VNAV paradigm that meets 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 operators of single-engine aircraft. The climb paradigm automatically compensates for an aircraft's ability to climb more steeply than specified and also warns of being below a desired climb gradient when the aircraft is unable to meet the specified climb angle. The descent paradigm encourages flying stabilized approaches.

3.3.28. Active Waypoint and Waypoint Identifier

Figure 3-59: Active Waypoint

The PFD displays the active waypoint symbol as a magenta “tethered balloon” consisting of an “X” depicted at the ground location of the active waypoint, 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 a line connecting the “X” and the hoop. The “X” and the connecting line are not shown if no ground elevation information is encoded with the navdata waypoint information (i.e., terminal and enroute fixes). The active waypoint symbol is drawn using the hidden surface removal techniques of the terrain and obstruction rendering such that an active waypoint behind terrain appears to be so. The active waypoint symbol disappears in Unusual Attitude Mode and turns yellow in the event of GPS Loss of Navigation caution.

The identifier of the waypoint along with the bearing and distance to that 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 the example above, the identifier will include 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 will always be visible regardless of distance.

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

If the waypoint is only a hoop hanging in space, that waypoint 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.

3.3.29. Mini Map

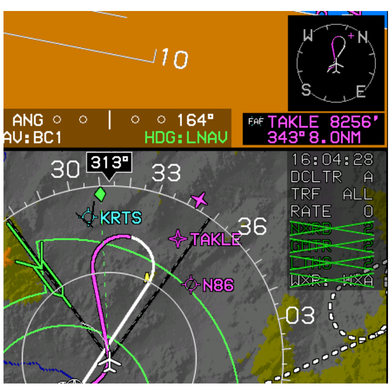
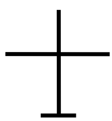
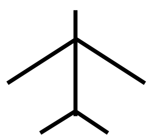
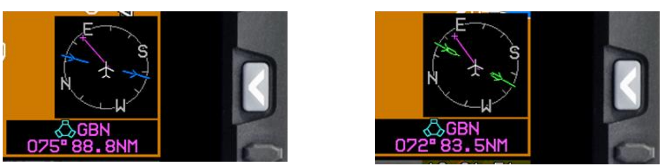


Figure 3-60: Mini Map

Table 3-13: Mini-Map behavior (When not decluttered)		
VOR Pointer, Active Leg Ownship symbol	**Color**	**Condition**
VOR 1	Blue	When Valid
VOR 2	Green	When Valid
Active Leg (GPS/SBAS normal)	Magenta	
Active Leg (GPS/SBAS LON condition)	Yellow	
Ownship symbol **Airplane w/o MMO**  **Airplane with MMO** 	White	
Mutually exclusive with the Analog AGL Indicator		
Mini-Map will disappear in Unusual Attitude Mode		
Mutually exclusive with Traffic Thumbnail		



VOR #1 **VOR #2**

Figure 3-61: Mini Map VOR Symbology

3.3.30. Runways

Figure 3-62: Runways

The PFD displays airport runways in a three-dimensional manner. Immediately upon a system startup on the ground, the runways for the nearest airport will be displayed. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, the runways for the airport associated with the procedure will also be displayed. In addition, the runways associated with the three nearest airports (as computed by the TAWS algorithms) will be displayed. The runways will be drawn using the hidden surface removal techniques of the terrain and obstruction rendering such that runways behind terrain will appear to be so. Runways will be shown in 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, will be shown in light gray.

3.3.31. Traffic Thumbnail

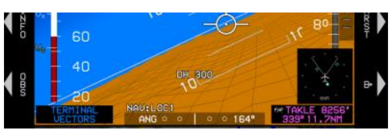


Figure 3-63: Traffic Thumbnail

The traffic thumbnail, when selected from declutter options 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. 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 will disappear in the Unusual Attitude Mode.

3.3.32. Traffic Display Definitions

1) Resolution Advisory ("**RA**"): RA is defined as traffic having a dangerous closest point of approach and that generates climb or descent commands as defined by internal TCAS-II sensor logic.

2) Traffic Advisory ("**TA**"): TA is defined as traffic having a dangerous closest point of approach as defined by internal traffic sensor logic.

3) Proximate Advisory ("**PA**"): PA is defined as traffic that is within 6 NM and ±1200 feet from ownship that is not an RA or TA.

4) Other Traffic ("**OT**"): OT is defined as traffic beyond 6 NM or ±1200 feet from ownship that is not an RA or TA.

3.3.33. Traffic Rendering Rules:

Traffic thumbnail and PFD traffic will be rendered as follows:

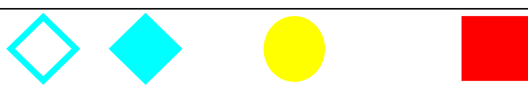
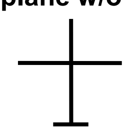
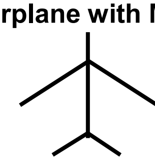
Table 3-14: Traffic Rendering Rules

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 3-15: Pilot Selected OT and PA Traffic Altitude-Filter

Mode	Parameter
AUTO	If aircraft VSI is less than -500FPM, traffic that is within +2,700 and -9,900 feet of aircraft altitude is displayed. If aircraft VSI is more than +500FPM, traffic that is within -2,700 and +9,900 feet of aircraft altitude is displayed. Otherwise, traffic that is within -2,700 and +2,700 feet of aircraft altitude is displayed.
ABOVE	Traffic that is within -2,700 and +9,900 feet of aircraft altitude is displayed.
BELOW	Traffic that is within +2,700 and -9,900 feet of aircraft altitude is displayed.
NORMAL	Traffic that is within -2,700 and +2,700 feet of aircraft altitude is displayed.
ALL	All received traffic is displayed, no altitude filtering is performed.

Table 3-14: Traffic Symbology

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

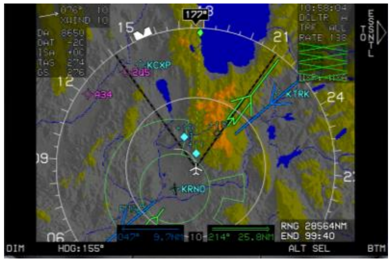
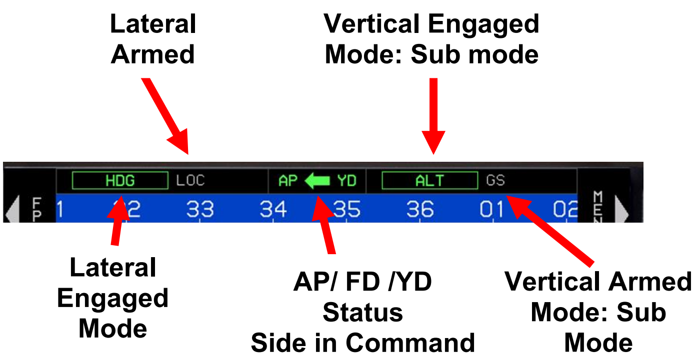


Figure 3-64: Traffic Symbology

3.4. Fully Integrated Autopilot Annunciations



Notes:

- Boxed engaged mode annunciation = AP is engaged
- Engaged mode annunciation flashes for 10 seconds upon mode / sub mode change

Figure 3-65: Autopilot Annunciation

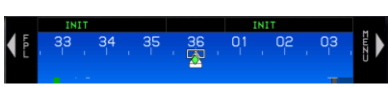


Figure 3-65A: Autopilot initializing in Roll and Pitch modes

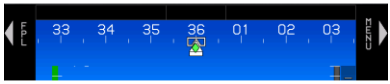


Figure 3-65B: Autopilot Ready (Absence of Fail or INIT)

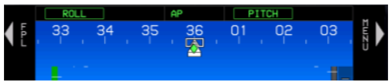


Figure 3-65C: Autopilot Roll and Pitch modes

Figure 3-65D: FD displayed on PFD with Roll and Pitch modes

Figure 3-65E: Autopilot HDG and ALT modes engaged

Figure 3-65F: Autopilot with NAV:VOR and ALT modes engaged

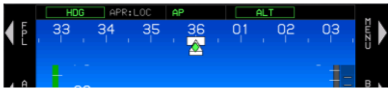


Figure 3-65G: Autopilot with HDG APR-LOC and ALT modes engaged

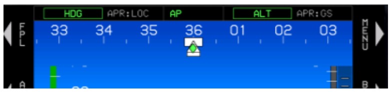


Figure 3-65H: Autopilot with HDG APR:LOC and ALT and APR: GS

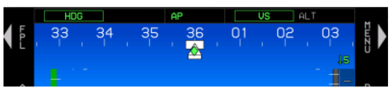


Figure 3-65J: Autopilot with HDG, and VS modes engaged

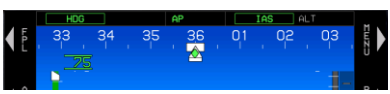


Figure 3-65K: Autopilot with HDG and IAS modes engaged

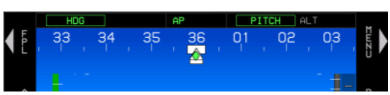


Figure 3-65L: Autopilot with HDG and Pitch modes engaged

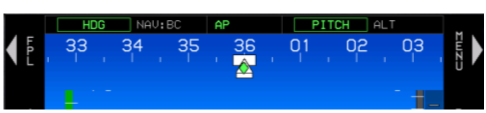


Figure 3-65M: Autopilot with HDG and NAV:BC and Pitch modes engaged

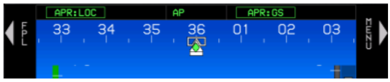


Figure 3-65N: Autopilot with APR:LOC and APR:GS modes engaged

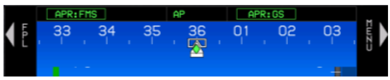


Figure 3-65P: Autopilot with APR:FMS and ALT modes engaged

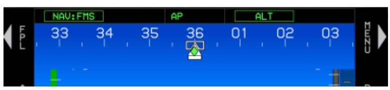


Figure 3-65Q: Autopilot with NAV:FMS and ALT modes engaged

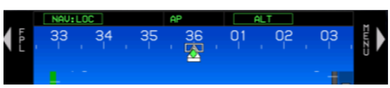


Figure 3-65R: Autopilot with NAV:LOC and ALT modes engaged

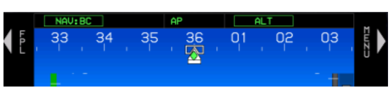


Figure 3-65S: Autopilot with APR:BC and ALT modes engaged

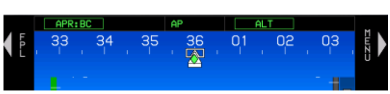


Figure 3-65T: Autopilot with APR:BC and ALT modes engaged

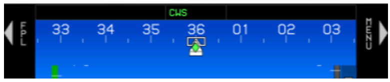


Figure 3-65U: Autopilot with CWS mode engaged

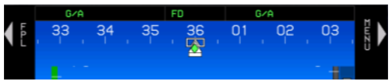


Figure 3-65V: Autopilot with G/A (Go-Around) engaged in Roll and Pitch modes

3.5. Navigation Display Symbology

The Navigation Display can be presented in a variety of formats, including:

- Moving Map
- Conventional HSI
- Navigation Log
- Strikes
- Traffic
- Datalink
- WX RDR
- Video
- EICAS

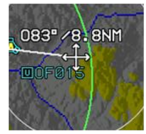
3.5.1. Basic Moving Map

Figure 3-66: Basic Moving Map

3.5.2. Ownship Symbology

Airplane FAR 23 with VNE

Airplane With V_{MO}/M_{MO}



Pan Mode

Figure 3-67: Ownship Symbology

3.5.3. Moving Map with Instrument Approach

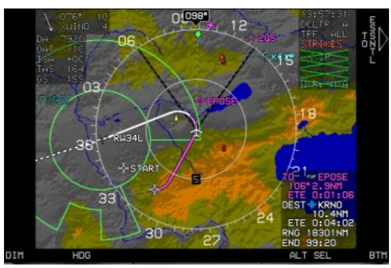


Figure 3-68: Moving Map with Instrument Approach

3.5.4. North-Up Arc Mode

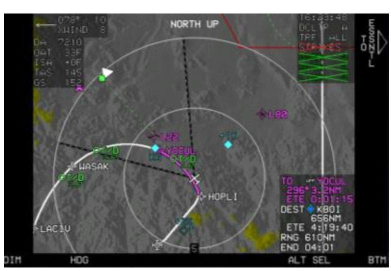


Figure 3-69: North-Up Arc Mode

3.5.5. North-Up Centered Mode

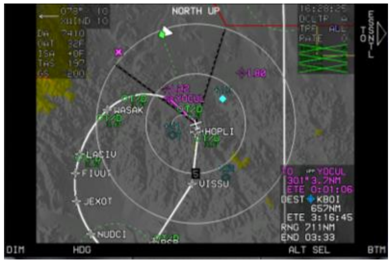


Figure 3-70: North-Up Centered Mode

3.5.6. Heading-Up Centered Mode

Figure 3-71: Heading-Up Centered Mode

3.5.7. Conventional HSI / PTR Format

Figure 3-72: Conventional HSI / PTR Format

The ownship symbol will be as follows:

Airplane w/o M_{MO} **Airplane with M_{MO}**

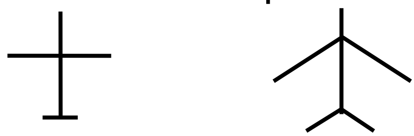


Figure 3-72a: HSI Ownship symbols (centered on the HSI and pointing straight up)

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 fails (FMS, VOR1, or VOR2), a red "X" will be displayed in place of the HSI deviations.

3.5.8. Compass Rose Symbols

Normal Mode **True North Mode**

Figure 3-73: 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 will use 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 and will not be displayed when groundspeed is less than 30 knots. The user-settable heading bug that geometrically interacts with the heading pointer appears on the compass rose. A magenta, star-shaped waypoint pointer will be displayed on the heading scale at a point that corresponds with the active waypoint and will turn yellow in the event of GPS Loss of Navigation caution.

3.5.9. Fuel Totalizer/Waypoint Bearing and Distance Functions

Figure 3-74 Fuel totalizer/Waypoint Bearing and Distance Functions

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) of the active flight plan will be shown. Waypoint information will normally be colored magenta and will turn 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)	ETA or ETE Degree ("°") symbol or

Table 3-15: Fuel Totalizer / Waypoint Bearing and Distance Functions		
Function	**Conditions**	**Type Symbols Options**
	of the active flight plan will be shown. Range and time to the destination waypoint will be based upon the flight plan route if the active waypoint is not the last waypoint, otherwise range and time to the destination waypoint will be based upon a direct geodetic path. The DEST Waypoint information will normally be colored white and turn yellow in the event of a GPS Loss of Navigation caution.	True North ("T") symbol
Range:	Aircraft range based upon instantaneous fuel flow, fuel remaining and groundspeed will be shown immediately below the "**DEST**" waypoint information for easy comparison.	
Endurance:	Aircraft endurance based upon instantaneous fuel flow and fuel remaining will be shown.	

3.5.10. Clock/Timers/Options:

Figure 3-75: Clock and Timers

The following data items are displayed in the upper right corner of the ND:

Table 3-16: Clock / Timers / Options

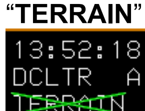
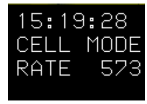
Feature	**Options**	**Notes**
Zulu Time	No other format available	Shown in hours : minutes : seconds format and is synchronized with the GPS/SBAS constellation.
Timer	**COUNT UP** **COUNT DN..** **FLT TIME**	A countdown timer or count-up timer can be displayed when selected by the pilot and match the timer shown on the PFD.
Declutter Mode	**DCLTR A** **DCLTR M**	= Automatic declutter mode = Manual declutter mode
Terrain Status	Enabled or Disabled	Status will be annunciated as "**TERRAIN**" with overlying "X".  if manually

Table 3-16: Clock / Timers / Options

Feature	Options	Notes
		deselected. If TERRAIN is decluttered from the PFI area the only indication is the absence of terrain from the PFI area. If TERRAIN is disabled the “X” will appear Red. 
Traffic Status	Enabled or Disabled	Status will be annunciated disabled as  if manually deselected. In the event of a traffic warning (TA or RA), the traffic thumbnail will automatically be enabled while the traffic warning is active and the aircraft is above 500’AGL. If traffic is disabled, the color of the “**X**” will be red. When traffic is selected and enabled, the status of traffic altitude filtering will be displayed as follows: AUTO= “**TRF AUTO**”, NORMAL= “**TRF NORM**”, ABOVE= “**TRF ABV**”, ALL= “**TRF ALL**” , BELOW= ‘**TRF BLW**”.
WX-500 Status	Enabled or Disabled	When selected, the ND displays Cell Mode lightning strikes in their correct relationship to the

Table 3-16: Clock / Timers / Options		
Feature	**Options**	**Notes**
		ownship symbol with the limits  found in §3.17.

3.6. Navigation Log

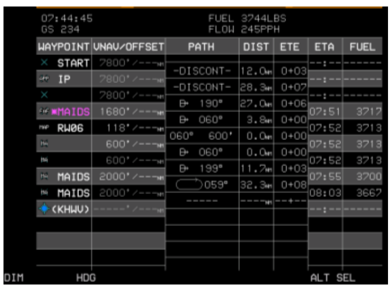


Figure 3-76: Navigation Log

3.6.1. Clock and Ground speed

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

1) Zulu Time: As specified in § 3.5.10 above.

2) Groundspeed: Groundspeed is displayed digitally in knots, Fuel Remaining, and Fuel Flow Data

3.6.2. Fuel Remaining and Fuel Flow Data

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

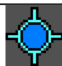
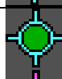
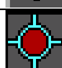
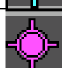
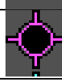
Fuel Remaining: If either fuel level or fuel flow are available, current fuel remaining will be displayed digitally in fuel units.

Fuel Flow: If fuel flow is available, current total fuel flow will be displayed digitally in fuel units.

3.6.3. Waypoint Identifier Column

The identifier for each waypoint of the active flight plan will be displayed in the left-most column of the NAV Log with. The current active waypoint is indicated with an asterisk and shown in magenta. The current active waypoint color will turn yellow in the event of a GPS Loss of Navigation caution. Suppressed waypoints are indicated by brackets. Navigation data symbols are shown with the waypoint identifier so that the pilot can easily distinguish the waypoint type. In the case of an airport with an available datalinked METAR, a graphical METAR will be displayed as a colored fill within the circular part of the airport symbol with the following coloring convention:

Table 3-17: Graphical METAR Symbols

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

When a waypoint is part of a procedure, small procedure legends will be drawn on top of the navigation data symbol so that the pilot can easily distinguish procedure waypoints. The following procedure legends are used:

FAF = Waypoint is a Final Approach Fix

MAP = Waypoint is a Missed Approach Point

MA = Waypoint is part of the missed approach segment of an Instrument Approach Procedure.

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.

VFR = Waypoint is part of a VFR Approach.

STAR = Waypoint is part of a Standard Terminal Arrival Procedure.

DP = Waypoint is part of a Departure Procedure.

3.6.4. VNAV and VNAV Offset Column

The VNAV altitude and associated VNAV Offset (in NM) will be displayed immediately to the right of the Waypoint Identifier Column. In the case of an approach with a Final Approach Segment data block, the VNAV Offset readout associated with the Missed Approach Point will be "**GPI**" to designate distance to the Glidepath Intercept point. VNAV altitudes and offsets that come from the navigation database or that have been manually entered will be shown in white. VNAV altitudes and offsets that are computed automatically will be shown in gray. The vertical position of the VNAV and VNAV Offset Column elements will be aligned with the Waypoint Identifier Column elements to indicate that the VNAV information applies to the associated waypoint.

Note:

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

3.6.5. Path Column

The LNAV path between waypoints will be displayed immediately to the right of the VNAV and VNAV Offset Column. The following paths will be displayed:

1) Geodetic path between waypoints is displayed using the "Direct-To" symbol 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.

The vertical position of the Path Column elements will be offset from the Waypoint Identifier Column elements to indicate that the path information applies to the leg between waypoints.

3.6.6. Distance Column

The distance between waypoints will be displayed immediately to the right of the Path Column. The distance between waypoints will be calculated taking into account the associated path as well as parallel offsets. In the case of a discontinuity, the distance between waypoints will be the direct geodetic distance between the two waypoints. The vertical position of the Distance Column elements will be offset from the Waypoint Identifier Column elements to indicate that the distance information applies to the leg between waypoints.

3.6.7. Estimated Time Enroute Column

The ETE between waypoints will be displayed immediately to the right of the Distance Column. The ETE between waypoints will be calculated taking into account the associated distance between waypoints and current groundspeed. The vertical position of the Estimated Time Enroute Column elements will be offset from the Waypoint Identifier Column elements to indicate that the ETE information applies to the leg between waypoints.

3.6.8. Estimated Time of Arrival Column

The ETA at the active waypoint and all subsequent waypoints will be displayed immediately to the right of the Estimated Time Enroute Column. The ETA at the active waypoint will be calculated taking into account the associated time remaining on the active leg and current time. The ETA at subsequent waypoints will be calculated taking into account the cumulative ETEs and current time. The vertical position of the Estimated Time of Arrival Column elements will be aligned with the Waypoint Identifier Column elements to indicate that the ETA information applies to the associated waypoint.

3.6.9. Fuel Remaining Column

The fuel remaining at the active waypoint and all subsequent waypoints will be displayed immediately to the right of the Estimated Time of Arrival Column. The 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. The fuel remaining at subsequent waypoints will be calculated taking into account the cumulative ETEs, current fuel flow and current fuel quantity. The vertical position of the Fuel Remaining Column elements will be aligned with the Waypoint Identifier Column elements to indicate that 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:

- Path data (dashes)
- Distance data (dashes)
- ETE data (dashes)
- ETA data (dashes)
- Fuel remaining data (dashes)

3.7. Start Point

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

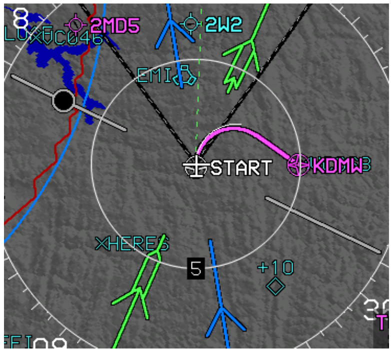


Figure 3-77: Start Point

3.8. Altitude Capture Predictor

3.8.1. Top of Descent

When a selected altitude or VNAV is specified on the PFD, the point at which a descent must be commenced will be marked with a T/D in the correct location on the flight plan path and contain location on the flight plan path with an indication of the glidepath angle used to calculate their position. That altitude will be captured and is 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.

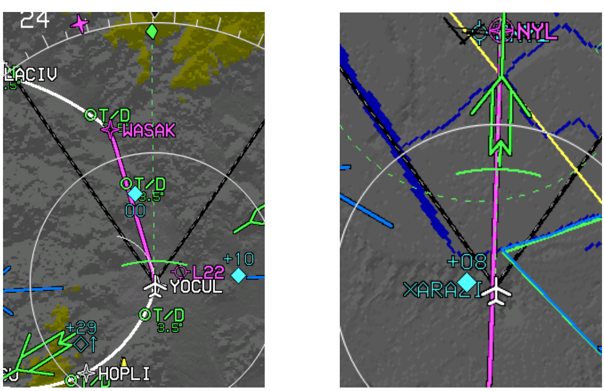


Figure 3-78: Top of Descent or Top-of-Climb

3.9. Projected Path

When the aircraft is in a bank angle, a projected path will emanate from the ownship symbol. This curving path will be based upon the aircraft bank angle and ground speed as it projects one minute into the future up to a maximum of 180° of turn.

The Projected path or "**Noodle**" can be used effectively to assist in course interception and making small adjustments to bank angle for proper roll out.

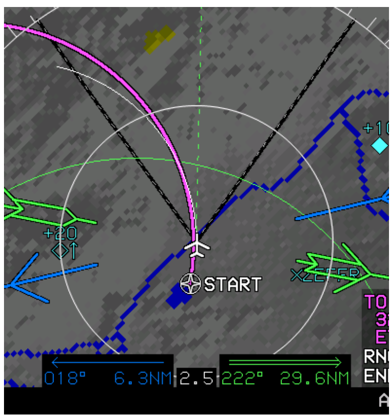


Figure 3-79: Projected Path

3.10. 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 will be shown on the ND in its correct relationship to the ownship symbol. The active flight plan path depiction meets all the requirements of GPS/SBAS path definition and will match the 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 will be 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

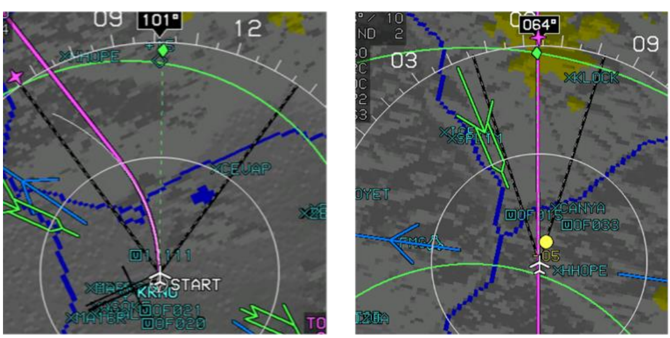
When there is an active waypoint and the GPS/SBAS OBS setting is manual, the manual course through the waypoint will be shown as a pointer centered on the waypoint. The pointer will match the lateral navigation guidance given on the PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes and mini-map).

The active flight plan path's active leg/manual course and active waypoint will normally be colored magenta and will turn yellow in the event of a GPS Loss of Navigation caution.

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

3.11. FOV Indication

The ND background will indicate 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 Field of View **Narrow Field of View**

Figure 3-80: Field of View

3.12. Range

The range ring is a white ring (centered on the aircraft's position) used to quickly estimate distances. Distance (in nautical miles) from the aircraft to the ring is shown as a white figure, overlaying at 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. The overall map scale ranges can be set to .5, 1, 2.5, 5, 10, 25, 50, 100, and 200NM by rotating the #2 or #1 encoder as appropriate.

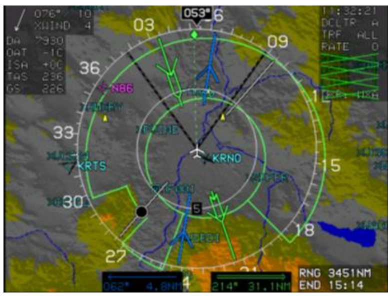


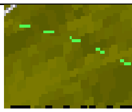
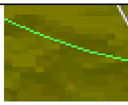
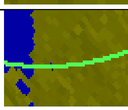
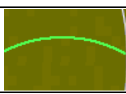
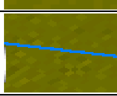
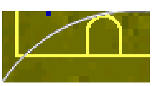
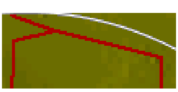
Figure 3-81: Range

3.13. Navigation Data

The ND displays navigation data in its correct relationship to the ownship symbol with Navigation data symbols which include airport symbols, NDBs, and user waypoints. It is possible to show high altitude and low altitude airways.

Figure 3-82: Navigation data and airspace depiction

Table 3-18: 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	YELLOW
 Prohibited Areas, Restricted Areas, Temporary Flight Restricted Areas (When equipped with Datalink)	RED

The ND has manual and automatic decluttering of navigation data. There are 6 levels of automatic declutter based upon the number of navigation data symbols that can potentially be drawn in the current ND format and range. Decluttering will be 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) **VOR**s: 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.

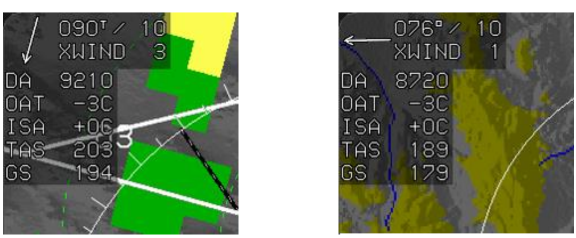
4) **Fixes** (including User Waypoints): Manually or automatically decluttered. In automatic declutter mode, enroute fixes are shown in level 1. Terminal fixes are manually selected and not shown in automatic declutter mode. Enroute fixes, terminal fixes and user waypoints can be manually decluttered separately from each other.

5) **High Altitude Airways**: Manually selected.

6) **Low Altitude Airways**: Manually selected.

7) **Airspace**: Manually selected.

3.13.1. Air Data and Groundspeed



True North Mode **Normal Mode**

Figure 3-83 Air Data and Groundspeed

The following data items are displayed in the upper left corner of the ND as seen above:

1) Wind: Wind information consists of the following readouts:

- Direction in degrees;
- Speed in knots;
- Crosswind component in knots; and
- Graphical wind vector arrow oriented to correspond to the ND orientation.

If referenced to magnetic North, the direction readout will use the degree ("°") symbol. Otherwise, a stylized True North ("T") symbol will be used. Wind information will not be shown when indicated airspeed is in the noise range generally, less than 30 KIAS or when the aircraft is in Ground Mode.

2) Outside Air Temperature: Digitally in Degrees C or F (as configured).

3) International Standard Atmosphere: The difference between International Standard Atmosphere ("ISA") temperature and current outside air temperature is displayed digitally in Degrees C or F (Negative values = less than Standard OAT)

4) Density Altitude: Digitally in feet.

5) True Airspeed: Digitally in knots.

6) Groundspeed: Digitally in knots.

3.13.2. Analog Navigation Symbology

When selected, the ND can display analog (VOR1, and VOR2) navigation symbology when valid as depicted below:

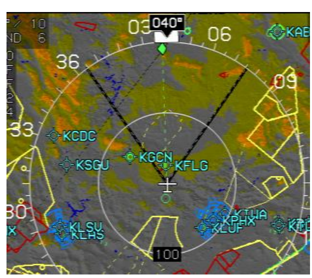
Figure 3-84: Analog Navigation Symbology

When the VOR1 and or VOR2 pointers are selected for display, a bearing and distance display for the selected VOR pointers appear at the bottom of the ND view. (Blue for VOR1 and Green for VOR2). If the DME channel is in hold mode, the associated distance readout will be displayed in yellow and the letter "**H**" will be shown above the distance readout.

3.13.3. Borders

National and United States state borders will be drawn if selected at map scales of 50NM or greater. The borders are drawn in black if the ND background includes terrain. Otherwise, the borders will be drawn in white.

State Borders drawn



Without State Borders drawn

Figure 3-85: Borders

3.13.4. Terrain / Obstructions

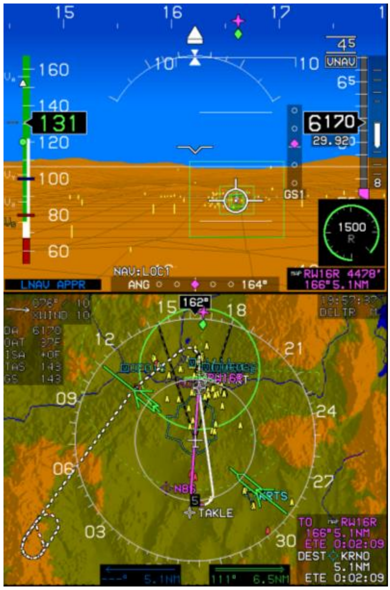


Figure 3-86: Terrain / Obstructions

Terrain is displayed on the ND in its correct relationship to the ownship symbol. Terrain will be shown using color to show relationship to aircraft altitude as follows:

Table 3-19: Terrain display on Navigation display color relationship to aircraft altitude

Based on Aircraft Altitude	Color	Notes #
Terrain More than 2000' below	Shades of Gray	#1
Terrain within 2000' and below	Shades of Olive	#1
Terrain at or above	Shades of Brown	#1
FLTA alerts	Amber and Red	#2
Water at All altitudes	Deep Blue	#3

Note #1 The shade used is determined by the slope between adjacent terrain pixels in an increasing longitude direction.

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

Note #3 Areas of water and takes precedence over other colors.

Figure 3-87: Obstructions

Obstruction symbols will be displayed on the ND in their correct relationship to the ownship symbol and shown using color to show relationship to aircraft altitude as follows:

Table 3-20: Obstructions		
Lateral Distance Away	8.5 NM	Not depicted on the ND
Vertical Criteria	More than 2000' below the aircraft	Not depicted on the ND
	Within 2000' but more than 500 below the aircraft	Are depicted in amber
	Within 500' but below aircraft	Are depicted in light red
	At or above aircraft altitude	Are depicted in deep red.

Terrain and obstruction rendering is user-selectable to allow the user 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 for Obstructions causing TAWS Alarms and depiction of separate symbology.

3.14. Pan Mode

The ND screen has a pan mode to allow the user to change the location of the center of the screen away from current location. The purpose of pan mode is to allow the user to view map details along the route of flight and at the intended destination or alternate destination while either in flight or on the ground. When pan mode is active, labeled buttons are used to move the pan mode 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 from the display as shown in Figure 3-88.

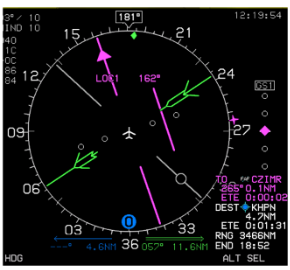
Figure 3-88: Pan Mode

Figure 3-88 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 will use 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 will be highlighted with a flashing circle as seen in this figure 3-87. Buttons are labeled to allow for viewing or hiding waypoint information (including datalink weather information associated with that point).

When exiting the pan mode, all previous settings are restored which were in place before the pan mode was enabled.

3.15. HSI Screen

The ND when selected, can display 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 will be yellow; otherwise the pointer color will remain magenta as seen in Figure 3-89.



Normal Magenta Pointer color

GPS Loss of Navigation condition

Figure 3-89: HSI pointer color

3.15.1. HSI Screen VDI

A vertical deviation indicator appears as seen if figure 3-89 when the VDI source is valid to display vertical deviation information for the currently selected navigation source. When the selected vertical 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 being displayed on the top of the VDI to avoid clutter with Waypoint information below.

For clarification the conformance to VDI display requirements are as specified in § 3.3.25 above.

- VNV1-B: Default FMS barometric VNAV mode.
- VNV2-B: Default FMS barometric VNAV mode.

- GS1: Glideslope #1

- GS2: Glideslope #2

3.15.2. Analog Navigation Symbology

The HSI has the capability when selected, to display analog (VOR1 (Blue) 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 3-89. If a DME channel is in hold mode, the associated distance readout will be displayed in yellow rather than blue or green and the letter “H” will be shown above the distance readout as seen in figure 3-90.

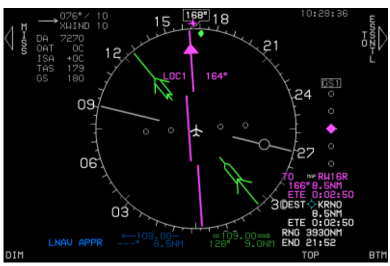


Figure 3-90: Analog Navigation display VOR1 and VOR2

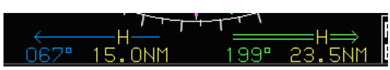


Figure 3-91: HSI Bearing Distance readout with DME in HOLD

Radio tuning can be handled by the Audio-Radio page of the EFIS. If a DME receiver is interfaced for frequency tuning by the EFIS, when the VOR1 pointer is selected for display, the NAV1 frequency will be displayed in blue over the VOR1 pointer in the bearing/distance display. If a DME receiver is interfaced for frequency tuning by the EFIS, when the VOR2 pointer is selected for display, the NAV2 frequency will be displayed in green over the VOR2 pointer in the bearing/distance display. (See fig 3-91a)

Figure 3-91a: 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 associated frequency displayed will be that DME's channel hold frequency shown in yellow. (See Fig 3-91b)

Figure 3-91b: HSI Bearing Distance readout with DME in HOLD

Valid Marker Beacon discretes will be displayed as indicators on the PFD and ND HSI display as seen in figure 3-91 with appropriate coloring markings. Only during a built-in-test, more than one marker beacon can be active. The display of marker beacons is disabled when the NAV source is FMS.

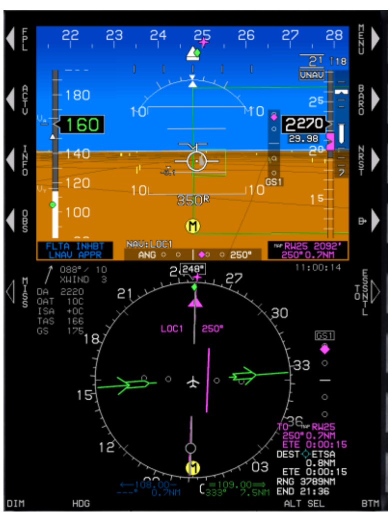


Figure 3-92: HSI with Marker Beacon displayed

3.15.3. Air Data and Groundspeed

The air data and groundspeed are displayed as shown in figure 3-93 and the same as explained as specified in § 3.14.1 above.

Figure 3-93: HSI display Air Data and Groundspeed

3.15.4. Clock / Timers / Options

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

Zulu Time: As specified in § 3.5.10 above.

Timer: As specified in § 3.5.10 above.

HSI Source: Shown when the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation, the HSI source will be yellow; otherwise the HSI source will be white.

OBS: The OBS setting associated with the HSI source will be shown. When the HSI source is FMS, the FMS OBS setting will match the OBS setting shown on the PFD FMS CDI. The FMS OBS setting will be labeled with an "**A**" for automatic or "**M**" for manual. When the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition, the OBS setting will be yellow; otherwise, the OBS setting will be white.

CDI Scale: The current CDI scale will be shown and match 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 will be yellow. Otherwise, the CDI scale will be white.

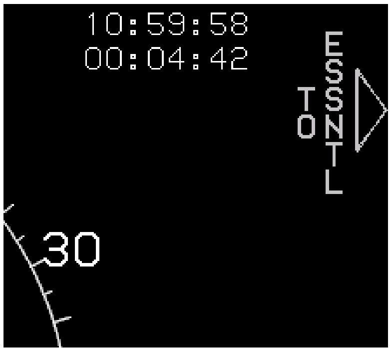


Figure 3-94: HSI Clock / Timers

3.15.5. Fuel Totalizer/Waypoint Bearing and Distance Functions

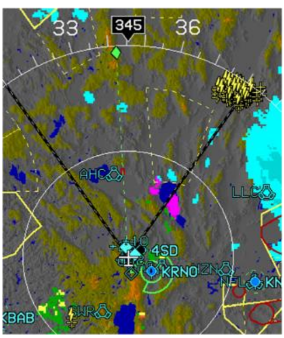
Fuel totalizer, waypoint bearing and waypoint distance is displayed in the lower right corner of the HSI as specified in § 3.6.9 above.

Figure 3-95: HSI Fuel Totalizer / Waypoint Bearing

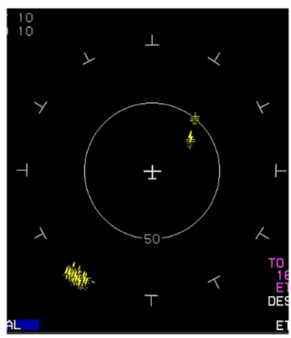
3.16. WX-500 Data

When selected, the ND displays Cell Mode lightning strikes in their correct relationship to the ownship symbol with the following limits:

Table 3-21: 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 Mins. old	Shown with large cross symbol
Strikes between 2 Mins. and 3 Mins. old	Shown with small cross symbol



ND lightning display



Strike Screen Display Format

Figure 3-96: Lightning symbols

The user can select either an arced or centered display format with the ownship displaced toward the bottom of the screen so that strike data can be 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.

3.16.1. Strike Screen Range

The following strike screen ranges can 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 will be 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 so that the user can ascertain the current strike screen setting.

3.16.2. Active Flight Plan Path/Manual Course/Runways

Figure 3-97: 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 will be shown on the strike screen in its correct relationship to the ownship symbol. The active flight plan path depiction is as specified in § 3.10 above.

When there is an active waypoint and the GPS/SBAS OBS setting is manual, the manual course through the waypoint will be shown as a pointer centered on the waypoint. The pointer will match 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 will normally be colored magenta and will turn yellow in the event of a GPS Loss of Navigation caution.

The strike screen can display airport runways in their correct relationship and scale to the ownship symbol as specified in § 3.10 above.

WX-500 Status: WX-500 strike status data will be shown as described in the following table:

Table 3-22: WX-500 Status

Condition	**Annunciation**
System Normal, Strikes Selected	"**RATE ###**" Depicts Current Strike Rate Strike Symbols Shown
System Normal, Strikes De-selected	"**STRIKES**" Overlaid with Green "X" Strike Symbols Removed
System Failed	"**STRIKES**" Overlaid with Red "X" Strike Symbols Removed
System in Test Mode	"**STRK TST**" Shown Strike Symbols Removed

A new strike rate value will be calculated every 5 seconds during normal operation, based upon strikes within the selected display range. The number of fresh strikes (less than 20 seconds old), are used to generate a strike rate that represents strikes per minute. Strike rate increases will be displayed immediately upon calculation while decreases in strike rate will be damped. Activating the strike clear function will reset the strike rate to zero.

3.17. Dedicated Traffic Screen

When selected, a traffic screen is available based roughly on the appearance of a TCAS display. The traffic screen has the following elements:

3.17.1. Ownship Symbol

Figure 3-98: Dedicated Traffic Screen Ownship Symbols

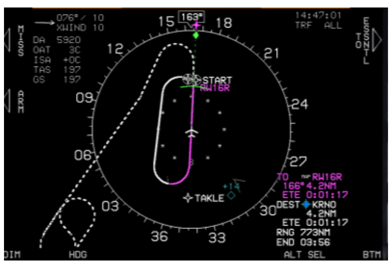


Figure 3-99: Traffic Display Format

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. The compass rose is aligned with either magnetic North or True North depending upon the status of the True North discrete input.

3.17.2. Traffic Screen Range

The following 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, and has a radius of half the range in 20NM, 50NM and 100NM ranges and presented on the TCAS range ring (i.e., 3NM, 10NM, 25NM or 50NM).

3.17.3. Compass Rose Symbols

Normal Mode

True North Mode

Figure 3-100: Traffic Screen Range Compass Rose Symbols

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 § 3.6.8 above. 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 that corresponds with predicted climb or descent distance (based upon current VSI). A top of descent symbol will be 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 will not be displayed when groundspeed is less than 30 knots. A user-settable heading bug that geometrically interacts with the heading pointer will appear on the compass rose. A magenta, star-shaped waypoint pointer will be displayed on the heading scale at a point that corresponds with the active waypoint and will turn yellow in the event of GPS Loss of Navigation caution.

3.17.4. 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 its correct relationship to the ownship symbol. The active flight plan path depiction will meet all the requirements of GPS/SBAS path definition and match 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 will be 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 will be shown as a pointer centered on the waypoint and will match 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 will normally be colored magenta and turn yellow in the event of a GPS Loss of Navigation caution.

The traffic screen will display airport runways in their correct relationship and scale to the ownship symbol as specified in § 3.10 above.

3.18. Datalink Symbology

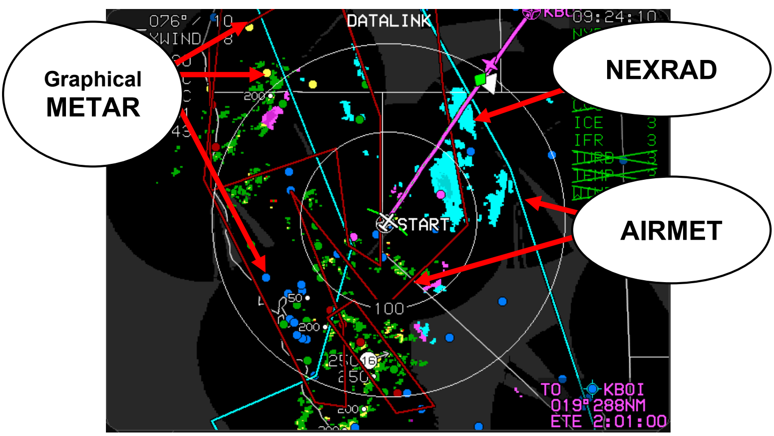


Figure 101: Datalink Symbology

When individually selected, the ND can display and annunciate status for Temporary Flight Restriction, NEXRAD radar, graphical METAR and Lightning ground strike data. Only the following products received are supported and may be displayed according to the following table:

Table 3-23: WSI Inflight™Data Products	
Temporary Flight Restriction Data	Available if included in user subscription
NEXRAD Radar Data	Available if included in user subscription
Graphical METAR Data	Available if Textual METAR data is included in user subscription. Derived from Textual METAR data using EFIS algorithm.
Lightning Ground Strike Data	Available if included in user subscription

Datalink Temporary Flight Restriction Data Status: When Temporary Flight Restriction Data has not been completely downlinked, such status will be annunciated as the word "**TFR**" with an overlying red "X."

Temporary Flight Restrictions (TFRs) will be displayed on the ND in their correct relationship to the ownship symbol. The NEXRAD Radar Data will be displayed on the ND in its correct relationship as colored regions of precipitation using the following convention:

Table 3-24: Datalink NEXRAD Radar Data

Color	**Meaning**
Gray Shading	Areas beyond the limits of radar coverage or areas with missing data
Magenta	Rain >= 50dBZ
Red	Rain >= 45dBZ and < 50dBZ
Light Red	Rain >= 40dBZ and < 45dBZ
Yellow	Rain >= 30dBZ and < 40dBZ
Green	Rain >= 20dBZ and < 30dBZ
Cyan	Snow >= 20dBZ
Light Cyan	Snow >= 5dBZ and < 20dBZ
Magenta	Mixed Precipitation >= 20dBZ (Note: Area is distinguishable from Rain >= 50dBZ by graphical context)
Light Magenta	Mixed Precipitation >= 5dBZ and < 20dBZ

Echo tops (the vertical height of NEXRAD Radar Data returns) will be displayed on the datalink screen in their correct relationship to the ownship symbol. Echo tops will be automatically decluttered at 400NM, 800NM and 1,600NM screen ranges. Major echo tops (i.e., the group of highest returns on the currently displayed datalink screen) will be displayed as a large circle containing a textual readout of speed and a graphical arrow indicating direction of travel. The height of the major echo top, in hundreds of feet, will be textually displayed to the right of the major echo top symbol. The echo top symbol will be color-coded and present amplifying text as follows:

Table 3-25: 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 their correct relationship to the ownship symbol. Graphical METARs are displayed as a large color-filled circle in accordance with the following convention:

Table 3-26: Datalink Graphical METARs

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

Table 3-27: 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 be displayed in the menu system "nearest airport," "nearest weather," and "info" functions as seen in Figure 102.

Figure 102: NRST airport INFO

Graphical weather conditions data is displayed in the menu system "info" function as a large colored square as per the following convention:

Table 3-28: Datalink Graphical METAR Precip	
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 data can be displayed on the datalink screen:

Lightning ground strikes: In their correct relationship to the ownship symbol as a yellow, small cross symbol.

Convective SIGMET: As magenta line segments showing the boundary of the area in its correct relationship to the ownship symbol. It is possible for the pilot to view the text of individual convective SIGMETs. When viewing such text, the associated convective SIGMET symbol will flash.

Icing AIRMET and SIGMET: As cyan line segments showing the boundary of the area in its correct relationship to the ownship symbol. It is possible for the pilot to view the text of individual icing AIRMETs and SIGMETs. When viewing such text, the associated icing AIRMET or SIGMET symbol will flash.

IFR AIRMET and SIGMET: As red line segments showing the boundary of the area in its correct relationship to the ownship symbol. It will be possible for the pilot to view the text of individual IFR AIRMETs and SIGMETs. When viewing such text, the associated IFR AIRMET or SIGMET symbol will flash.

Turbulence AIRMET and SIGMET: As yellow line segments showing the boundary of the area in its correct relationship to the ownship symbol. It will be possible for the pilot to view the text of individual turbulence AIRMETs and SIGMETs. When viewing such text, the associated turbulence AIRMET or SIGMET symbol will flash.

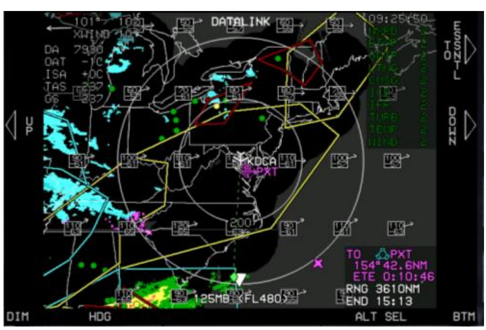


Figure 103: Datalink Winds and Temperature aloft

Winds and temperature aloft data can be displayed on the datalink screen in their 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 flag) 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.

Textual METAR and TAF data will be displayed when appropriate in the menu system "info" function. Note that time of observation and forecast are contained within the text.

3.18.1. 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 as seen in figure 104.

Figure 104: Datalink Screen Legend

3.18.2. Air Data and Groundspeed

Air data and groundspeed will be displayed in the upper left corner of the datalink screen as specified in § 3.13.1 above.

3.18.3. Clock/Timers/Options

Figure 3-105: Clock /Timers/Options

The following data items are displayed in the upper right corner of the ND:

Zulu Time: As specified in § 3.5.10 above.

Timer: As specified in § 3.5.10 above.

Datalink Weather Status: The status of datalink products will be displayed as follows:

Datalink Temporary Flight Restriction Data Status: When the Temporary Flight Restriction Data has not been completely downlinked, such status will be annunciated as the word “**TFR**” with an overlying red “X.”

Datalink Weather Status: When the status of NEXRAD radar, graphical METARs and lightning ground strike data will be displayed as follows:

Table 3-29: Datalink NEXRAD Radar Status

Condition	**Annunciation**
NEXRAD Radar Status:	
NEXRAD Radar never completely downlinked	No Annunciation
NEXRAD Radar downlinked within last 5 minutes and selected for display (weather radar, if installed, deselected from display).	“NXRD ##” drawn in Green where ## is age in minutes. NEXRAD Radar shown on display.
NEXRAD Radar downlinked within last 5 minutes and deselected from display or weather radar, if installed, has been selected for display.	“NXRD ##” drawn in Green where ## is age in minutes. “NXRD ##” overlaid with Green “X” NEXRAD Radar not shown on display
NEXRAD Radar not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display (weather radar, if installed, deselected from display).	“NXRD ##” drawn in Yellow where ## is age in minutes. NEXRAD Radar shown on display.

Table 3-29: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
NEXRAD Radar 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.	"NXRD ##" drawn in Yellow where ## is age in minutes. "NXRD ##" overlaid with Green "X" NEXRAD Radar not shown on display
NEXRAD Radar 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 Radar 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" NEXRAD Radar not shown on display
NEXRAD Radar 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

Table 3-29: Datalink NEXRAD Radar Status

Condition	Annunciation
METARs downlinked within last 5 minutes and selected for display	"GMTR ##" drawn in Green where ## is age in minutes. Graphical METARs shown on display.
METARs downlinked within last 5 minutes and deselected from display	"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	"GMTR ##" drawn in 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	"GMTR ##" drawn in Yellow where ## is age in minutes. "GMTR ##" overlaid with Green "X" Graphical METARs not shown on display
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	"GMTR ##" drawn in Red where ## is age in minutes. "GMTR ##" overlaid with Green "X" Graphical METARs not shown on display

Table 3-29: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
METARs not downlinked within last 75 minutes (timed-out)	“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	“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 for display	“LTNG ##” drawn in Yellow where ## is age in minutes. Lightning Ground Strikes shown on display.
Lightning Ground Strikes not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display	“LTNG ##” drawn in Yellow where ## is age in minutes. “LTNG ##” overlaid with Green “X” Lightning Ground Strikes not shown on display

Table 3-29: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
Lightning Ground Strikes not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display	"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	"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)	"LTNG XX" drawn in Red "LTNG XX" overlaid with Red "X" Lightning Ground Strikes not shown on display

3.18.4. Datalink Screen Orientation

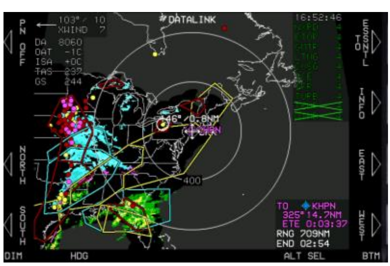


Figure 3-106: Datalink

The datalink screen will always be displayed in North-up orientation and have a boundary circle instead of a compass rose. A

"**DATALINK**" label appears above the boundary circle, and, if not in pan mode, the ownship symbol aligns with aircraft heading.

3.18.5. Datalink Screen Range

When selected the following datalink screen ranges are available as follows:

Table 3-30: Datalink Screen Range Values

Distance from the 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

3.18.6. Boundary Circle Symbols

Figure 3-107: Boundary Circle Symbol

A white triangular heading pointer aligned with the longitudinal axis of the ownship symbol will appear 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 will be displayed on the lubber line at a point that corresponds with predicted climb or descent distance (based upon current VSI). A top of descent symbol will be shown as specified in § 3.8.1 above;

however this will not be displayed when groundspeed is less than 30 knots. A user-settable heading bug that geometrically interacts with the heading pointer appears on the boundary circle. A magenta, star-shaped waypoint pointer is displayed on the boundary circle at a point that corresponds with the active waypoint. The waypoint pointer will turn yellow in the event of GPS Loss of Navigation caution. Note that boundary circle symbols will not be drawn if the datalink screen is in pan mode.

3.18.7. 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 can be selected and shown on the datalink screen in its 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 will match 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 will normally be colored magenta and will turn yellow in the event of a GPS Loss of Navigation caution.

The datalink screen will display airport runways in their correct relationship and scale to the ownship symbol as specified in § 3.5.2 above.

3.18.8. Borders

National and United States state borders are drawn in white in their correct relationship to the ownship symbol.

3.18.9. Pan Mode

The datalink screen has a pan mode to allow the user to change the location of the center of the screen away from current location. The purpose of pan mode is to allow the user to view weather conditions along the route of flight and at the intended destination or alternate destination. When pan mode is active, scrolling encoder #1 (or #2 as applicable) allows the user to move the pan mode location North, South, East and West. When pan mode is active, a line from the map center to the aircraft's current position will be drawn. When pan mode is active 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 § 3.14 above). When panning, the nearest displayed graphical METAR symbol within the inner range ring becomes highlighted with a flashing circle. When such a point is highlighted, dedicated buttons are present to allow the user to view and hide the waypoint information (including datalink weather information) associated with that point. When a USR waypoint is designated in Pan Mode drop down targets are created at new and original positions.

3.19. Weather Radar

Weather Radar automatically declutters when weather radar returns are selected for display on the ND map screen in its correct relationship to the ownship symbol unless inhibited during active FLTA alerts. When Weather Radar is selected for display, datalink NEXRAD is automatically deselected. The following table defines all inhibited factors with display:

Table 3-31: 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)

Figure 3-108 Weather Radar image on ND

3.19.1. Weather Screen Format

In a horizontal depiction, the weather screen will use 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 3-109 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 with the weather area depicted as an arc to the right of the ownship symbol as in Figure 3-110.

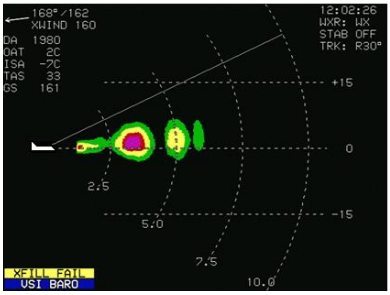


Figure 3-110: Radar image in profile depiction

User selection of the profile depiction is performed using a separate Weather Radar Control Panel that is connected to the IDU. The IDU will ensure that 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 user sets up the screens such that no weather radar page is shown on any weather radar-enabled screen. The purpose of this is to maximize the availability of weather radar information on the ND screen. The ND screen can only show a horizontal depiction and will automatically disable profile depiction if the weather radar mode is set to off or standby via Radar Control Panel.

3.19.2. Weather Screen Range

Weather screen range is pilot-selectable with selection made through either encoder #1 (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 will be four equidistant dashed arcs. When in 2.5NM range, there will be five equidistant dashed arcs. Each arc will be 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 will also be 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 will be level with the ownship symbol to represent the aircraft's altitude. The other two lines will be 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.

3.19.3. 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 will be displayed adjacent to the outer end of the track line.

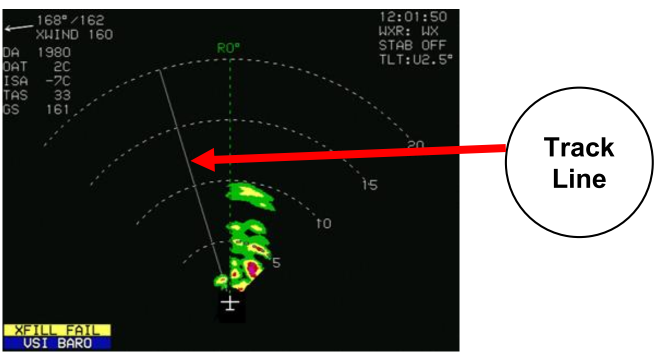


Figure 3-111: Radar Track Line

3.19.4. Active Flight Plan Path/Manual Course/Runways

The active flight plan path (when selected), waypoints and manual course appear as specified in § 3.10 above when the weather radar screen is showing horizontal depiction.

The weather radar screen will display airport runways as specified in § 3.10 above when the weather radar screen is showing horizontal depiction.

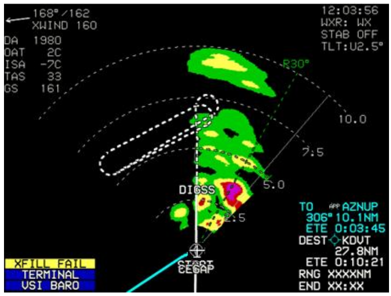


Figure 3-112: Radar Active Flight Plan

Weather radar data will be displayed as colored regions according to the value found in the following table:

3.19.5. Weather Radar Return Data

Weather radar return data will be displayed on the weather radar screen in its correct relationship to the ownship symbol.

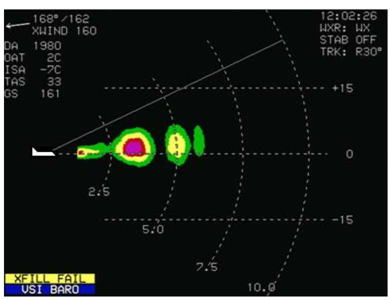


Figure 3-113: Radar Return data

Weather radar return data will be displayed as colored regions according to the value of the ARINC 453 3-bit range bins as follows:

Table 3-32: Weather Radar Return Data

ARINC 453 3-Bit Range Bin	Color	Meaning
000b		No Returns
001b	GREEN	Low-Level Weather or Low-Level Ground Returns
010b	YELLOW	Mid-Level Weather or Mid-Level Ground Returns
011b	RED	Third-Level Weather Returns. Note that this color should be 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 an RDR-2000 or RDR-2100 weather radar type, this color alternates between MAGENTA and BLACK at 1Hz when the internal submode is WXA.
101b	CYAN	Automatic Range Limit Returns. Indicates areas of unreliable returns due to radar power absorption.
110b	LIGHT GRAY	Moderate Turbulence Returns.
111b	WHITE	Severe Turbulence Returns.

The following weather radar-specific warning will appear in a conspicuous area adjacent to the weather radar return data such that they do not conflict with the weather radar return data:

- ANT FAULT: Shown when the weather radar antenna is temporarily dislodged by turbulence.

- STAB LIMIT: Shown when the aircraft attitude has moved to a point where the weather radar antenna can no longer by effectively stabilized. A stability limit condition is indicated by ARINC 453 label 055 or label 171 Bit 18.

- TURB ALRT: Shown when a turbulence alert condition is active. A turbulence alert condition is indicated by ARINC 453 label 055 Bit 14. Note that Honeywell Primus and Honeywell RDR-2000/2100 do not set this bit.

- WX ALRT: Shown when a weather alert condition is active. A weather alert condition is indicated according to weather radar type as follows:

-ARINC 708-6:	ARINC 453 label 055 Bit 15
-Collins 800/840:	ARINC 453 label 055 Bit 15
-Honeywell Primus:	ARINC 453 label 055 Bit 12
-Honeywell RDR-2000/2100:	ARINC 453 label 055 or label 171 Bit 20

Only one weather radar-specific warning will appear at any given time, with the following order of precedence:

- WX ALRT;
- TURB ALRT;
- STAB LIMIT;
- ANT FAULT

3.19.6. Air Data and Groundspeed

Air data and groundspeed will be displayed in the upper left corner of the weather radar screen as specified in § 3.13.8 above.

3.19.7. Clock/Timers/Options

Figure 3-114: Radar Clock/Timer/Options

1) Zulu Time: Zulu time information will be displayed as specified in § 3.5.10 above;

2) Timer: A countdown timer or count-up timer will be displayed as specified in § 3.5.10 above;

3) Weather Radar Mode Annunciation will be as follows:

Table 3-33: 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 3-34: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
Overlaid with Red X	Weather Radar Mode is off or not defined. A Cooling Fault Condition exists. An Attitude or Range Fault Condition exists. A Control Fault Condition exists. A T/R Fault Condition exists. A Control Fault Condition exists. A T/R Fault Condition exists.
STAB OFF (Stabilization)	The weather radar mode annunciation is not overlaid with a Red “X”; The weather radar mode is not standby or forced standby; and The weather radar indicates that stabilization is off.
TGT ALERT **(Target Alert)**	The weather radar mode annunciation is not overlaid with a Red “X”; The weather radar mode is not standby or forced standby; The 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, can appear – use “**U**” for **0°**); **XX.X** represents the absolute value of the tilt angle in degrees truncated to the nearest tenth;

Table 3-34: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
	“**TLT:AUTO**” is used where the weather radar reports a value of -16°, representing automatic tilt. The weather radar tilt annunciation will only appear when all of the following conditions are true: The weather radar mode annunciation is not overlaid with a Red “X”; The weather radar mode is not standby or forced standby; and The weather radar is not in Vertical Profile submode.
TRK:LXX (TRACK)	L = Left or Right (either L or R, but not both, can appear – use “R” for 0°); and XX represents the absolute value of the track angle in degrees. The weather radar track annunciation will only appear when all of the following conditions are true: The weather radar mode annunciation is not overlaid with a Red “X”; The weather radar mode is not standby or forced standby; and The weather radar is in Vertical Profile submode (profile depiction).
“GN:SXXDB,” “GN:CAL” or “GN:MAX” **(GAIN)**	S = Sign (either “+” or “-“, but not both, can appear – use “+” for 0°); and **XXDB** represents the manual gain setting in decibels.

Table 3-34: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
	"**GN:CAL**" represents the calibrated condition "**GN:MAX**" represents maximum manual gain The weather radar manual gain annunciation will only appear when all of the following conditions are true: The weather radar mode annunciation is not overlaid with a Red "X"; The weather radar mode is not standby or forced standby; and The weather radar mode is Ground Map.

3.19.8. Fuel Totalizer/Waypoint Bearing and Distance Functions

Fuel totalizer, waypoint bearing and waypoint distance will be displayed in the lower right corner of the weather radar screen as specified in § 3.6.9 above.

3.20. 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: When no video signal is detected, the video input screen is black with the annunciation displayed in white centered on the screen. To aid in diagnosing problems with undetected video signals, the following annunciations is displayed below this annunciation in white centered on the screen:

NO INTERLACED SIGNAL: When there is no interlaced signal detected, the system will display

NO HORIZ OR VERT SYNC: When there is no horizontal or vertical synchronization detected, the system will display

NO COLOR SIGNAL: When there is no video chroma signal detected, the system will display

LOAD ERROR DETECTED: When the video chip reports a load error, the system will display

TRIGGER ERROR DETECTED: When the video chip reports a trigger error, the system will display

PROGRAMMING ERROR DETECTED: When the video chip reports a programming error, the system will display

3.20.1. ZOOM Level

The user is able to zoom the video image by replicating pixels to a desired ZOOM levels from 1 (no pixel replication) to 10 in increments of 1.

3.20.2. Pan Mode

When the ZOOM level is greater than 1, the Video Input screen has a pan mode to allow the user to select the portion of the video image displayed by replicating pixels. When pan mode is active, controls are present to allow moving the portion displayed Up, Down, Left and Right. A mini-map of the displayed image’s position in the full video image will be displayed for 10 seconds after:

- Entering pan mode,
- Changing the ZOOM level to a value greater than 1,
- Panning the zoomed image.

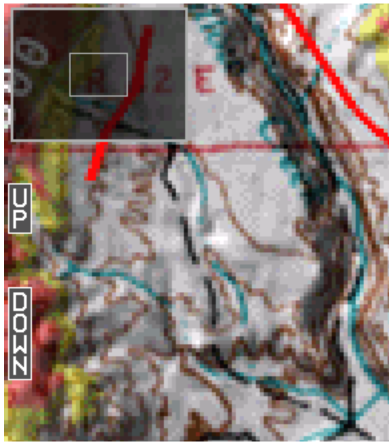


Figure 3-115: Video Pan view

Exiting the pan mode will remove the pan mode controls and the mini-map, if any.

3.20.3. Video Input Status Display

The following data items will be optionally displayed in the upper right corner of the Video Input display:

Label: When selected by the pilot, a label is displayed identifying the video input source and is configurable to one of a set of predefined labels. If no label is configured, the label will be '**VIDEO-n**' where '**n**' is the video input source number.

ZOOM: When selected by the pilot, the amount of pixel expansion is displayed as "**ZOOM nnX**" where '**nn**' is the ZOOM level.

Brightness: When selected by the pilot, the video brightness setting will be displayed. The setting will be formatted as "**BRT nnn%**" where '**nnn**' is the brightness setting as a percentage of the maximum value.

Contrast: When selected by the pilot, the video contrast setting will be displayed. The setting will be formatted as "**CTRST nnn%**" where '**nnn**' is the contrast setting as a percentage of the maximum value.

Saturation: When selected by the pilot, the video chroma saturation setting will be displayed and is formatted as "**SAT nnn%**" where '**nnn**' is the saturation setting as a percentage of the maximum value.

Hue: When selected by the pilot, the video chroma hue setting will be displayed and formatted as "**HUE nnn%**" where '**nnn**' is the hue setting as a percentage of the maximum value.

Figure 3-116: Video Status

3.21. Audio/Radio Page

The Audio/Radio page is a common interface for managing multiple devices. It allows the selection of devices, changing of frequencies, settings, modes, volumes and other values for the devices.

Figure 3-117: Audio Radio Page Format

The AR page displays the interfaced audio and radio devices configured for the EFIS displays.

3.21.1. Common Symbols

Some symbols are common for different lines of the AR page.

Device Label

Each line of the AR page displays a label up to 5 characters long in gray for the device represented by that line.

Line Select

Each device is user-selectable indicated by a gray rectangle drawn around the line for that device.

Figure 3-118: Device Label Line select

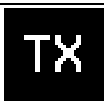
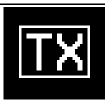
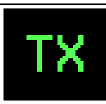
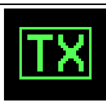
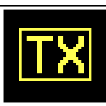
Fail

When communications from a device have ceased for more than 2 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 displayed.

Figure 3-119: Device Failure indication

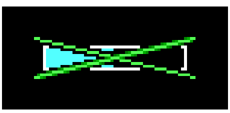
TX Indicator

Table 3-35: TX Indicator symbols

Symbol	Meaning	Notes
	A transceiver has been selected for transmit on the line for that device.	Only displayed for one device at a time.
	When the device is actively transmitting.	
	Confirmed the transmit selection	When an AMU is in use.
	Confirms the device is actively transmitting.	When an AMU is in use.
	Confirms the device indicates there is a stuck microphone.	TX indicator and box will flash at 1 Hz rate.
	Indicates Split Transmit with same color as TX indicator.	When AMU is enabled to Split Transmit.

Level Bar

Table 3-36: Level Bar

Symbol	Meaning	Notes
	Indicates level as increasing from the left to right the magnitude of its value. The minimum of value is an empty level bar filled in black.	Indicates Volume or other attribute as indicated
	The volume is muted	When representing a volume and it has been muted.

Note:

When an audio management unit (AMU) fails, the line for the intercom will be displayed as shown in Figure 3-119. However, the failure of the AMU may cascade across the other devices. When the AMU fails, only the devices having audio control through those other devices' interfaces will display a volume level bar.

Selected Line Highlight

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 will be shown. The color of the rectangle will correspond to the encoder label color for the encoder which modifies the value within the rectangle.

Figure 3-122: Selected Line Highlighted

3.22. VHF COM Transceiver

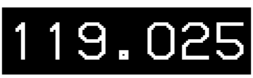
When VHF communication transceivers are configured for management from the audio/radio page, the AR page line for the device will be displayed as seen in the example views:

3.22.1. VHF COM Symbols

Figure 3-120: VHF Com Symbols

Table 3-37: VHF Com Transceiver Line Symbols

Symbol	Meaning	Notes
	The VHF Com Transceiver is selected for Transmit	When TX is selected
	Indication received from device that it is actively receiving	
	Active frequency in	When the device confirms the

Table 3-37: VHF Com Transceiver Line Symbols		
Symbol	**Meaning**	**Notes**
	magenta initially.	frequency selection, the Active Frequency will be light green.
	Will display a magenta “T” when in squelch mode.	When the device confirms the mode, the “T” will be light cyan.
	Will display the standby frequency in gray initially.	When the device confirms the frequency selection, the frequency will be white.
	Represents volume setting for the device.	When an AMU is present and not failed, the volume level of the VHF Com Transceiver indicates the volume setting of the AMU for the device.

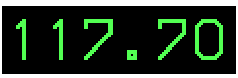
3.23. VHF NAV Receiver

When VHF navigation receivers are interfaced for management from the audio/radio page, the AR page line for the device will be displayed in the following manner:

3.23.1. VHF NAV Receiver Symbols

Figure 3-121: VHF NAV Receiver line symbols

Table 3-38: VHF NAV Receiver line Symbols

Symbol	Meaning	Notes
	Decoded station identifier	Only done with receivers able to decode an identifier. Will display up to five characters.
	Active frequency displayed in magenta initially	When the device confirms the frequency selection, the Active Frequency will be light green.
	DME receiver or channel associated with Navigation receiver is set to Hold Mode	
	Standby frequency	For devices that do not accept a standby frequency, this frequency will be white. For devices which can accept a standby frequency, when the device confirms the frequency selection, the standby frequency will be white. Localizer frequencies are not valid standby frequencies.
	Volume setting	When an AMU is present and not failed, the volume level of the VHF NAV Receiver line will indicate the volume setting of the AMU for the device.

3.24. ADF Receiver

When ADF receivers are interfaced for management from the audio/radio page, the AR page line for the device will be displayed in the following manner:

3.24.1. ADF Receiver Symbols

Figure 3-122: ADF Receiver Symbols

Table 3-39: ADF Receiver Symbols

Symbol	Meaning	Notes
	Active frequency initially displayed in magenta	When the receiver confirms the frequency selection, the active frequency will be light green.
	ADF initially displayed in magenta when device is set to ADF mode.	**"BFO"** will be displayed in magenta when the device is set to **BFO** mode and "**TST**" in magenta when the device is set to Test mode. "**REC**" will be displayed in magenta when the device is set to receive or antenna mode. When the ADF receiver confirms the mode selection, the mode will be displayed in light green.
	ADF Standby frequency initially displayed in gray.	When the receiver confirms the frequency selection the frequency will be white.

Table 3-39: ADF Receiver Symbols

Symbol	Meaning	Notes
	Volume setting for the ADF receiver.	When an AMU is present and not failed, the volume level of the ADF receiver indicates the volume setting of the AMU for the device.

3.25. Transponder

When a transponder is interfaced for management from the audio/radio page, the AR page line for the device will be displayed in the following manner:

3.25.1. Transponder Symbols

Figure 3-123: Transponder Symbols

Table 3-40: Transponder Symbols

Symbol	Meaning	Notes
	Altitude reported by transponder	When the altitude to be displayed is invalid, the displayed altitude will be shown as “---“. The displayed altitude is prefixed by cyan “FL and reported as 10’s of feet, in 3 digits with leading zeros, when set for display with flight level. The displayed altitude will be suffixed by cyan “M” and display the reported altitude in meters

Table 3-40: Transponder Symbols		
Symbol	**Meaning**	**Notes**
		when set for display as meters.
	Active transponder code initially displayed in magenta.	When the device confirms the code selection, the active transponder code will be light green.
	Transponder is reporting an active reply to an ATC interrogation.	
	Transponder is reporting an active position identification (“ident”)	
	Transponder standby code.	
	Standby mode initially displayed in magenta.	The transponder will display “GRD” in magenta when the device is initially set to ground mode, “ON” in magenta when set to ON mode and “ALT” in magenta when set to altitude mode. When the device confirms the mode selection, the mode will be displayed in white.

3.26. DME Receiver

DME receiver parameters are established through interfaces with VHF navigation receivers. When a DME receiver device is interfaced, the DME receiver will be displayed as an Audio-Only Device.

3.27. Intercom

When an audio management unit (AMU) is interfaced for management from the audio/radio page, the AR page line for the device will be displayed in the following manner:

3.27.1. Intercom Symbols

Figure 3-124: Intercom Symbols

Table 3-41: Intercom Symbols

Symbol	Meaning	Notes
	Voice operated switch	Represents VOX threshold and filter level applied to the intercom microphone before the AMU.
	VOX or Volume level bar	
	Volume level	Represents volume threshold of the intercom system representing the level of the spoken communications over the intercom system.

3.28. Audio-Only

Some devices can be interfaced for transmit enable and volume adjust through an AMU 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 will be displayed in the following manner:

3.28.1. Audio-Only Symbols

Figure 3-125: Audio-Only Symbols

Table 3-42: Audio-Only Symbols

Symbol	Meaning	Notes
	Name of device being controlled	
	Transmit enabled	These devises will lose the TX selection and volume adjustment if the controlling AMU fails.
	Volume level	

3.29. Marker Beacon Receiver

When marker beacon receivers are interfaced for management from the audio/radio page, the AR page line for the device will be displayed in the following manner:

3.29.1. Marker Beacon Receiver Symbols

Figure 3-126: Marker Beacon Receiver Symbols

3.30. Expanded AR Page

For devices managed by the AR page that have more features which the user needs to access than can be managed from the AR page interface, expanded pages will be developed. These pages show attributes specific to the device as well as the attributes for the device that can be seen on the full AR page. The first line of each expanded AR page displays the text and symbols of the AR page line for that device. When selected, the first line of each device's expanded AR page displays the Encoder highlighting of the AR page when selected for frequency, code, mode, or volume level adjustment.

Figure 3-127: Expanded page

Note:

See Section 5 for ADR 7050 Expand page details.

Section 4 Reversionary Modes

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List of Figures & Tables

4.1. Reversionary Modes

The equipment has 8 reversionary modes as follows:

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

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

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

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

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

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

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

Mode 7: GPS, ADC and AHRS failed.

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

All possible IDU-680 display configurations and format combinations are not represented here. All 8 modes of System Operation are represented for description purposes.

System operation in the above modes will be as follows:

Table 4-1: PFD Functions

PFD Function	Mode							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Airspeed	OK	OK	19	OK	19	OK	19	19
Altimeter	OK	OK	19	OK	19	OK	19	19
Altimeter Set Display	OK	OK	-	OK	-	OK	-	-
Bank Scale	OK	OK	OK	-	OK	-	-	-
CDI	OK	1 + 20	OK	OK	20	20	OK	20

Table 4-1: PFD Functions

PFD Function	Mode							
	0	1	2	3	4	5	6	7
Runway	OK	1	-	-	-	-	-	-
Waypoint Pointer	7	1	7	7	-	-	7	-
Heading Scale	7	7	7	7	7	-	7	-
AGL Ind.	OK	2	4	OK	11	11	4	-
Flight Path Marker	OK	1 + 14	-	-	-	-	-	-
G-meter	OK	OK	OK	-	OK	-	-	-
Ground Track	7	1	7	7	-	-	7	-
Heading Indicator	7	7	7	-	7	-	-	-
Horizon	OK	OK	OK	-	OK	-	-	-
Mini-Map	7	1	7	7	-	-	7	-
Pitch Limit Indicator	OK	OK	-	8	-	8	-	-
Pitch Scale	OK	OK	OK	-	OK	-	-	-
Highway in the Sky	OK	1 + 15	-	-	-	-	-	-
Terrain / Obstruct	OK	-	-	-	-	-	-	-
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

Table 4-1: PFD Functions								
PFD Function	**Mode**							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Speed Trend	OK	OK	-	-	-	-	-	-
Dynamic Stall Speed	OK	OK	-	8	-	8	-	-

Table 4-2: ND Functions								
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	-
Glide Range	9	1	-	10	-	-	-	-
Groundspeed	OK	1	OK	OK	-	-	OK	-
Ground Track	9	1	9	9	-	-	9	-
Heading Indicator	9	9	9	-	9	-	-	-
Navigation Symbols	9	1	9	9	-	-	9	-
Outside Air Temp.	OK	OK	-	OK	-	OK	-	-
Projected Path	OK	1	OK	-	-	-	-	-
Traffic	OK	OK	OK	OK	OK	OK	OK	OK
Terrain/ Obstructions	OK	-	-	OK	-	-	-	-
Clock Functions	OK	OK	OK	OK	OK	OK	OK	OK

Table 4-2: ND Functions								
ND Functions	**Mode**							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Waypoint Brg. /Dist.	OK	1	OK	OK	-	-	OK	-
Wind	21	3	-	-	-	-	-	-
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: 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
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

Table 4-3: Output Functions

Output Functions	Mode							
	0	1	2	3	4	5	6	7
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 (i.e., heading is failed or true airspeed cannot be calculated) then function is disabled.

Note 2: Only radar altitude presented when available.

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

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

Note 5: Waterline symbol expanded to large attitude bars.

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

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

Note 8: Based upon 1G stall speed.

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

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

Note 11: Only radar altitude presented when available.

Note 12: Assuming valid fuel flow information, endurance is presented.

Note 13: Large attitude bars presented and X'd out.

Note 14: Flight Path Marker grayed after 1 minute to indicate degraded operation.

Note 15: Highway in the Sky removed after 1 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: N/A for Fixed Wing aircraft.

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.

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 will be 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 will align with track (if available) or be removed and replaced with a Red-X. Note that in this failure mode, the PFD heading scale will include the nomenclature “**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 (CPU #2, 3 or 4) becomes the “transmit-enabled” IDU, the MFD will automatically switch to Essential Mode. Essential Mode will show a PFD screen in the Top Area. In addition, if an EICAS is defined, Essential Mode will show the Essential Mode EICAS screen in the bottom area. If an EICAS is not defined, then the bottom area of Essential Mode will be free to show any MFD screen as defined. It is possible to change the MFD back to Normal Mode after the automatic switch by pressing **To NORMAL** / **TO ESSNTL (R5)**.

4.1.4. EICAS Screen Single-Action Reversion

When configured with an EICAS, it is a design goal that the pilot be able 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:

Pressing **To NORMAL** / **TO ESSNTL (R5)**; alternates 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 (CPU #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 can degrade or fail as a result of loss of satellite information, or GPS equipment failure. When the integrity is provided by SBAS, the IDU will provide a LOI (Loss of Integrity) monitoring caution within 2 seconds if the current HPL (Horizontal Protection Level) exceeds the HAL (Horizontal Alert Level). This LOI caution appears when there is no integrity monitoring and disappears when integrity monitoring is restored.

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

GPS LOI (Loss of Integrity caution displayed with no time delay)

HPL > HAL for the phase of flight we are currently in. Position is still presented based upon a GPS navigation solution.

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

The absence of power;

Equipment malfunction or failure;

The presence of a condition lasting 5 seconds or more where there are an inadequate number of satellites to compute position solution;

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

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

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, the user can view HFOM on the FAULTS page to see the system-reported accuracy.

1) **DR** (Dead Reckoning)

   In the event a GPS position cannot be calculated, a dead reckoning solution is provided with a timer. This solution is calculated from Heading and TAS derived from the AHRS and ADC.

   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, the **VERT LON** flag will appear within one second of the onset of any of the following conditions:

   - The absence of power;
   - Equipment malfunction or failure;
   - The presence of a condition where fault detection detects a position failure that cannot be excluded;
   - There are an insufficient number of SBAS HEALTY satellites;
   - The horizontal protection level exceeds the alert limit as follows for LNAV/VNAV approaches:
     - Prior to sequencing the FAWP- HAL should be 0.3 NM with no limit on VAL

- After sequencing the FAWP- HAL 556m (0.3NM) and VAL 50m

When in LNAV mode, the fault detection function will detect positioning failures within 10 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.

The IDU-680 PFD and MFD are affected as follows:

4.2. PFD Failure Mode 0 (Normal Mode)

Figure 4-1: PFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS normal

Table 4-4: Function Table PFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS normal			
PFD Functions	**Mode 0**	**ND Functions**	**Mode 0**
Airspeed	**OK**	Aircraft Position	**OK**
Altimeter	**OK**	Special Use Airspace	**9**
Altimeter Set Display	**OK**	Waypoint Pointer	**9**
Bank Scale	**OK**	Active Flight Plan Path	**9**
CDI	**OK**	Glide Range	**9**
Runway	**OK**	Groundspeed	**OK**
Waypoint Pointer	**7**	Ground Track	**9**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**OK**	Navigation Symbols	**9**
Flight Path Marker	**OK**	Outside Air Temp	**OK**
		Projected Path	**OK**
G-Meter	**OK**	Traffic	**OK**
Ground Track	**7**	Terrain/ Obstructions	**OK**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**21**
Pitch Limit Indicator	**OK**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**OK**	Fuel Totalizer	**23**
Terrain / Obstruction	**OK**	True Airspeed	**OK**
Clock Functions	**OK**	Density Altitude	**OK**
VSI	**OK**	OAT/ISA Display	**OK**
Waterline Symbol	**22**		
Waypoint Symbol	**OK**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**OK**		
Dynamic Stall Speed	**OK**		

4.2.1. MFD Failure Mode 0 (Normal Mode)

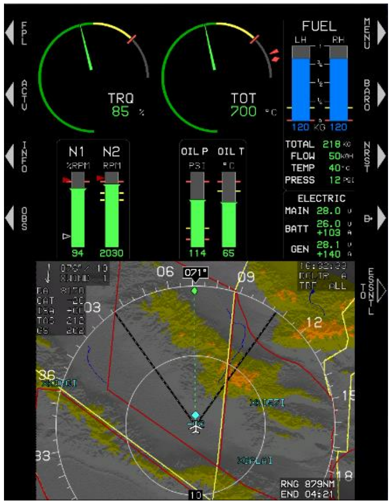

Figure 4-2: MFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS normal

Figure 4-5: Function Table MFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS normal

PFD Functions	Mode 0	ND Functions	Mode 0
Airspeed	**OK**	Aircraft Position	**OK**
Altimeter	**OK**	Special Use Airspace	**9**
Altimeter Set Display	**OK**	Waypoint Pointer	**9**
Bank Scale	**OK**	Active Flight Plan Path	**9**
CDI	**OK**	Glide Range	**9**
Runway	**OK**	Groundspeed	**OK**
Waypoint Pointer	**7**	Ground Track	**9**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**OK**	Navigation Symbols	**9**
Flight Path Marker	**OK**	Outside Air Temp	**OK**
		Projected Path	**OK**

Figure 4-5: Function Table MFD Failure Mode 0 (Normal Mode) GPS, ADC and AHRS normal

PFD Functions	Mode 0	ND Functions	Mode 0
G-Meter	**OK**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**OK**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**21**
Pitch Limit Indicator	**OK**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**OK**	Fuel Totalizer	**23**
Terrain / Obstruction	**OK**	True Airspeed	**OK**
Clock Functions	**OK**	Density Altitude	**OK**
VSI	**OK**	OAT/ISA Display	**OK**
Waterline Symbol	**22**		
Waypoint Symbol	**OK**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**OK**		
Dynamic Stall Speed	**OK**		

4.3. PFD Failure Mode 1 (Normal Mode)

Figure 4-3: PFD Failure Mode 1 (Normal Mode) GPS/SBAS failed, ADC and AHRS normal

Table 4-6: Funtion Table PFD Failure Mode 1 (Normal Mode) GPS/SBAS failed, ADC and AHRS normal

PFD Functions	Mode 1	ND Functions	Mode 1
Airspeed	**OK**	Aircraft Position	**1**
Altimeter	**OK**	Special Use Airspace	**1**
Altimeter Set Display	**OK**	Waypoint Pointer	**1**
Bank Scale	**OK**	Active Flight Plan Path	**1**
CDI	**1 + 20**	Glide Range	**1**
Runway	**1**	Groundspeed	**1**
Waypoint Pointer	**1**	Ground Track	**1**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**2**	Navigation Symbols	**1**
Flight Path Marker	**1 + 14**	Outside Air Temp	**OK**
		Projected Path	**1**

Table 4-6: Funtion Table PFD Failure Mode 1 (Normal Mode)
GPS/SBAS failed, ADC and AHRS normal

PFD Functions	Mode 1	ND Functions	Mode 1
G-Meter	**OK**	Traffic	**OK**
Ground Track	**1**	Terrain / Obstructions	**-**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**1**
Mini-Map	**1**	Wind	**3**
Pitch Limit Indicator	**OK**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**1 + 15**	Fuel Totalizer	**24**
Terrain / Obstruction	**-**	True Airspeed	**OK**
Clock Functions	**OK**	Density Altitude	**OK**
VSI	**OK**	OAT/ISA Display	**OK**
Waterline Symbol	**22**		
Waypoint Symbol	**1**		
Waypoint Brg. / Dist.	**1**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**OK**		
Dynamic Stall Speed	**OK**		

4.3.1. PFD Failure Mode 1 (Essential Mode)

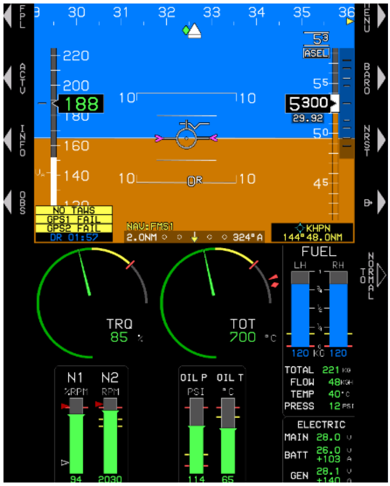

Figure 4-4: PFD Failure Mode 1 (Essential Mode) GPS/SBAS failed, ADC and AHRS normal

Table 4-7: Function Table MFD Failure Mode 1 (Essential Mode) GPS/SBAS failed, ADC and AHRS normal

PFD Functions	**Mode 1**	**ND Functions**	**Mode 1**
Airspeed	**OK**	Aircraft Position	**1**
Altimeter	**OK**	Special Use Airspace	**1**
Altimeter Set Display	**OK**	Waypoint Pointer	**1**
Bank Scale	**OK**	Active Flight Plan Path	**1**
CDI	**1 + 20**	Glide Range	**1**
Runway	**1**	Groundspeed	**1**
Waypoint Pointer	**1**	Ground Track	**1**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**2**	Navigation Symbols	**1**
Flight Path Marker	**1 + 14**	Outside Air Temp	**OK**
		Projected Path	**1**

Table 4-7: Function Table MFD Failure Mode 1 (Essential Mode) GPS/SBAS failed, ADC and AHRS normal			
PFD Functions	**Mode 1**	**ND Functions**	**Mode 1**
G-Meter	**OK**	Traffic	**OK**
Ground Track	**1**	Terrain / Obstructions	**-**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**1**
Mini-Map	**1**	Wind	**3**
Pitch Limit Indicator	**OK**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**1 + 15**	Fuel Totalizer	**24**
Terrain / Obstruction	**-**	True Airspeed	**OK**
Clock Functions	**OK**	Density Altitude	**OK**
VSI	**OK**	OAT/ISA Display	**OK**
Waterline Symbol	**OK**		
Waypoint Symbol	**1**		
Waypoint Brg. / Dist.	**1**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**OK**		
Dynamic Stall Speed	**OK**		

4.3.2. MFD Failure Mode 1 (Normal Mode)

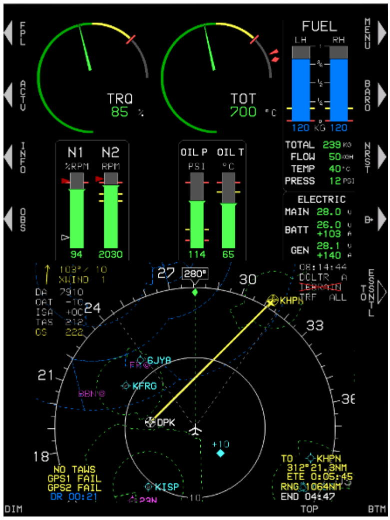

Figure 4-5: MFD Failure Mode 1 (Normal Mode) GPS/SBAS failed, ADC and AHRS normal

Table 4-8: Function Table MFD Failure Mode 1 (Normal Mode) GPS/SBAS failed, ADC and AHRS normal

PFD Functions	Mode 1	ND Functions	Mode 1
Airspeed	OK	Aircraft Position	1
Altimeter	OK	Special Use Airspace	1
Altimeter Set Display	OK	Waypoint Pointer	1
Bank Scale	OK	Active Flight Plan Path	1
CDI	1 + 20	Glide Range	1
Runway	1	Groundspeed	1
Waypoint Pointer	1	Ground Track	1
Heading Scale	7	Heading Indicator	9
AGL Ind.	2	Navigation Symbols	1
Flight Path Marker	1 + 14	Outside Air Temp	OK

Table 4-8: Function Table MFD Failure Mode 1 (Normal Mode) GPS/SBAS failed, ADC and AHRS normal

PFD Functions	Mode 1	ND Functions	Mode 1
		Projected Path	**1**
G-Meter	**OK**	Traffic	**OK**
Ground Track	**1**	Terrain / Obstructions	**-**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**1**
Mini-Map	**1**	Wind	**3**
Pitch Limit Indicator	**OK**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**1 + 15**	Fuel Totalizer	**24**
Terrain / Obstruction	**-**	True Airspeed	**OK**
Clock Functions	**OK**	Density Altitude	**OK**
VSI	**OK**	OAT/ISA Display	**OK**
Waterline Symbol	**OK**		
Waypoint Symbol	**1**		
Waypoint Brg. / Dist.	**1**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**OK**		
Dynamic Stall Speed	**OK**		

4.4. PFD Failure Mode 2 (Normal Mode)

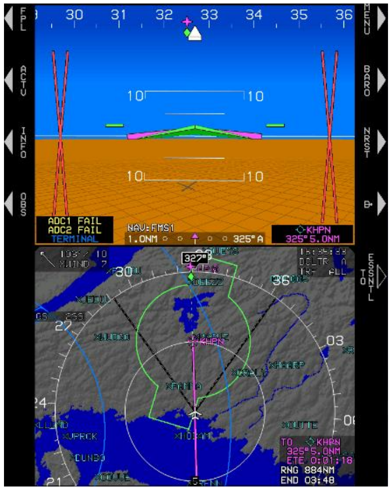

Figure 4-6: PFD Mode 2 (Normal mode) ADC failed, GPS/SBAS and AHRS normal

Table 4-9: Function Table PFD Mode 2 (Normal mode) ADC failed, GPS/SBAS and AHRS normal

PFD Functions	Mode 2	ND Functions	Mode 2
Airspeed	**19**	Aircraft Position	**OK**
Altimeter	**19**	Special Use Airspace	**6**
Altimeter Set Display	**-**	Waypoint Pointer	**9**
Bank Scale	**OK**	Active Flight Plan Path	**9**
CDI	**OK**	Glide Range	**-**
Runway	**-**	Groundspeed	**OK**
Waypoint Pointer	**7**	Ground Track	**9**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**4**	Navigation Symbols	**9**
Flight Path Marker	**-**	Outside Air Temp	**-**

Table 4-9: Function Table PFD Mode 2 (Normal mode) ADC failed, GPS/SBAS and AHRS normal

PFD Functions	Mode 2	ND Functions	Mode 2
		Projected Path	**OK**
G-Meter	**OK**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**-**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**23**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**OK**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.4.1. MFD Failure Mode 2 (Normal Mode)

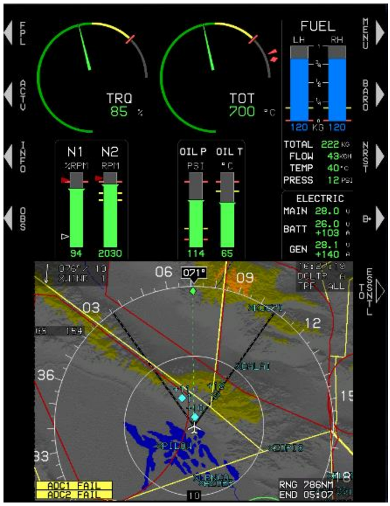

Figure 4-7: MFD Failure Mode 2, (Normal Mode) ADC failed, GPS/SBAS and AHRS normal

Table 4-10: Function Table MFD Failure Mode 2, (Normal Mode) ADC failed, GPS/SBAS and AHRS normal

PFD Functions	Mode 2	ND Functions	Mode 2
Airspeed	**19**	Aircraft Position	OK
Altimeter	**19**	Special Use Airspace	6
Altimeter Set Display	**-**	Waypoint Pointer	9
Bank Scale	**OK**	Active Flight Plan Path	9
CDI	**OK**	Glide Range	-
Runway	**-**	Groundspeed	OK
Waypoint Pointer	**7**	Ground Track	9
Heading Scale	**7**	Heading Indicator	9
AGL Ind.	**4**	Navigation Symbols	9
Flight Path Marker	**-**	Outside Air Temp	-

Table 4-10: Function Table MFD Failure Mode 2, (Normal Mode) ADC failed, GPS/SBAS and AHRS normal			
PFD Functions	**Mode 2**	**ND Functions**	**Mode 2**
		Projected Path	OK
G-Meter	**OK**	Traffic	OK
Ground Track	**7**	Terrain / Obstructions	-
Heading Indicator	**7**	Clock Functions	OK
Horizon	**OK**	Waypoint Brg. / Dist.	OK
Mini-Map	**7**	Wind	-
Pitch Limit Indicator	**-**		
Pitch Scale	**OK**	Compass Rose	9
Highway in the Sky	**-**	Fuel Totalizer	23
Terrain / Obstruction	**-**	True Airspeed	-
Clock Functions	**OK**	Density Altitude	-
VSI	**-**	OAT/ISA Display	-
Waterline Symbol	**5**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.4.2. MFD Failure Mode 2 (Essential Mode)

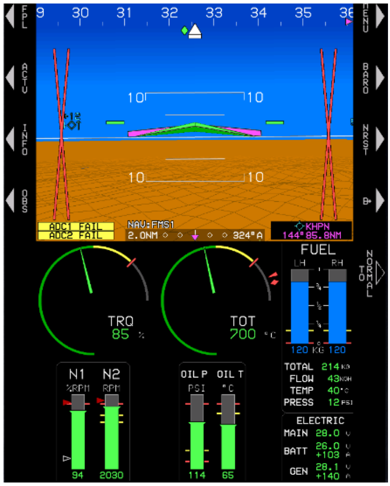

Figure 4-8: MFD Failure Mode 2 (Essential Mode) ADC failed, GPS/SBAS and AHRS normal

Table 4-11: Function Table MFD Failure Mode 2 (Essential Mode) ADC failed, GPS/SBAS and AHRS normal

PFD Functions	Mode 2	ND Functions	Mode 2
Airspeed	19	Aircraft Position	OK
Altimeter	19	Special Use Airspace	6
Altimeter Set Display	-	Waypoint Pointer	9
Bank Scale	OK	Active Flight Plan Path	9
CDI	OK	Glide Range	-
Runway	-	Groundspeed	OK
Waypoint Pointer	7	Ground Track	9
Heading Scale	7	Heading Indicator	9
AGL Ind.	4	Navigation Symbols	9
Flight Path Marker	-	Outside Air Temp	-

Table 4-11: Function Table MFD Failure Mode 2 (Essential Mode) ADC failed, GPS/SBAS and AHRS normal			
PFD Functions	**Mode 2**	**ND Functions**	**Mode 2**
		Projected Path	**OK**
G-Meter	**OK**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**-**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**23**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**5**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**OK**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.5. PFD Failure Mode 3 (Normal Mode)

Figure 4-9: PFD Failure Mode 3 (Normal Mode) AHRS failed, GPS/SBAS and ADC normal

Table 4-12: Function Table PFD Failure Mode 3 (Normal Mode) AHRS failed, GPS/SBAS and ADC normal			
PFD Functions	**Mode 3**	**ND Functions**	**Mode 3**
Airspeed	**OK**	Aircraft Position	**OK**
Altimeter	**OK**	Special Use Airspace	**9**
Altimeter Set Display	**OK**	Waypoint Pointer	**9**
Bank Scale	**-**	Active Flight Plan Path	**9**
CDI	**OK**	Glide Range	**10**
Runway	**-**	Groundspeed	**OK**
Waypoint Pointer	**7**	Ground Track	**9**
Heading Scale	**7**	Heading Indicator	**-**
AGL Ind.	**OK**	Navigation Symbols	**9**
Flight Path Marker	**-**	Outside Air Temp	**OK**

Table 4-12: Function Table PFD Failure Mode 3 (Normal Mode) AHRS failed, GPS/SBAS and ADC normal

PFD Functions	Mode 3	ND Functions	Mode 3
		Projected Path	-
G-Meter	-	Traffic	OK
Ground Track	7	Terrain / Obstructions	OK
Heading Indicator	-	Clock Functions	OK
Horizon	-	Waypoint Brg. / Dist.	OK
Mini-Map	7	Wind	-
Pitch Limit Indicator	8		
Pitch Scale	-	Compass Rose	9
Highway in the Sky	-	Fuel Totalizer	23
Terrain / Obstruction	-	True Airspeed	OK
Clock Functions	OK	Density Altitude	OK
VSI	OK	OAT/ISA Display	OK
Waterline Symbol	13		
Waypoint Symbol	-		
Waypoint Brg. / Dist.	OK		
Traffic	-		
Traffic Thumbnail	OK		
Speed Trend	-		
Dynamic Stall Speed	8		

4.5.1. MFD Failure Mode 3 (Normal Mode)

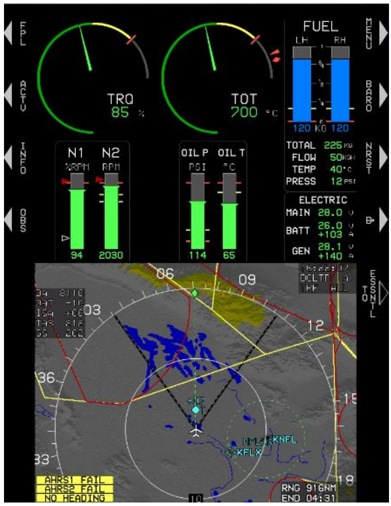

Figure 4-10: MFD Failure Mode 3 (Normal Mode) AHRS failed, GPS/SBAS and ADC normal

Table 4-13: Function Table MFD Failure Mode 3 (Normal Mode) AHRS failed, GPS/SBAS and ADC normal

PFD Functions	Mode 3	ND Functions	Mode 3
Airspeed	OK	Aircraft Position	OK
Altimeter	OK	Special Use Airspace	9
Altimeter Set Display	OK	Waypoint Pointer	9
Bank Scale	-	Active Flight Plan Path	9
CDI	OK	Glide Range	10
Runway	-	Groundspeed	OK
Waypoint Pointer	7	Ground Track	9
Heading Scale	7	Heading Indicator	-
AGL Ind.	OK	Navigation Symbols	9

Table 4-13: Function Table MFD Failure Mode 3 (Normal Mode) AHRS failed, GPS/SBAS and ADC normal			
PFD Functions	**Mode 3**	**ND Functions**	**Mode 3**
Flight Path Marker	**-**	Outside Air Temp	**OK**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**OK**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**-**
Pitch Limit Indicator	**8**		
Pitch Scale	**-**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**23**
Terrain / Obstruction	**-**	True Airspeed	**OK**
Clock Functions	**OK**	Density Altitude	**OK**
VSI	**OK**	OAT/ISA Display	**OK**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**8**		

4.6. PFD Failure Mode 4 (Normal Mode)

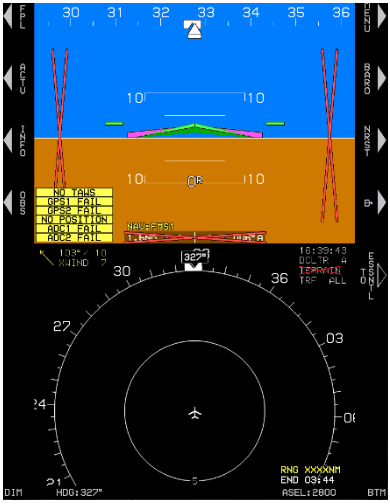

Figure 4-11: PFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC failed, AHRS normal

Table 4-13: Function Table PFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC failed, AHRS normal			
PFD Functions	**Mode 4**	**ND Functions**	**Mode 4**
Airspeed	**19**	Aircraft Position	**-**
Altimeter	**19**	Special Use Airspace	**-**
Altimeter Set Display	**-**	Waypoint Pointer	**-**
Bank Scale	**OK**	Active Flight Plan Path	**-**
CDI	**20**	Glide Range	**-**
Runway	**-**	Groundspeed	**-**
Waypoint Pointer	**-**	Ground Track	**-**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**11**	Navigation Symbols	**-**

Table 4-13: Function Table PFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC failed, AHRS normal

PFD Functions	Mode 4	ND Functions	Mode 4
Flight Path Marker	-	Outside Air Temp	-
		Projected Path	-
G-Meter	OK	Traffic	OK
Ground Track	-	Terrain / Obstructions	-
Heading Indicator	7	Clock Functions	OK
Horizon	OK	Waypoint Brg. / Dist.	-
Mini-Map	-	Wind	-
Pitch Limit Indicator	-	WX-500 Data	OK
Pitch Scale	OK	Compass Rose	9
Highway in the Sky	-	Fuel Totalizer	12
Terrain / Obstruction	-	True Airspeed	-
Clock Functions	OK	Density Altitude	-
VSI	-	OAT/ISA Display	-
Waterline Symbol	5		
Waypoint Symbol	-		
Waypoint Brg. / Dist.	-		
Traffic	-		
Traffic Thumbnail	OK		
Speed Trend	-		
Dynamic Stall Speed	-		

4.6.1. MFD Failure Mode 4 (Normal Mode)

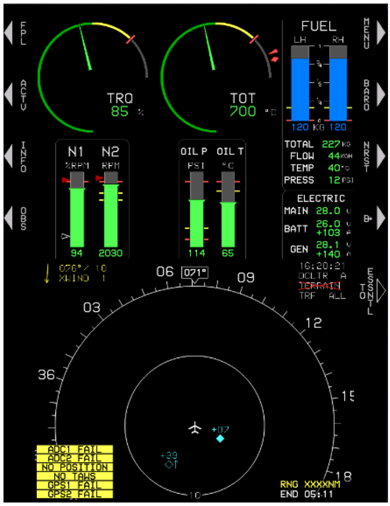

Figure 4-12: MFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC failed, AHRS normal

Table 4-14: Function Table MFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC failed, AHRS normal

PFD Functions	Mode 4	ND Functions	Mode 4
Airspeed	19	Aircraft Position	-
Altimeter	19	Special Use Airspace	-
Altimeter Set Display	-	Waypoint Pointer	-
Bank Scale	OK	Active Flight Plan Path	-
CDI	20	Glide Range	-
Runway	-	Groundspeed	-
Waypoint Pointer	-	Ground Track	-
Heading Scale	7	Heading Indicator	9
AGL Ind.	11	Navigation Symbols	-
Flight Path Marker	-	Outside Air Temp	-

Table 4-14: Function Table MFD Failure Mode 4 (Normal Mode) GPS/SBAS and ADC failed, AHRS normal

PFD Functions	Mode 4	ND Functions	Mode 4
		Projected Path	-
G-Meter	OK	Traffic	OK
Ground Track	-	Terrain / Obstructions	-
Heading Indicator	7	Clock Functions	OK
Horizon	OK	Waypoint Brg. / Dist.	-
Mini-Map	-	Wind	-
Pitch Limit Indicator	-		
Pitch Scale	OK	Compass Rose	9
Highway in the Sky	-	Fuel Totalizer	12
Terrain / Obstruction	-	True Airspeed	-
Clock Functions	OK	Density Altitude	-
VSI	-	OAT/ISA Display	-
Waterline Symbol	5		
Waypoint Symbol	-		
Waypoint Brg. / Dist.	-		
Traffic	-		
Traffic Thumbnail	OK		
Speed Trend	-		
Dynamic Stall Speed	-		

4.6.2. MFD Failure Mode 4 (Essential Mode)

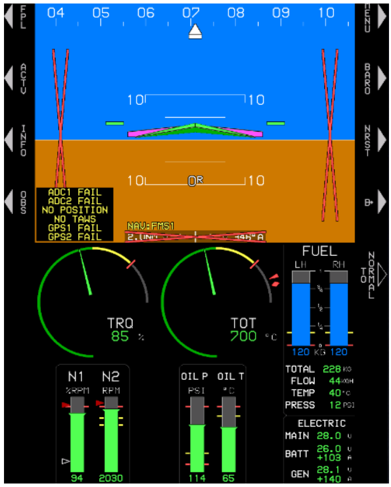

Figure 4-13: MFD Failure Mode 4 (Essential Mode) GPS/SBAS and ADC failed, AHRS normal

Table 4-15: Function Table MFD Failure Mode 4 (Essential Mode) GPS/SBAS and ADC failed, AHRS normal

PFD Functions	Mode 4	ND Functions	Mode 4
Airspeed	**19**	Aircraft Position	**-**
Altimeter	**19**	Special Use Airspace	**-**
Altimeter Set Display	**-**	Waypoint Pointer	**-**
Bank Scale	**OK**	Active Flight Plan Path	**-**
CDI	**20**	Glide Range	**-**
Runway	**-**	Groundspeed	**-**
Waypoint Pointer	**-**	Ground Track	**-**
Heading Scale	**7**	Heading Indicator	**9**
AGL Ind.	**11**	Navigation Symbols	**-**

Table 4-15: Function Table MFD Failure Mode 4 (Essential Mode) GPS/SBAS and ADC failed, AHRS normal			
PFD Functions	**Mode 4**	**ND Functions**	**Mode 4**
Flight Path Marker	**-**	Outside Air Temp	**-**
		Projected Path	**-**
G-Meter	**OK**	Traffic	**OK**
Ground Track	**-**	Terrain / Obstructions	**-**
Heading Indicator	**7**	Clock Functions	**OK**
Horizon	**OK**	Waypoint Brg. / Dist.	**-**
Mini-Map	**-**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**OK**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**5**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**-**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.7. PFD Failure Mode 5 (Normal Mode)

Figure 4-14: PFD Failure Mode 5 (Normal Mode) GPS/SBAS and AHRS failed, ADC normal

Table 4-16: Function Table PFD Failure Mode 5 (Normal Mode) GPS/SBAS and AHRS failed, ADC normal

PFD Functions	Mode 5	ND Functions	Mode 5
Airspeed	**OK**	Aircraft Position	**-**
Altimeter	**OK**	Special Use Airspace	**-**
Altimeter Set Display	**OK**	Waypoint Pointer	**-**
Bank Scale	**-**	Active Flight Plan Path	**-**
CDI	**20**	Glide Range	**-**
Runway	**-**	Groundspeed	**-**
Waypoint Pointer	**-**	Ground Track	**-**
Heading Scale	**-**	Heading Indicator	**-**
AGL Ind.	**11**	Navigation Symbols	**-**

Table 4-16: Function Table PFD Failure Mode 5 (Normal Mode) GPS/SBAS and AHRS failed, ADC normal

PFD Functions	Mode 5	ND Functions	Mode 5
Flight Path Marker	**-**	Outside Air Temp	**OK**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**-**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**-**
Mini-Map	**-**	Wind	**-**
Pitch Limit Indicator	**8**		
Pitch Scale	**-**	Compass Rose	**-**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**OK**	OAT/ISA Display	**-**
Waterline Symbol	**13**		**-**
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**-**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**8**		

4.7.1. MFD Failure Mode 5 (Normal Mode)

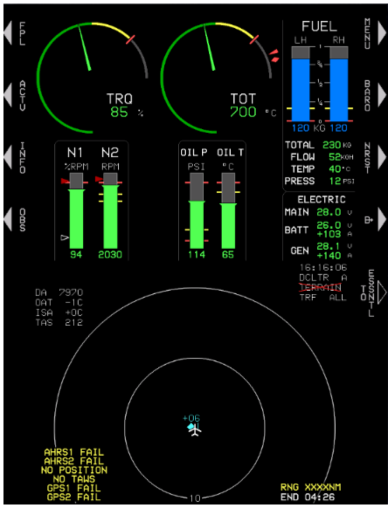

Figure 4-15: MFD Failure Mode 4 (Normal Mode) GPS/SBAS and AHRS failed, ADC normal

Table 4-17: Function Table MFD Failure Mode 4 (Normal Mode) GPS/SBAS and AHRS failed, ADC normal

PFD Functions	Mode 5	ND Functions	Mode 5
Airspeed	OK	Aircraft Position	-
Altimeter	OK	Special Use Airspace	-
Altimeter Set Display	OK	Waypoint Pointer	-
Bank Scale	-	Active Flight Plan Path	-
CDI	20	Glide Range	-
Runway	-	Groundspeed	-
Waypoint Pointer	-	Ground Track	-
Heading Scale	-	Heading Indicator	-
AGL Ind.	11	Navigation Symbols	-

Table 4-17: Function Table MFD Failure Mode 4 (Normal Mode) GPS/SBAS and AHRS failed, ADC normal

PFD Functions	Mode 5	ND Functions	Mode 5
Flight Path Marker	-	Outside Air Temp	OK
		Projected Path	-
G-Meter	-	Traffic	OK
Ground Track	-	Terrain / Obstructions	-
Heading Indicator	-	Clock Functions	OK
Horizon	-	Waypoint Brg. / Dist.	-
Mini-Map	-	Wind	-
Pitch Limit Indicator	8		
Pitch Scale	-	Compass Rose	-
Highway in the Sky	-	Fuel Totalizer	12
Terrain / Obstruction	-	True Airspeed	-
Clock Functions	OK	Density Altitude	-
VSI	OK	OAT/ISA Display	-
Waterline Symbol	13		-
Waypoint Symbol	-		
Waypoint Brg. / Dist.	-		
Traffic	-		
Traffic Thumbnail	OK		
Speed Trend	-		
Dynamic Stall Speed	8		

4.7.2. MFD Failure Mode 5 (Essential Mode)

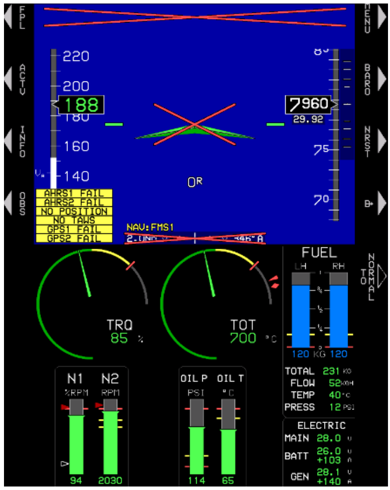

Figure 4-16: MFD Failure Mode 5 (Essential Mode) GPS/SBAS and AHRS failed, ADC normal

Table 4-18: Function Table MFD Failure Mode 5 (Essential Mode) GPS/SBAS and AHRS failed, ADC normal

PFD Functions	Mode 5	ND Functions	Mode 5
Airspeed	**OK**	Aircraft Position	**-**
Altimeter	**OK**	Special Use Airspace	**-**
Altimeter Set Display	**OK**	Waypoint Pointer	**-**
Bank Scale	**-**	Active Flight Plan Path	**-**
CDI	**20**	Glide Range	**-**
Runway	**-**	Groundspeed	**-**
Waypoint Pointer	**-**	Ground Track	**-**
Heading Scale	**-**	Heading Indicator	**-**
AGL Ind.	**11**	Navigation Symbols	**-**
Flight Path Marker	**-**	Outside Air Temp	**OK**

Table 4-18: Function Table MFD Failure Mode 5 (Essential Mode) GPS/SBAS and AHRS failed, ADC normal

PFD Functions	Mode 5	ND Functions	Mode 5
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**-**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**-**
Mini-Map	**-**	Wind	**-**
Pitch Limit Indicator	**8**		
Pitch Scale	**-**	Compass Rose	**-**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**OK**	OAT/ISA Display	**-**
Waterline Symbol	**13**		-
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**-**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**8**		

4.8. PFD Failure Mode 6 (Normal Mode)

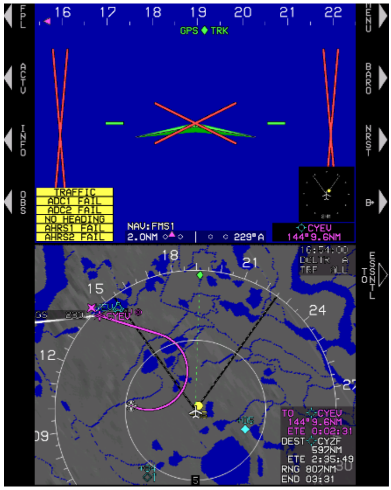

Figure 4-17: PFD Failure Mode 6 (Normal Mode) ADC and AHRS failed, GPS/SBAS normal

Table 4-19: Function Table PFD Failure Mode 6 (Normal Mode) ADC and AHRS failed, GPS/SBAS normal

PFD Functions	Mode 6	ND Functions	Mode 6
Airspeed	**19**	Aircraft Position	**OK**
Altimeter	**19**	Special Use Airspace	**6 + 9**
Altimeter Set Display	**-**	Waypoint Pointer	**9**
Bank Scale	**-**	Active Flight Plan Path	**9**
CDI	**OK**	Glide Range	**-**
Runway	**-**	Groundspeed	**OK**
Waypoint Pointer	**7**	Ground Track	**9**
Heading Scale	**7**	Heading Indicator	**-**
AGL Ind.	**4**	Navigation Symbols	**9**
Flight Path Marker	**-**	Outside Air Temp	**-**

Table 4-19: Function Table PFD Failure Mode 6 (Normal Mode) ADC and AHRS failed, GPS/SBAS normal			
PFD Functions	**Mode 6**	**ND Functions**	**Mode 6**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**-**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.8.1. MFD Failure Mode 6 (Normal Mode)

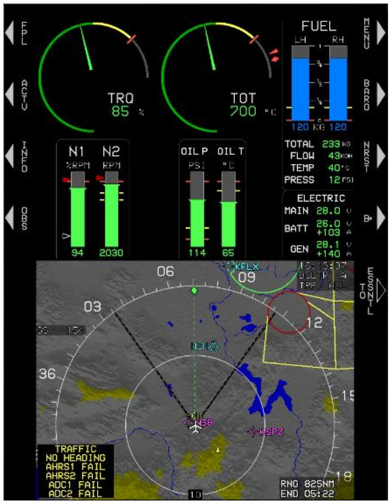

Figure 4-18: MFD Failure Mode 6 (Normal Mode) ADC and AHRS failed, GPS/SBAS normal

Table 4-20: Function Table MFD Failure Mode 6 (Normal Mode) ADC and AHRS failed, GPS/SBAS normal

PFD Functions	Mode 6	ND Functions	Mode 6
Airspeed	**19**	Aircraft Position	**OK**
Altimeter	**19**	Special Use Airspace	**6 + 9**
Altimeter Set Display	**-**	Waypoint Pointer	**9**
Bank Scale	**-**	Active Flight Plan Path	**9**
CDI	**OK**	Glide Range	**-**
Runway	**-**	Groundspeed	**OK**
Waypoint Pointer	**7**	Ground Track	**9**
Heading Scale	**7**	Heading Indicator	**-**
AGL Ind.	**4**	Navigation Symbols	**9**
Flight Path Marker	**-**	Outside Air Temp	**-**

Table 4-20: Function Table MFD Failure Mode 6 (Normal Mode) ADC and AHRS failed, GPS/SBAS normal			
PFD Functions	**Mode 6**	**ND Functions**	**Mode 6**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**-**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.8.2. MFD Failure Mode 6 (Essential Mode)

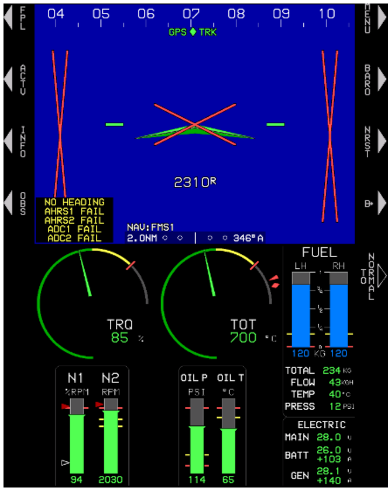

Figure 4-19: MFD Failure Mode 6 (Essential Mode) ADC and AHRS failed, GPS/SBAS normal

Table 4-21: Function Table MFD Failure Mode 6 (Essential Mode) ADC and AHRS failed, GPS/SBAS normal

PFD Functions	Mode 6	ND Functions	Mode 6
Airspeed	19	Aircraft Position	OK
Altimeter	19	Special Use Airspace	6 + 9
Altimeter Set Display	-	Waypoint Pointer	9
Bank Scale	-	Active Flight Plan Path	9
CDI	OK	Glide Range	-
Runway	-	Groundspeed	OK
Waypoint Pointer	7	Ground Track	9
Heading Scale	7	Heading Indicator	-
AGL Ind.	4	Navigation Symbols	9
Flight Path Marker	-	Outside Air Temp	-

Table 4-21: Function Table MFD Failure Mode 6 (Essential Mode) ADC and AHRS failed, GPS/SBAS normal

PFD Functions	Mode 6	ND Functions	Mode 6
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**7**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**OK**
Mini-Map	**7**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**-**	Compass Rose	**9**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**OK**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.9. PFD Failure Mode 7 (Normal Mode)

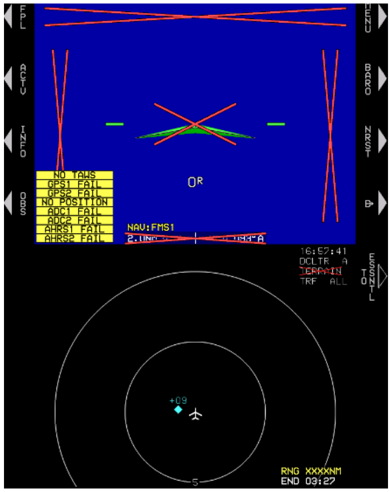

Figure 4-20: PFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS failed

Table 4-22: Function Table PFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS failed

PFD Functions	Mode 7	ND Functions	Mode 7
Airspeed	**19**	Aircraft Position	-
Altimeter	**19**	Special Use Airspace	-
Altimeter Set Display	-	Waypoint Pointer	-
Bank Scale	-	Active Flight Plan Path	-
CDI	**20**	Glide Range	-
Runway	-	Groundspeed	-
Waypoint Pointer	-	Ground Track	-
Heading Scale	-	Heading Indicator	-
AGL Ind.	-	Navigation Symbols	-
Flight Path Marker	-	Outside Air Temp	-

Table 4-22: Function Table PFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS failed			
PFD Functions	**Mode 7**	**ND Functions**	**Mode 7**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**-**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**-**
Mini-Map	**-**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**-**	Compass Rose	**-**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**-**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.9.1. MFD Failure Mode 7 (Normal Mode)

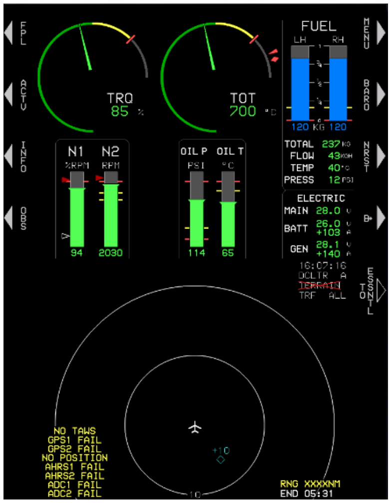

Figure 4-21: MFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS failed

Table 4-23: Function Table MFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS failed

PFD Functions	Mode 7	ND Functions	Mode 7
Airspeed	**19**	Aircraft Position	-
Altimeter	**19**	Special Use Airspace	-
Altimeter Set Display	-	Waypoint Pointer	-
Bank Scale	-	Active Flight Plan Path	-
CDI	**20**	Glide Range	-
Runway	-	Groundspeed	-
Waypoint Pointer	-	Ground Track	-
Heading Scale	-	Heading Indicator	-
AGL Ind.	-	Navigation Symbols	-
Flight Path Marker	-	Outside Air Temp	-

Table 4-23: Function Table MFD Failure Mode 7 (Normal Mode) GPS/SBAS, ADC and AHRS failed			
PFD Functions	**Mode 7**	**ND Functions**	**Mode 7**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**-**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**-**
Mini-Map	**-**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**-**	Compass Rose	**-**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**-**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

4.9.2. MFD Failure Mode 7 (Essential Mode)

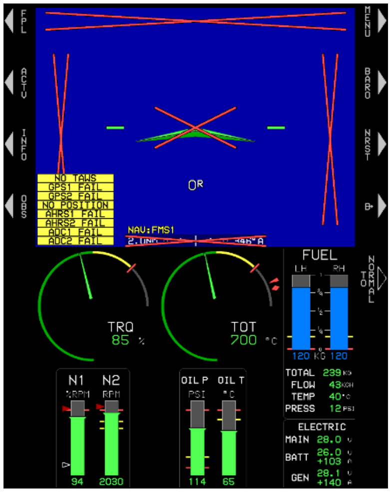

Figure 4-22: MFD Failure Mode 7 (Essential Mode) GPS/SBAS, ADC and AHRS failed

Table 4-24: Function Table MFD Failure Mode 7 (Essential Mode) GPS/SBAS, ADC and AHRS failed			
PFD Functions	**Mode 7**	**ND Functions**	**Mode 7**
Airspeed	**19**	Aircraft Position	-
Altimeter	**19**	Special Use Airspace	-
Altimeter Set Display	-	Waypoint Pointer	-
Bank Scale	-	Active Flight Plan Path	-
CDI	**20**	Glide Range	-
Runway	-	Groundspeed	-
Waypoint Pointer	-	Ground Track	-
Heading Scale	-	Heading Indicator	-
AGL Ind.	-	Navigation Symbols	-
Flight Path Marker	-	Outside Air Temp	-

Table 4-24: Function Table MFD Failure Mode 7 (Essential Mode) GPS/SBAS, ADC and AHRS failed			
PFD Functions	**Mode 7**	**ND Functions**	**Mode 7**
		Projected Path	**-**
G-Meter	**-**	Traffic	**OK**
Ground Track	**-**	Terrain / Obstructions	**-**
Heading Indicator	**-**	Clock Functions	**OK**
Horizon	**-**	Waypoint Brg. / Dist.	**-**
Mini-Map	**-**	Wind	**-**
Pitch Limit Indicator	**-**		
Pitch Scale	**-**	Compass Rose	**-**
Highway in the Sky	**-**	Fuel Totalizer	**12**
Terrain / Obstruction	**-**	True Airspeed	**-**
Clock Functions	**OK**	Density Altitude	**-**
VSI	**-**	OAT/ISA Display	**-**
Waterline Symbol	**13**		
Waypoint Symbol	**-**		
Waypoint Brg. / Dist.	**-**		
Traffic	**-**		
Traffic Thumbnail	**OK**		
Speed Trend	**-**		
Dynamic Stall Speed	**-**		

Section 5 Menu Functions and Step-By-Step Procedures

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List of Figures and Tables

5.1. Menu Functions

IDU menu functions are navigated using the peripheral buttons and rotary encoders.

The IDU-680 has 16 peripheral buttons and three rotary encoders (center left, center right and lower right). The rotary encoder in the lower left corner of the IDU-680 is only used for adjusting screen and button brightness and cannot be used for menu functions. The IDU-680's lower left rotary encoder will always be labeled "DIM."

Figure 5-1: IDU-680 Input Controls

5.2. Menu Synchronization

System settings changed by the menu system will be synchronized between multiple IDUs and between top and bottom areas of an IDU-680 in MFD-MFD mode according to the following tables:

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.	
Fuel Totalizer Quantity	
VNAV Climb Angle	
Countdown Timer Start Time	
Countdown Timer Default Value	
Remote Tune Frequencies	
VNAV Descent Angle	
Decision Height Setting	
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	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
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 FMS's 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	
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Navigation Source	

Table 5-1: Menu Synchronization	
Menu Parameter	**Notes**
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	
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the user 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.	

Table 5-1: Menu Synchronization	
Menu Parameter	**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 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.
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
MFD Strike (WX-500) Page Settings	Independent between top and bottom 680 MFD areas
MFD Traffic Page Settings	Independent between top and bottom 680 MFD areas

Table 5-1: Menu Synchronization

Menu Parameter	Notes
MFD Video Page Settings	Independent between top and bottom 680 MFD areas with the exception of: Selected Input Brightness Contrast Saturation Hue (Note: the above are video hardware settings)

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 periphery. Soft menu function tiles will 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. Soft menu function tiles will appear next to the appropriate IDU key or adjacent to one of the rotary encoders when use of the encoder is appropriate. Menus that appear adjacent to rotary encoders are frequently of a selection list format. Within such selection lists, the indication of further menu levels will consist of a two-dot trailer. Selection lists that are too long to be presented in the space available will provide an indication of location within the list. Whenever the menu system is beyond the top-level, an "**EXIT**" **(R1)** tile will appear adjacent to the top right pushbutton to provide one touch escape to the top-level. Whenever a soft menu level is deeper than the first-level, a "**BACK**" **(L1)** tile will appear adjacent to the top left pushbutton to provide a method of regressing 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

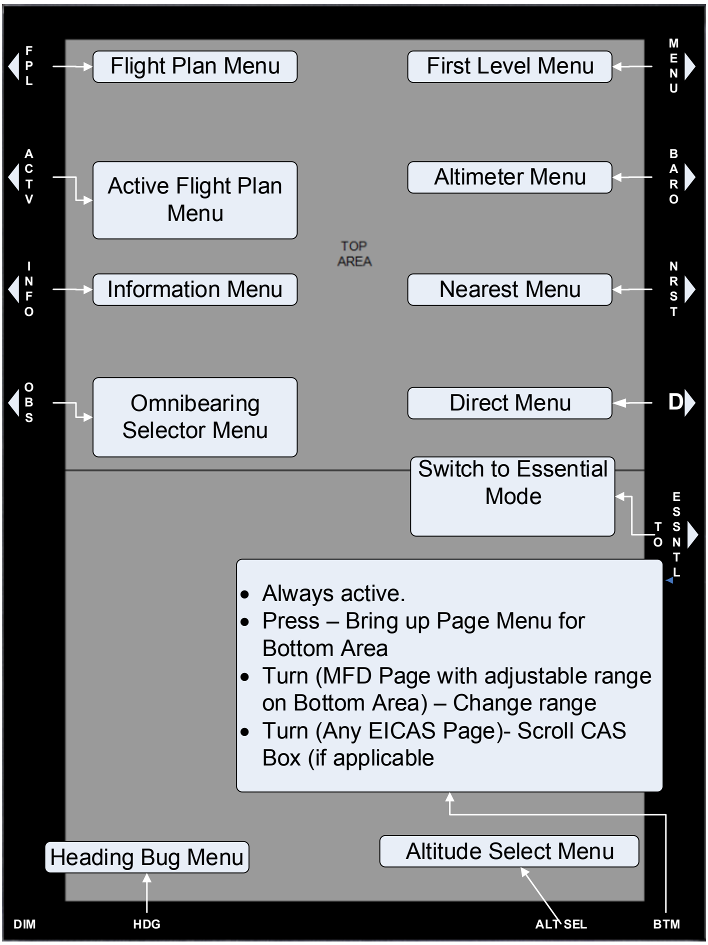


Figure 5-2: PFD Normal Mode Top-Level Menu

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

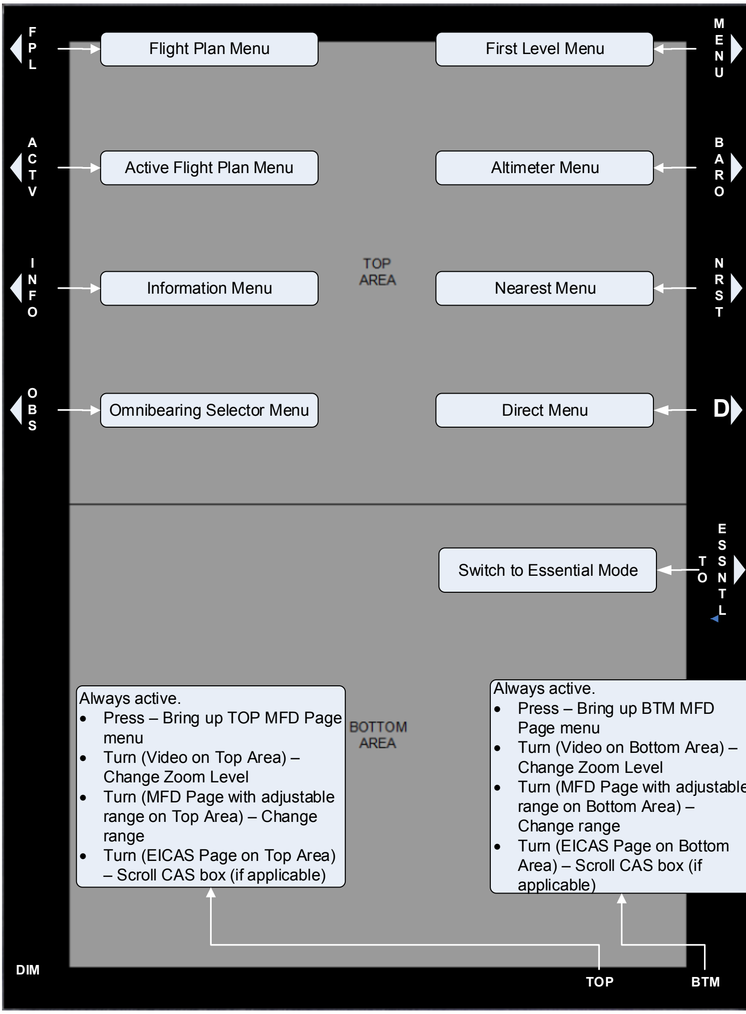


Figure 5-3: IDU-680 MFD Normal Mode Top-Level Menu

5.6. IDU-680 PFD or MFD Essential Mode Top-level Menu

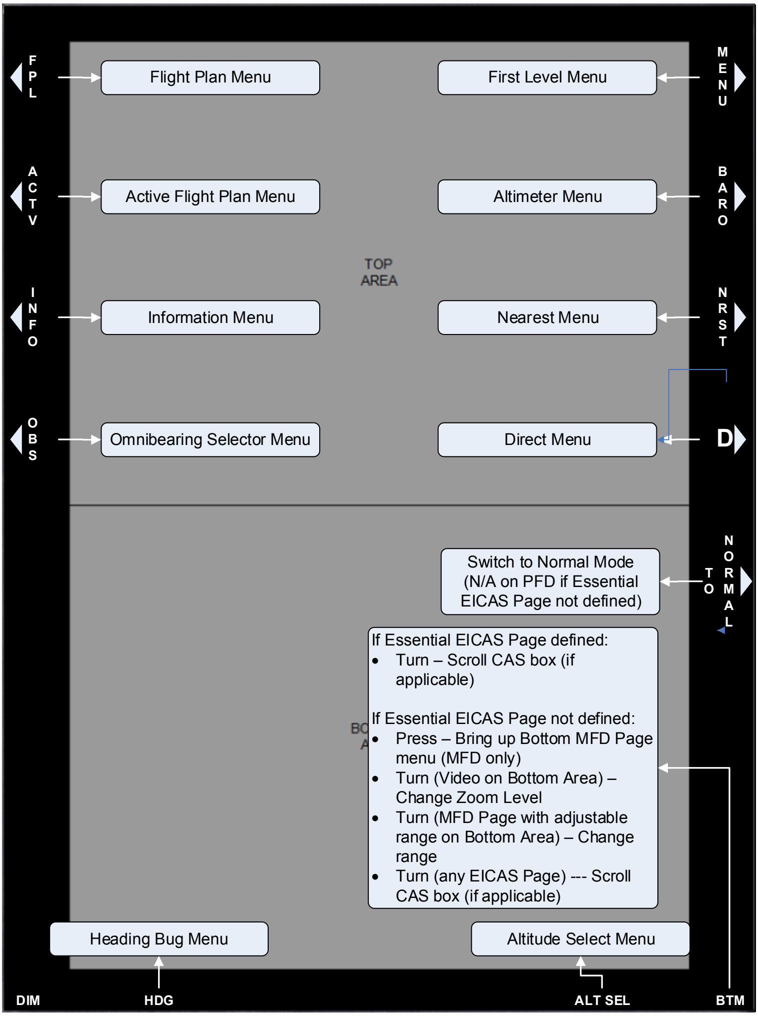


Figure 5-4: IDU-680 PFD or MFD Essential Mode Top-Level Menu

5.6.1. Top-level Menu Option Descriptions

- **FPL (L1)**: Flight plan menu.
- **ACTV (L2)**: Active flight plan menu.
- **INFO (L3)**: Information menu.
- **OBS (L4)**: Omnibearing selector menu.
- **MENU (R1)**: First-level associated with the current display page and automatically times out after 10 seconds if there are no subsequent user actions.
- **BARO (R2)**: Altimeter menu option.
- **NRST (R3)**: Nearest menu option.
-  **(R4)**: Direct menu option.
- **TO ESSNTL / TO NORMAL (R5)**: Manually switches between Normal and Essential modes.
- #3 Encoder: Function depends upon IDU number and mode (Normal vs. Essential) as follows:
    - On a PFD (IDU #1), Pushing the #3 encoder will sync current heading and turning will activate the Heading menu.
    - On an MFD (IDU's other than #1) operating in Essential Mode, Pushing the #3 encoder will sync current heading and turning will activate the Heading menu.
- #2 Encoder:
    - On a PFD (IDU #1), any encoder action will activate the target altitude selection function of the PFD Bugs menu. The encoder will be labeled "ALT SEL."
    - On an MFD (IDU's other than #1) operating in Normal Mode, if the Top Area is showing a page with an adjustable display scale (i.e., ND, Strike, Traffic, Datalink or Weather Radar, rotating the encoder will change the display scale (clockwise = Increase Scale, counterclockwise = Decrease Scale).

- On an MFD (CPU's other than #1) operating in Normal Mode, if the Top Area is showing a video page, rotating the encoder will change the zoom level (clockwise = Increase Zoom, counterclockwise = Decrease Zoom).
- On an MFD (IDU's other than #1) operating in Normal Mode, if the Top Area is showing an EICAS that includes a CAS box, rotating the encoder will scroll the CAS box.
- On an MFD (CPU's other than #1) operating in Normal Mode, if the Top Area is showing an Audio/Radio page, rotating the encoder will change the selected Audio/Radio device.
- On an MFD (CPU's other than #1) operating in Normal Mode, if the Top Area is showing an Audio/Radio page, rotating the encoder changes the selected Audio/Radio device .
- On an MFD (CPU's other than #1) operating in Normal Mode, pressing the encoder activates the TOP MFD Page Menu as described in the MFD Page Menu section. The TOP MFD Page Menu is drawn above the center right encoder, unlike other menu lists. It is possible for the user to have selected a full screen EICAS in the Bottom Area that consumes both the Top and Bottom Areas. In this case, completion of the MFD Page menu action will automatically switch the EICAS in the Bottom Area to its related "backup" displays.
- On an MFD (IDU's other than #1) operating in Essential Mode, the encoder will be labeled "TOP" when either an encoder rotation or press could have an effect.
- On an MFD (IDU's other than #1) operating in Essential Mode, any encoder action will activate the target altitude selection function of the PFD Bugs menu. The encoder will be labeled "ALT SEL."

5.6.2. #1 Encoder:

- On a PFD or MFD operating in Normal Mode, if the Bottom Area is showing a page with an adjustable display scale (i.e., ND, Strike, Traffic, Datalink or Weather Radar.), rotating the encoder will change the display scale (clockwise = Increase Scale, counterclockwise = Decrease Scale).

- On a PFD or MFD operating in Normal Mode, if the Bottom Area is showing a video page, rotating the encoder changes the zoom level (clockwise = Increase Zoom, counterclockwise = Decrease Zoom).

- On a PFD or MFD operating in Essential Mode with an Essential EICAS page configured, if the Essential EICAS page includes a CAS box, rotating the encoder will scroll the CAS box.

- On a PFD or MFD operating in Normal Mode, if the Bottom Area is showing an Audio/Radio page, rotating the encoder will change the selected Audio/Radio device.

  - On a PFD or MFD operating in Essential Mode with an EICAS configured, if the EICAS includes a CAS box, rotating the encoder will scroll the CAS box.

- In Normal Mode or Essential Mode without an Essential EICAS page configured, pushing the encoder will activate the MFD Bottom Page menu option as described in the MFD Page Menu section. Note that it is possible for the user to have selected a full screen EICAS page in the Top Area that consumes both the Top and Bottom Areas. In this case, completion of the MFD Page menu action will automatically switch the EICAS page in the Top Area to its related “backup” display.

  - The #1 encoder will be labeled “BTM.” The #1 encoder will not be labeled if in Essential Mode with an Essential EICAS page configured and the EICAS page does not include a CAS box.

5.6.3. Top-level Menu Automatic Pop-up Function Descriptions

Under certain conditions, soft menu tiles automatically appear at the top-level to provide the user with 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 Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
L1	**L5**	1) As specified in IDU TAWS section 8, when a terrain popup occurs during a TAWS FLTA alert, a "**RESET**" tile appears. 2) When showing the Datalink Page with Pan Mode enabled a "**PN OFF**" tile will appear. When pressed, this button will disable the Pan Mode. "**RESET**" **(L5)** has precedence over "**PN OFF**" **(L5)**. 3) When showing the ND Page with Pan Mode enabled, **"PN OFF" (L5)** will appear. When pressed, this button will disable the Pan Mode. "**RESET**" **(L5)** tile has precedence over the "**PN OFF**" **(L5)**. 4) When the display is "transmit enabled", "**LNAV**" **(L5)** appears when there is an active flight plan, the heading bug sub-mode is active and the system is integrated with an analog autopilot. When "**LNAV**" **(L5)** is pressed, the heading bug sub-mode will be deactivated and guidance to the active flight plan path will resume. The "**RESET**" **(L5)** and "**PN OFF**" **(L5)** have precedence over "**LNAV**" **(L5)**. 5) When the display is "transmit enabled", "**MISS**" **(L5)** will appear upon transitioning the Final Approach Fix. When the "**MISS**" **(L5)** is pressed, the missed approach procedure will be activated. The "**RESET**," **(L5)** "**PN**

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
		OFF” **(L5)** and “**LNAV**” **(L5)** will have precedence over the “**MISS**” **(L5)**. 6) When the display is “transmit enabled”, “**CONT**” **(L5)** will appear when in a holding pattern with further active flight plan legs after the holding pattern. When the “**CONT**” **(L5)** is pressed, automatic waypoint sequencing will be re-enabled to allow normal sequencing to the leg after the holding pattern. The “**PN OFF**,” **(L5)** and “**MISS**” **(L5)** will have precedence over “**CONT**” **(L5)**.
L2	**L6**	1) When showing the Datalink Page with Winds and Temperatures Aloft enabled, “**UP**” **(L6)** appears. When “**UP**” **(L6)** is pressed, the Winds and Temperatures Aloft grid level is increased. “**UP**” **(L6)** will not appear when the highest grid level is being displayed. 2) When showing the Video Input Page with pan mode enabled, a “**UP**” tile will appear. When the “**UP**” tile is pressed, the section of the video image displayed is moved up in the full video image. 3) When showing the 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**” **(L6)** appears to allow the display of textual METAR

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
		and TAF data for the airport. "**UP**" **(L6)** has precedence over "**WX**" **(L6)**. 4) When showing the 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**" **(L6)** appears to allow the display of textual METAR and TAF data for the airport. 5) When the display is "transmit enabled", "**VNAV**" **(L6)** appears when VNAV guidance is valid, the selected altitude sub-mode is active and the system is integrated with an analog autopilot. When the "VNAV" tile is pressed, the selected altitude sub-mode will be deactivated and guidance to the VNAV path will resume. "**UP**" **(L6)** and "**WX**" **(L6)** have precedence over the "**VNAV**" **(L6)**. 6) When the display is "transmit enabled", "**ARM**" **(L6)** appears when on the Final Approach Segment (between the Final Approach Fix and Missed Approach Point). When "**ARM**" **(L6)** is pressed, the missed approach procedure will be armed to automatically activate upon sequencing the Missed Approach Point. The "**UP**" **(L6)** , "**WX**" and "**VNAV**" **(L6)** has precedence over "**ARM**" **(L6)**.

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
		7) When showing the AR page and a device having adjustable volume is selected, "**MUTE**" **(L6)** appears. When pressed, this button will toggle mute for the selected device. Note: Not applicable for intercom system. "**VNAV**" **(L6)** has precedence over "**MUTE**" **(L6)**. 8) When showing the AR page and an intercom system is selected, "**SYNC TX**" **(L6)** will appear when the intercom system is set to Split Transmit. When pressed, this button will synchronize the selected transceivers in a multi-unit configuration and clear the Split Transmit feature. For Intercom systems, "**SPLIT TX**" **(L6)** appears when the intercom system is set to synchronize transmit. When pressed, this button will set the system to Split Transmit. "**VNAV**" **(L6)** have precedence over the "**SPLIT TX**" **(L6)** and "**SYNC TX**" **(L6)**.
L3	**L7**	1) When showing the Datalink Page with Pan Mode enabled, "**NORTH**" **(L7)** appears. When pressed, this button will cause the center of the Pan Mode Datalink Page to shift in the specified direction. 2) When showing the ND Page with Pan Mode enabled, a "**NORTH**" **(L7)** appears. When pressed, this button will cause the center of the Pan Mode

Table 5-2: Top-Level Auto Popup Function Descriptions

IDU-680 (Note 1)	IDU-680 (Note 2)	Precedence, Tile Legend and Action
		ND Page to shift in the specified direction. 3) When showing the Video Input Page with pan mode enabled, “**DOWN**” **(L7)** will appear. When “**DOWN**” **(L7)** is pressed, the section of the video image displayed will be moved down in the full video image. 4) When showing the AR page when interfaced with a transponder, an “**IDENT**” **(L7)** appears. When pressed, this button enables the special position identification or “ident” feature of the transponder.
L4	**L8**	1) When showing the Datalink Page with Pan Mode enabled, “**SOUTH**” **(L8)** appears. When pressed, this button causes the center of the Pan Mode Datalink Page to shift in the specified direction. 2) When showing the ND Page with Pan Mode enabled, a “**SOUTH**” tile appears. When pressed, this button causes the center of the Pan Mode ND Page to shift in the specified direction. 3) When showing the AR page and a device having an expanded AR page is selected, an “**EXP**” tile will appear. When pressed, this button enables the AR Expand Page First-Level options.
R2	**R6**	1) When showing the Datalink Page with Winds and Temperatures Aloft

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
		enabled, “**DOWN**” **(R6)** will appear. When the “**DOWN**” **(R6)** is pressed, the Winds and Temperatures Aloft grid level will be decreased. The “**DOWN**” **(R6)** will not appear when the lowest grid level is being displayed. 2) When showing the Video Input Page with pan mode enabled, a “**LEFT**” **(R6)** appears. When the “**LEFT**” **(R6)** is pressed, the section of the video image displayed is moved left in the full video image. 3) When showing the Datalink Page with Pan Mode enabled, an "**INFO**" or “**HIDE**” **(R6)** appears. When pressed, this button will toggle the display of information for the nearest highlighted waypoint. Refer to the INFO Menu requirements for the amount and type of information presented. The “**DOWN**” **(R6)** has precedence over the “**INFO”/”HIDE**” **(R6)**. 4) When showing the ND Page with Pan Mode enabled, an "**INFO**" **(R6)** or “HIDE” **(R6)** will appear. When pressed, this button will toggle the display of information for the nearest highlighted waypoint. Refer to the INFO Menu requirements for the amount and type of information presented. 5) When showing the AR page and a transceiver is selected which is not currently enabled for transmit, a “**TX**"

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
		(R6) appears. When pressed, this button enables the selected device for transmit and un-mute the selected device. When the interfaced AMU fails, the AR page will omit "**TX**" **(R6)** and button operation for the devices. 6) When showing the AR page and a VHF Nav Receiver is selected, and a DME receiver is interfaced and DME presents a valid signal, "**HOLD**" **(R6)** appears. When pressed, this button toggles DME Hold for the Nav receiver and associated DME channel. When pressed, this button will set the hold frequency of the DME channel for the current Nav Receiver equal to the Nav receiver active frequency. 7) When showing the AR page and an ADF Receiver is selected, "**BFO**" **(R6)** appears when the ADF receiver is in ADF mode. When the ADF receiver is in BFO or TEST mode, a "REC" tile appears. When the ADF Receiver is in receive mode, "**ADF**" **(R6)** appears. When pressed, this button enables the BFO mode when the receiver is in ADF mode. When pressed, this button enables the ADF mode when the receiver is in receive mode. When pressed, this button will enable the receive mode when the receiver is in BFO or TEST mode. 8) When showing the AR page and a transponder is selected, "**VFR**" **(R6)** appears. When pressed, this button

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
		will set the transponder standby code to the transponder VFR code set by the user interface. 9) When showing the AR page and a marker beacon having sensitivity control is selected, "**SENSE**" **(R6)** appears. When pressed, this button toggles the marker beacon hi/lo discrete output.
R3	**R7**	1) When showing the Datalink Page with Pan Mode enabled, "**EAST**" **(R7)** appears. When pressed, this button causes the center of the Pan Mode Datalink Page to shift in the specified direction. 2) When showing the ND Page with Pan Mode enabled, "**EAST**" **(R7)** appears. When pressed, this button causes the center of the Pan Mode ND Page to shift in the specified direction. 3) When showing the Video Input Page with pan mode enabled, "**RIGHT**" **(R7)** appears. When "**RIGHT**" **(R7)** is pressed, the section of the video image displayed is moved right in the full video image. 4) When showing the AR page and a device having a tunable frequency or code is selected, a "**SWAP**" **(R7)** appears. When pressed, this button switches the standby frequency/code and the active frequency/code for the selected device.

Table 5-2: Top-Level Auto Popup Function Descriptions		
IDU-680 (Note 1)	**IDU-680 (Note 2)**	**Precedence, Tile Legend and Action**
R4	**R8**	1) When showing the Datalink Page with Pan Mode enabled, "**WEST**" **(R8)** appears. When pressed, this button causes the center of the Pan Mode Datalink Page to shift in the specified direction. 2) When showing the ND Page with Pan Mode enabled, "**WEST**" **(R8)** appears. When pressed, this button causes the center of the Pan Mode ND Page to shift in the specified direction. 3) When showing the AR page and a VHF COM transceiver, VHF NAV Receiver, or ADF Receiver is selected, "**TUNE\VOL**.." **(R8)** appears. When pressed, this button enables AR Tune page first-level options. 4) When showing the AR page and a transponder is selected, "**CODE\MODE**" **(R8)** appears. When pressed, this button enables AR Tune page first-level options. 5) When showing the AR page and a audio-only device is selected, "**VOL**" **(R8)** appears. When pressed, this button enables AR Tune page first-level options. 6) When showing the AR page and an AMU is selected, "**VOX\VOL**" **(R8)** appears. When pressed, this button enables AR Tune page first-level options.

Notes:

1) The designated buttons are used when the function is tied to a Page in the top area.

2) The designated buttons are used when the function is tied to a Page in the bottom area or when the function is tied to being “Transmit Enabled.”

5.7. First Page (PFD)

The top area of IDU #1 is fixed to the PFD page and other IDU’s can show the PFD page in the top area by selecting Essential Mode. IDU-680 PFD page first-level options are shown adjacent to the top area in the top 8 pushbuttons. Note that options may also appear on the bottom 8 pushbuttons as appropriate to the page being shown in the bottom area. When an identical option would be shown adjacent to both the top area and bottom area, the option will only be shown adjacent to the top area.

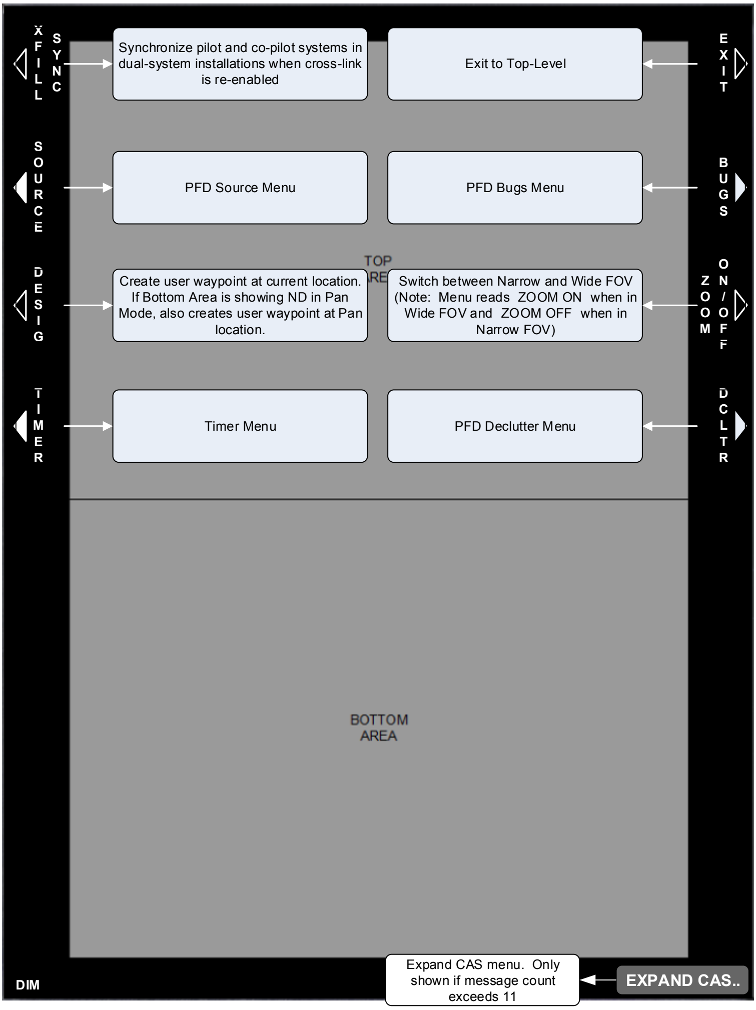


Figure 5-5: First Page PFD

5.7.1. PFD Page First-Level Option Descriptions

XFILL SYNC (L1): Appears in dual-system installations where the pilot and co-pilot systems are not synchronized but crosslink is enabled. When pressed, will synchronize the pilot and co-pilot active flight plan parameters to the system where the button press occurred.

Source (L2): Activates the PFD source selection menu option.

DESIG (L3): Creates a user waypoint at the current aircraft location. In addition, if pressed on an IDU-680 with an ND page operating in panning mode, will create a user waypoint at the panning location. User waypoint will automatically be named "**OF###**," where **###** is the next available over-fly user waypoint number.

TIMER (L4): Activates the timer menu option.

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

ZOOM ON / **ZOOM OFF (R3):** Toggles between wide FOV mode and narrow FOV mode. "**ZOOM ON**" will appear when the current mode is wide FOV. "**ZOOM OFF**" will appear when the current mode is narrow FOV.

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

EXPAND CAS (#1 Encoder) Will only appear when there are more than 11 active CAS messages being displayed and will activate the Expand CAS menu option.

5.7.2. First level (MFD)

The Bottom Area of all CPUs always shows the MFD Page in all modes (note that the Essential EICAS page is considered a type of MFD page). CPU's other than CPU#1 can also show the MFD page in the Top Area when in Normal Mode. The MFD page first-level options will be shown adjacent to the area in which the MFD page resides. When an identical option would be shown adjacent to both the Top Area and Bottom Area, the option will only be shown adjacent to the Top Area. (Note: options spelled the same but which affect different areas of the screen are not identical.) The MFD page first-level options will be as follows (note: all possible options shown adjacent to the Top Area for illustrative purposes):

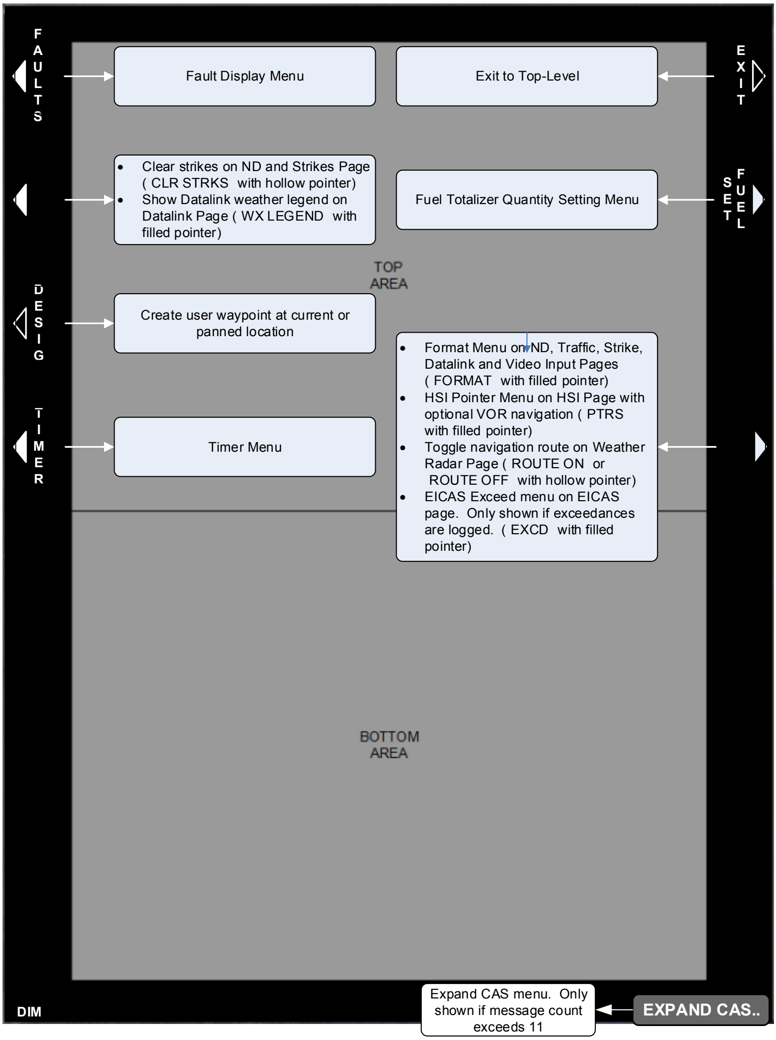
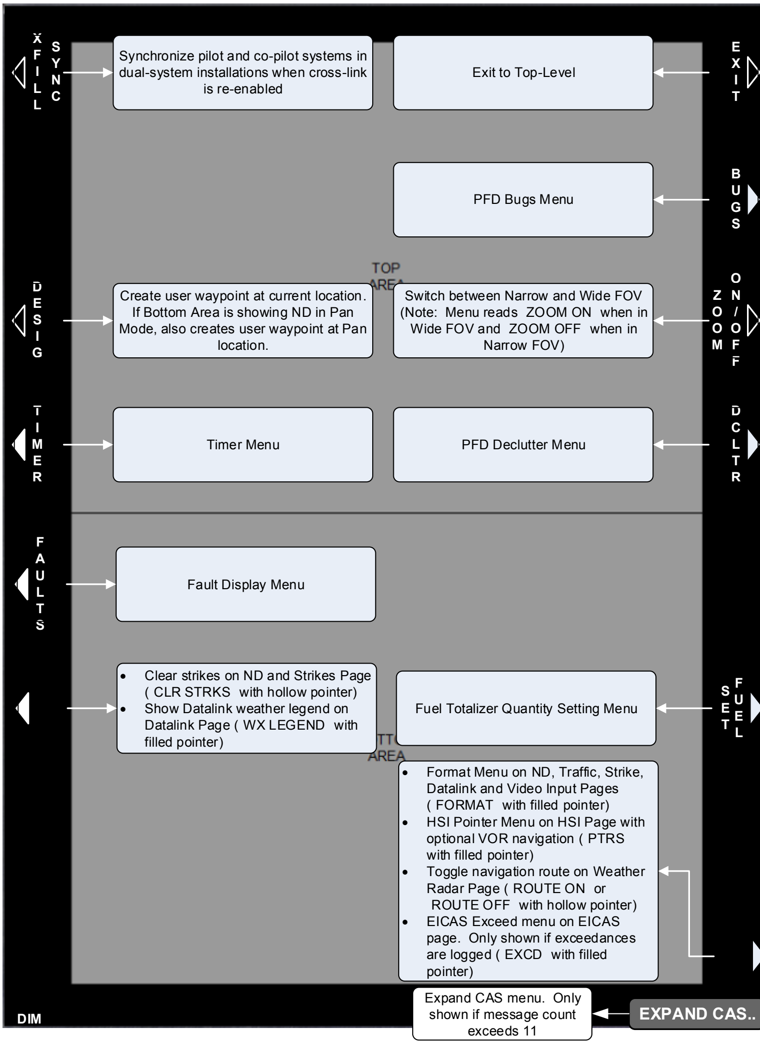


Figure 5-6: First Level MFD

5.7.3. First level (PFD IDU#1) Normal Mode



Figre 5-7: First Level PFD

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

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

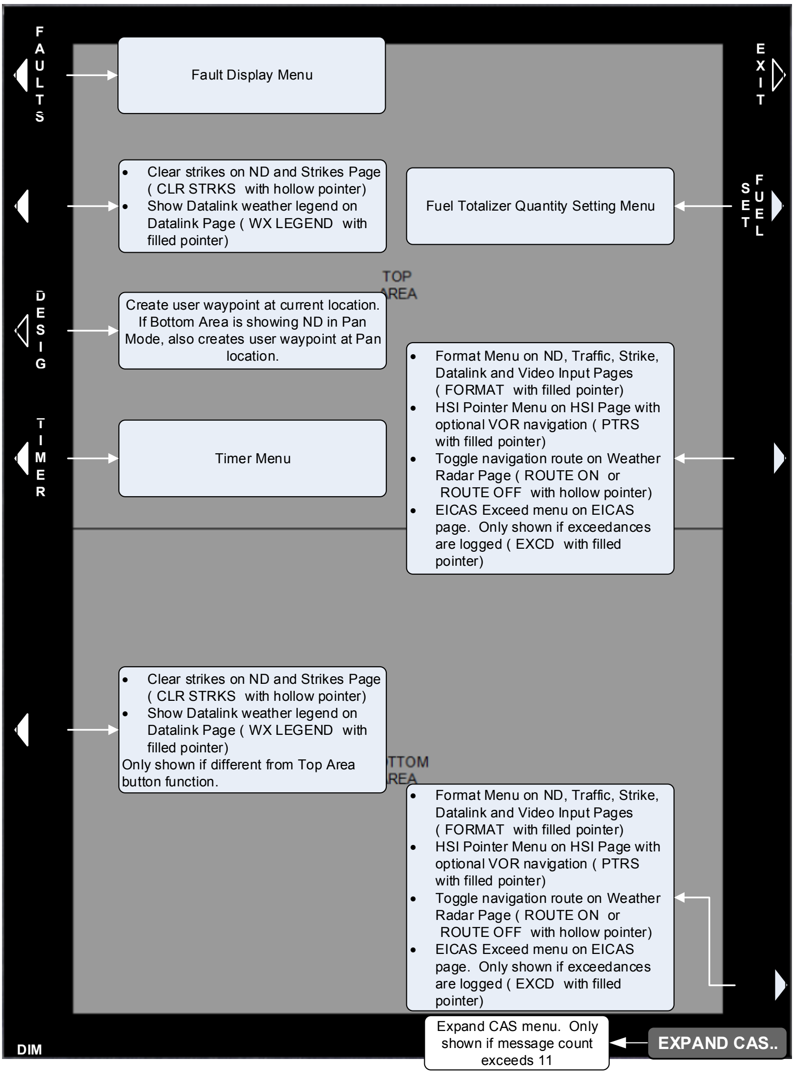


Figure 5-8: First Level (MFD IDU other than #1) Normal Mode

5.7.5. MFD Page First-Level Option Descriptions

1) **FAULTS**: Activates the fault display menu option.

2) **CLR STRKS** or **WX LGND**: On ND page or Strike page with WX-500 option enabled, "**CLR STRKS**" will activate the strike clear option. On Datalink page, "**WX LGND**" will activate the datalink weather legend.

3) **DESIG**: Same function as PFD Page First-level.

4) **TIMER**: Same function as PFD Page First-level.

5) **SET FUEL**: Activate fuel totalizer set menu option.

6) **PAGE** Note that on IDU-680 MFDs, this function is handled at the top-level by pressing the two right rotary encoders.

7) **FORMAT: PTRS, Route ON/ROUTE OFF or EXCD** (**R8**): On the ND, "**FORMAT**" will activate the appropriate page format menu option.

8) **PTRS:** On HSI page with optional VOR or ADF symbology enabled will activate HSI RMI pointer menu option.

9) **ROUTE ON/ROUTE OFF**: On the Weather Radar page, "**ROUTE ON/OFF**" will toggle the display of the active flight plan on the horizontal weather radar display. "**ROUTE ON**" will appear when the display of the active flight plan is disabled. "**ROUTE OFF**" will appear when the display of the active flight plan is enabled.

10) **EXCD**: On a generic EICAS page of type EICAS, "EXCD" will activate the EICAS Exceedance menu option. "**EXCD**" will only appear if exceedances are logged.

11) **EXPAND CAS (#1 Encoder)**: Activates the Expand CAS menu option. Only appears when there are more than 11 active CAS messages.

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

The bottom area of the IDU-680 shows the EICAS page. In Normal Mode on IDU's other than #1, the EICAS page can be shown in the top area (note that a full-screen EICAS page that uses both the top and bottom Areas is considered to be a top area page). IDU-680 EICAS page first-level options will be shown adjacent to the area in which the EICAS page resides. When an identical option would be shown adjacent to both the top area and bottom area, the option will only be shown adjacent to the top area. IDU-680 EICAS page first-level options will be as follows:

(Note: All possible options are shown adjacent to the top area for illustrative purposes in figure 5-9):

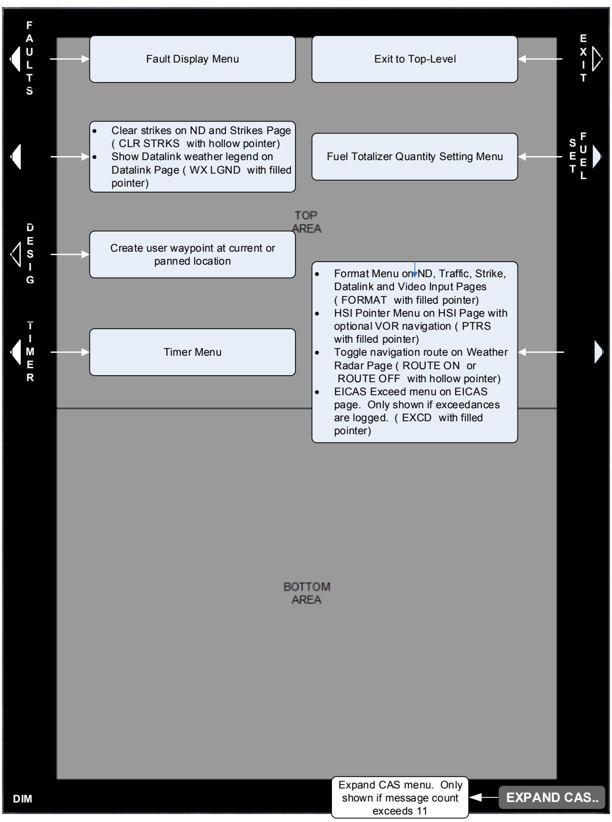


Figure 5-9: IDU-680 EICAS Page First-Level in Essential Mode

5.7.7. PFD Page in Top Area and Essential Mode EICAS Page in bottom area

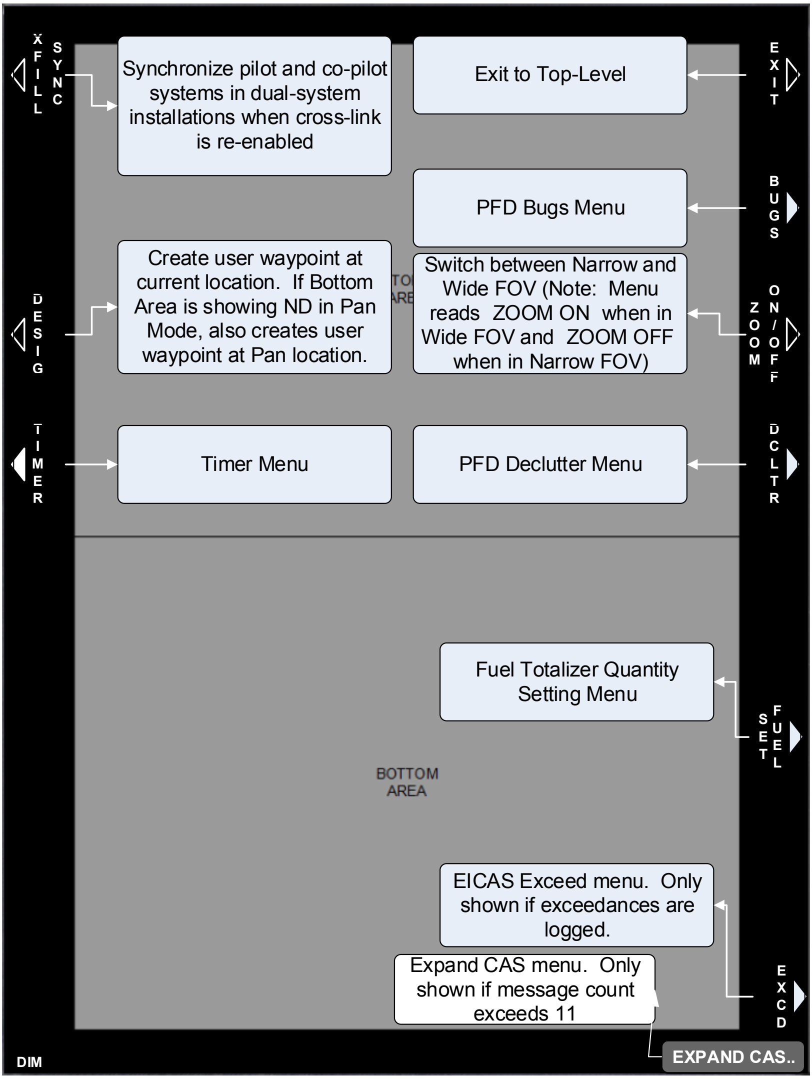


Figure 5-10: PFD Page in Top Area and Essential Mode EICAS page in Bottom Area

5.7.8. First-Level menu of an MFD (IDU other than #1) in Normal Mode

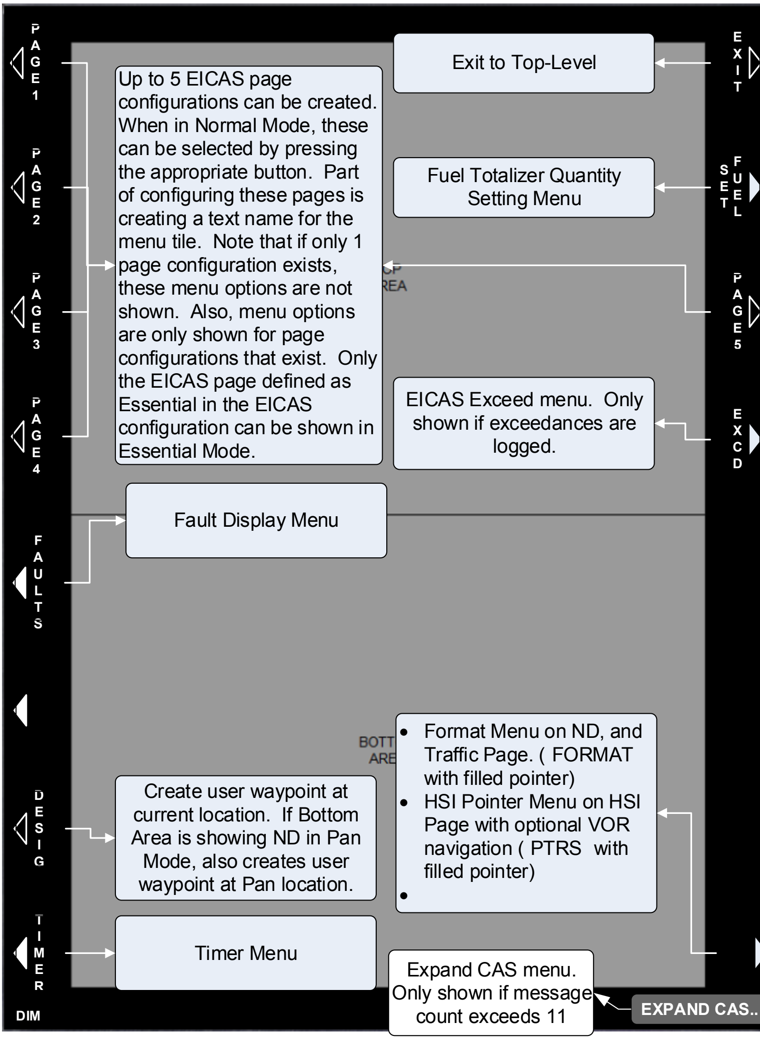
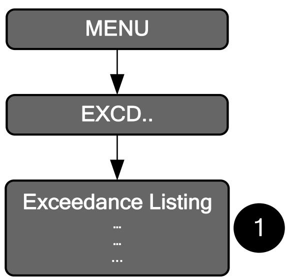


Figure 5-11: First-Level menu of an MFD (IDU other than #1 in Normal Mode

5.7.9. 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 will be as configured in the EICAS configuration file. Options will only be shown if more than one EICAS page is configured; and will only be shown for EICAS pages that are configured.
3) **EXPAND CAS:** (**#1 Encoder**): Activates the Expand CAS menu option and only appear when there are more than 11 active CAS messages.
4) **EXCD:** Activates the EICAS Exceedance menu option and only appear if exceedances are logged.

5.8. EICAS Exceedance Menu

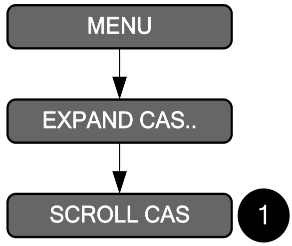


The EICAS Exceedance menu presents a listing of logged EICAS exceedances whereby the ➊ encoder can be scrolled to view each line.

The format for each exceedance line will be the following:

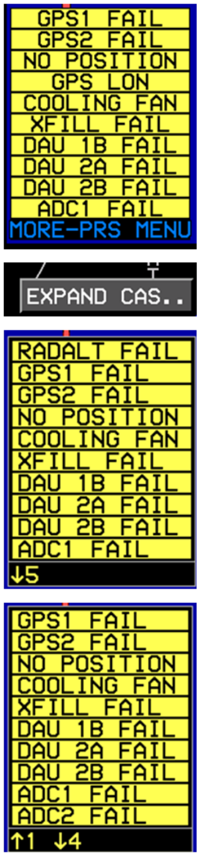
- Exceedance element name;
- Logged peak value in element units; and
- Logged duration in Hour: Minute: Second format.

5.9. Expand CAS Menu



The Expand CAS menu will change the display of CAS messages from a stacked presentation to a presentation using a CAS Display Box element. This allows scrolling to view off-screen messages when the message count exceeds 11. In the Expand CAS menu, the #1 encoder is dedicated to scrolling the CAS Display Box.

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



1) When more than11 CAS messages are available Press MENU

2) Scroll #1 encoder to view additional CAS messages

3) This example indicates there are an additional 5 messages below.

Figure 5-12: CAS List Scrolling

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

The Top-Level and First-Level menus, called lower-level menus that are described in this section are controlled by the 16 pushbuttons and rotary encoders on IDU-680. In the following diagrams, button and encoder numbers are interpreted according to the following view:

Figure 5-13: IDU 680 Input Controls

5.11. Flight Plan (FPL) Menu

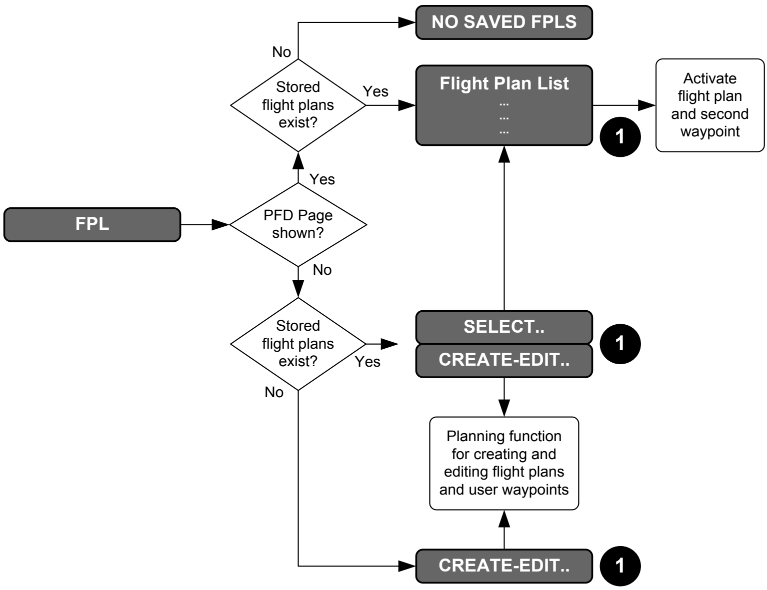


Figure 5-14: Flight Plan Menu

5.11.1. Flight Planner Page

The Flight Planner page is used for detailed operations on user-modifiable elements in the IDU database. Through the Flight Planner page, the following types of functions are performed:

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

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, the Flight Planner page will take over the IDU's controls and disable 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 will be restored upon:

1) Exiting the Flight Planner page; or
2) Automatic reversion of the IDU to the PFD or Essential Mode. Note that 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 on an IDU-680, the Flight Planner page will only appear in the bottom area. Note that it is possible for the user to have selected a full screen EICAS in the top area that consumes both the top and bottom areas. In this case, the top area will automatically switch to the Essential Mode 640x480 EICAS page.

5.11.2. PFD Page Shown on IDU

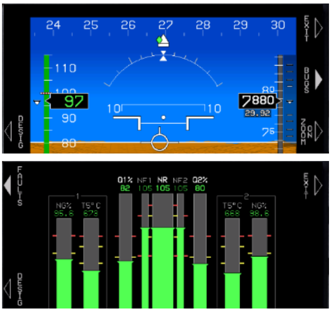
Upon activation of the flight plan menu, the application will check for the existence of saved flight plans. If there are no saved flight plans, a "**NO SAVED FPLS**" advisory will be issued. Otherwise, a selection list of saved flight plans will be presented. Upon selection of a saved flight plan, the second waypoint in the flight plan will be activated.

5.11.3. No PFD Page Shown on IDU

Upon activation of the flight plan menu, the application will check for the existence of saved flight plans. If there are no saved flight plans, then the Flight Planner page will be activated. Otherwise, an option list will be presented allowing the user to either select a saved flight plan or enter the flight planning page. Selecting the saved flight plan select option will lead to a list of saved flight plans. Upon selection of a saved flight plan, the second waypoint in the flight plan will be activated.

5.11.4. To Create an Overfly User Waypoint

When flying over intended waypoint, press **MENU (R1)** then **DESIG (L3)** on the PFD or MFD.



A user waypoint will be created at the present position, and automatically be named "OF###", where ### is the next in sequence overfly user waypoint number available.

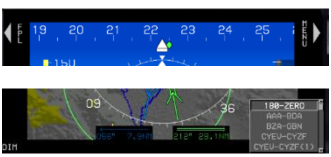
The waypoint name may be changed using the **EDIT USER WPT** function.

Figure 5-14a: Creation of Overfly User Waypoint

Note:

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

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

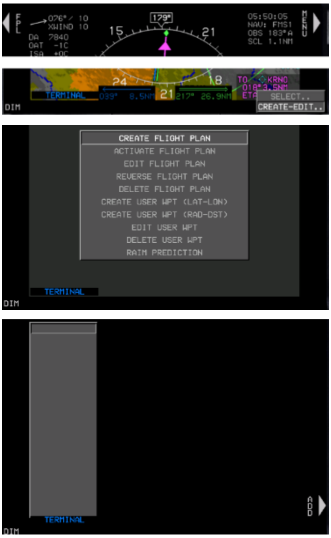


Press **FPL (L1)**

Scroll ➊ to desired flight plan and push to enter

Figure 5-14b: Flight Plan Menu Selection

5.11.6. Flight Plan (FPL) Menu Create-Edit (MFD only) (Step-By-step)



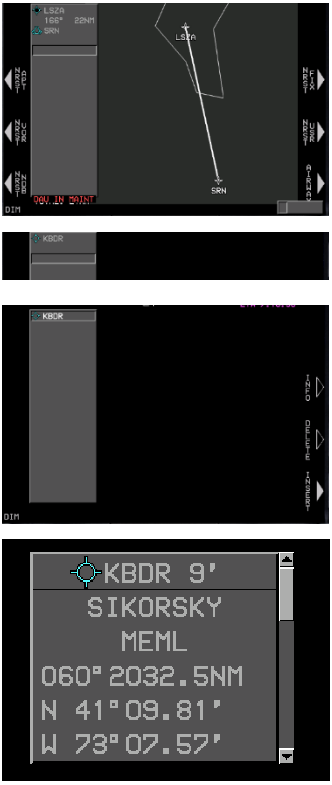
1) Press **FPL (L1)**

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

3) Push ❶ to Enter

4) Press **ADD (R8)** to begin creating first waypoint.

Figure 5-14c: Flight Plan Menu Selection

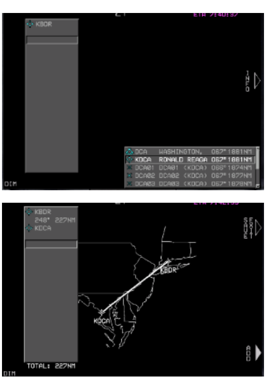


1) Press **NRST APT (L6)**, **NRST VOR (L7)**, **NRST NDB (L8)**, **NRST FIX (R6)**, **NRST USR (R7) or AIRWAY (R8)** to view applicable list, scroll ➊ to desired selection and push to insert into flight plan.

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

3) If necessary scroll up to KBDR

Figure 5-14d: Flight Plan Menu Selection



1) Scroll to next space and add another waypoint

2) Push ➊ to enter waypoint.

3) View current flight plan and press **SAVE EXIT (R5)** if accepted.

4) If necessary press **ADD (R8)** to create additional waypoints.

Figure 5-14e: Flight Plan Creation

5.11.7. Activate 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 ACTIVATE FLIGHT PLAN and push to enter

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

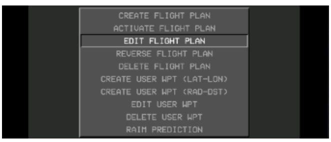
5) If no other action is necessary press **EXIT (R1)**

Figure 5-14f: Activate Flight Plan (MFD ONLY)

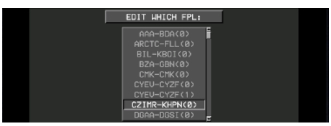
5.11.8. Edit Flight Plan (MFD only) (Step-By-Step)

1) Press **FPL (L1)**

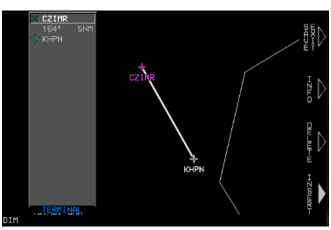
2) Scroll ➊ to **CREATE-EDIT..** and push to enter



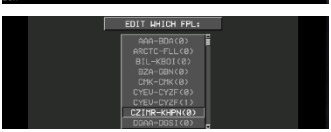
3) Scroll ➊ to **EDIT FLIGHT PLAN** and push to enter



4) Scroll ➊ to desired flight plan and push to enter



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



6) Press **SAVE EXIT (R5)** to save and exit to **EDIT WHICH FPL:** list

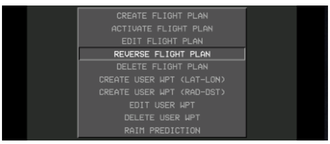
7) If no other action is necessary, press **EXIT (R1)**

Figure 5-14g: Edit Flight Plan (MFD only)

5.11.9. Reverse 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 **REVERSE FLIGHT PLAN** and push to enter

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

5) If no other flight plan requires reversing press **EXIT (R1)** to exit

Figure 5-14h: Edit Flight Plan (MFD only)

5.11.10. Delete 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 desired flight plan to be deleted and push to enter

4) Push ❶ to confirm deletion of **FPL**

5) The next flight plan is highlighted and if no further deletions are required

6) Press **EXIT (R1)** and push to enter

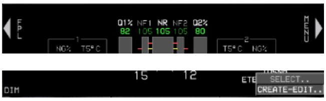
Figure 5-14j: Delete Flight Plan (MFD only)

5.11.11. Create User Waypoint (LAT-LON) (MFD only) (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 the following step-by-step procedure should be followed:



1) Press **FLP (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) A new user waypoint can be named through scrolling ❶ and pushing to enter all five character spaces

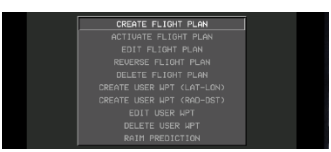
5) With new name created for user waypoint continue to press ❶ to proceed through all fields as necessary

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

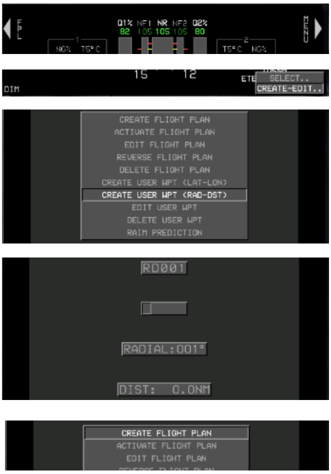
If desired, specify the approach bearing to the user waypoint in degrees 1°-360°. An "OFF" value will disable VFR approaches to the user waypoint



6) Once all fields are entered pushing ❶ will result in saving the user waypoint and returning to the editing screen

Figure 5-14k: Create User Waypoint (LAT-LON) (MFD only)

5.11.12. Create User Waypoint (RAD-DST) (MFD only) (Step-By-Step)



1) Press **FPL (L1)**

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

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

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

* **Reference Waypoint:** The user will be prompted to enter an identifier for the reference waypoint on the second line. The reference waypoint will be entered in the same manner as a waypoint is entered for a flight plan using ➊. If there is a single result from the search, the user will be advanced to the radial entry box. If there is no result from the search, the user will be re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers will be displayed, and upon selection, the user will be advanced to the radial entry box. An **INFO (R6)** menu providing access to information for the highlighted result will appear at this level to aid in selection.

Radial Entry: The third line will allow the user to specify a radial from the reference waypoint in increments of degrees.

Distance Entry: The fourth line will allow the user to specify a distance from the reference in increments of tenths of nautical miles.

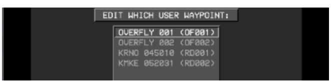
Figure 5-14m: Create User Waypoint (RAD-DST) (MFD only)

5.11.13. Edit User Waypoint (MFD only) (Step-By-Step)

1) Press **FPL (L1)**

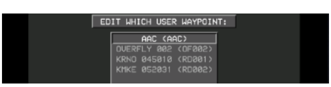
2) Scroll ➊ to **CREATE-EDIT..** and push to enter

3) Scroll ➊ to **EDIT USER WPT** and push to enter



4) Scroll ➊ to desired waypoint to be edited

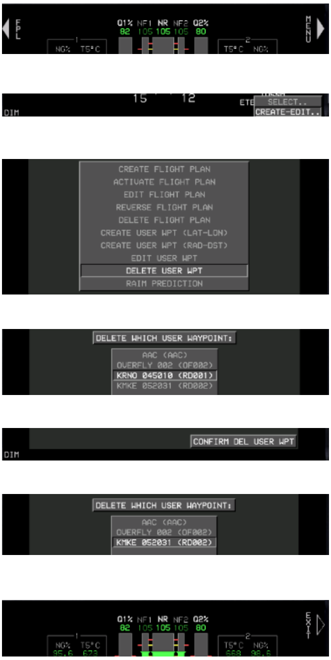
5) Using ➊ enter alphanumeric characters, follow on-screen prompts to edit information. Step through all character spaces by pushing ➊. To back up press **BACK (L1)** and continue to the end of all character spaces



6) If necessary select another **USR WPT** to edit or push **EXIT (R1)** to save changes

Figure 5-14n: Edit User Waypoint (MFD only)

5.11.14. Delete User Waypoint (MFD only) (Step-By-Step)



1) Press **FPL (L1)**
2) Scroll ➊ to **CREATE-EDIT..** and push to enter
3) Scroll ➊ to **DELETE USER WPT** and push to enter
4) Scroll ➊ to desired waypoint to be deleted
5) Push ➊ to confirm **DEL USER WPT**
6) Press **EXIT (R1)** to exit if no more **USER WAYPOINT**s are to be deleted

Figure 5-14p: Delete User Waypoint (MFD only)

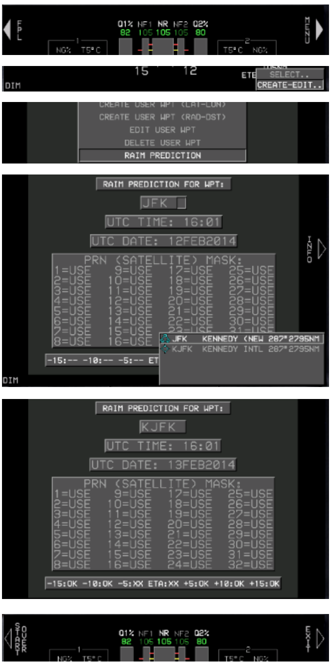
Note:

Pilot alterations of user waypoint parameters while in flight will not automatically be 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:

- EDIT the user waypoint as described above
- Open a flight plan which uses the user waypoint
- Delete the existing waypoint from the flight plan
- Save and Exit
- Reload the flight plan if it was in use.

5.11.15. RAIM Prediction

When selected, this RAIM prediction screen is only shown if the GPS/SBAS receiver is capable of performing a RAIM Prediction. This requires that there be no faults along with a current almanac in memory. The FAULTS menu can 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** and push to enter

   See note below.

4) If another RAIM Prediction is necessary press **START OVER (L1)** for starting the process again or press **EXIT (R1)** to exit the RAIM Prediction screen

Figure 5-14q: RAIM Prediction (MFD only)

Note:

The RAIM prediction screen allows the user 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 user is prompted to enter an identifier for the designated waypoint. If there is a single result from the search, the user is advanced to the UTC time entry box. If there is no result from the search, the user is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented and upon selection, the user is advanced to the UTC time entry box. An "INFO" (R6) tile giving access to information for the highlighted results appears at this level to 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 user to specify the PRN number of satellites that are expected to be unavailable at the destination.

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

Once a designated waypoint and UTC estimated time of arrival are entered, a "CALC" soft key appears to allow the user to initiate the RAIM Prediction. Upon pressing the "CALC" (R6) button, the UTC estimated time of arrival is checked to ensure that 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 will reply 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, a "START OVER" (L1) soft key appears to allow the user to perform another prediction without having to exit the RAIM Prediction screen.

5.12. Active Flight Plan (ACTV) Menu

5.12.1. Main Menu

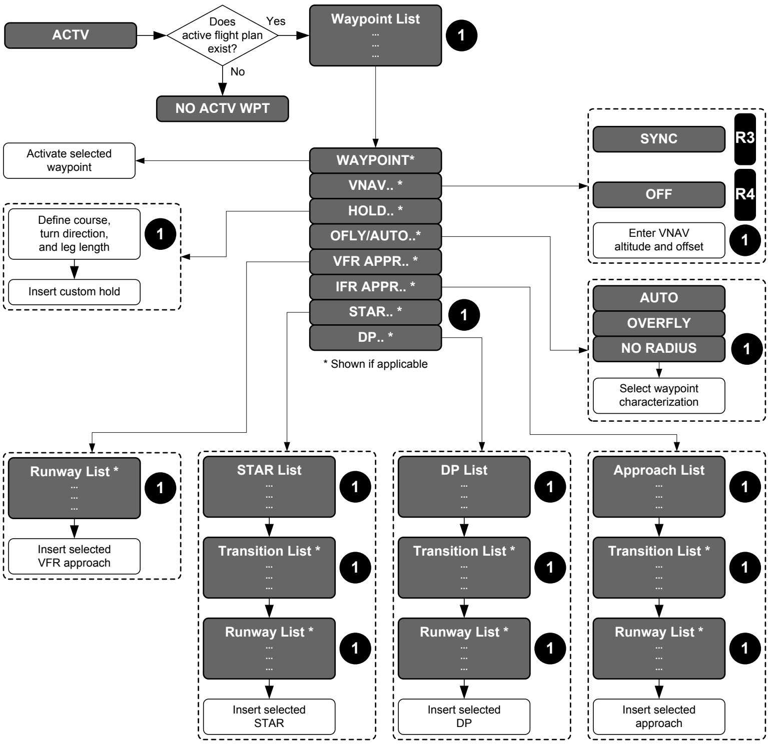


Figure 5-18: Active Flight Plan Main Menu

Upon activation of the active flight plan menu, the application checks for the existence of an active waypoint. If there is no active waypoint, a "**NO ACTIVE WPT**" is issued. Otherwise, a selection list in the form of 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 will be "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 that come from the navigation database or that have been manually entered will be shown in white and those offsets altitudes that are computed automatically will be shown in gray. The current active waypoint is designated by an asterisk and shown in magenta and turns 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 so that it can be highlighted for information or to activate other procedures to the airport. Since there can only be one approach active at any given time, there can only be one suppressed waypoint at any given time.

A skipped waypoint is a waypoint associated with a dynamic termination leg that has 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.

The user can scroll through each waypoint of the flight plan and one position past the end for purposes of adding a waypoint to the end of the active flight plan.

If not, the application will make the selected waypoint active. Otherwise, an option list will be presented as follows:

Upon selection of a waypoint from the selection list, the EFIS checks to see 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 will be presented as follows:

WAYPOINT: If the selected waypoint is neither suppressed, skipped nor a manual termination, it will be possible for the user to make the selected waypoint the active waypoint with this option.

VNAV: If the selected waypoint is neither suppressed, skipped, a manual termination, part of an IFR approach nor part of a VFR approach, it will be possible for the user to enter a manual VNAV altitude and offset for the selected waypoint with this option. This level will include tiles for synchronizing the VNAV altitude to current altitude and for removing the manual VNAV altitude and offset entry. VNAV altitudes will be settable in increments of 100 feet and offsets will be settable in increments of 1NM.

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, it is possible for the user to enter a manual holding pattern at the selected waypoint with this option. The user will be able to 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.

OFLY/AUTO: If the selected waypoint is neither suppressed, skipped nor a manual termination, it will be possible for the user to change the waypoint's overly characterization. The choices will be:

AUTO: Reset automatic overfly characterization by the FMS system;

OVERFLY: Manually force the overfly characterization to be an Overfly Adjust-Exit waypoint. This forces the inbound course to go directly to the waypoint regardless of the amount of course change required.

NO RADIUS: Manually force the turn radius at the waypoint to be zero. This forces the inbound course and outbound course to go directly to and from the waypoint regardless of the amount of course change required. Note that it is not possible to actually track a "NO RADIUS" path perfectly, but the FMS path guidance will quickly recapture the outbound course after automatic waypoint sequencing. Note that designating a waypoint as a "NO RADIUS" waypoint will affect the turn radius used to calculate procedure turn and holding pattern leg paths.

VFR APP: If the selected waypoint is a user waypoint with an approach bearing, then a VFR approach to the user waypoint based upon the approach bearing will be created and the user waypoint will be suppressed. If the selected waypoint is a VFR airport or an IFR airport with surveyed runways, then the user will be presented with a selection list of runways. After selecting a runway, a VFR approach to the runway will be created and the airport waypoint will be suppressed. Activating a VFR approach will automatically delete any pre-existing IFR or VFR approaches. If a heading bug is not already active, activating a VFR approach will automatically activate the heading bug on current aircraft heading and then be used to define the course intercept angle.

IFR APP: If the selected waypoint is an airport with an IFR approach, then this option will be available. Upon selecting this option, the user will be presented with a selection list of available approaches (including, if applicable, the 5-digit channel number, followed by a selection list of available transitions (if there are more than one), and a selection list of runways (if there are surveyed runways at the airport). After selection, the appropriate IFR approach will be created and the airport waypoint will be suppressed. Activating an IFR approach will automatically delete any pre-existing IFR or VFR approaches. If there is a pre-existing STAR to the airport, then the IFR approach waypoints will be 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 will automatically activate the heading bug on current aircraft heading for purposes of defining the course intercept angle.

STAR: If the selected waypoint is an airport with a STAR, then this option will be available. Upon selecting this option, the user will be presented with a selection list of available STARs, followed by a selection list of available transitions (if there are more than one), and a selection list of runways (if there are surveyed runways at the airport). After selection, the appropriate STAR will be created. Activating a STAR will automatically delete any pre-existing STAR. If there is a pre-existing approach (IFR or VFR) to the airport, then the STAR waypoints will be inserted prior to the approach waypoints.

DP: If the selected waypoint is an airport with a DP, then this option will be available. Upon selecting this option, the user will be presented with a selection list of DPs, followed by a selection list of available transitions (if there are more than one), and a selection 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 will be created and upon activation, automatically delete any pre-existing DPs.

5.12.2. Active Flight Plan (ACTV) Menu Options

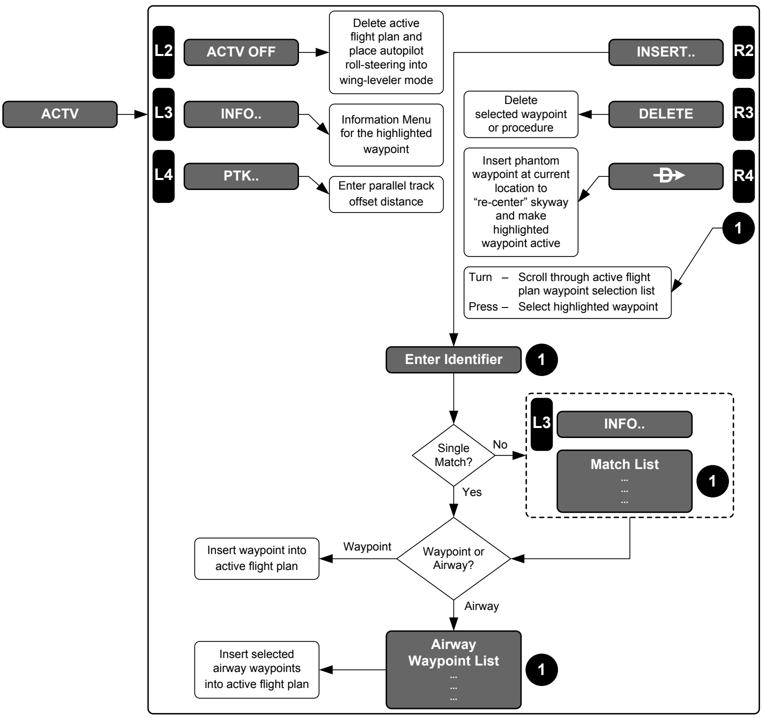


Figure 5-20: Active Flight Plan Menu Options

Various options will 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:

SAVE (L1): Saves the active flight plan. Stored flight plans are saved without procedures or phantom waypoint (note: 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, then a number (1 - 9) are appended to the name to uniquely identify up to 10 routings with the same start and end points.

ACTV OFF (L2): Deletes the active flight plan. The user is prompted to confirm deletion prior to completion of the operation.

INFO (L3): Activates the information menu option for the highlighted waypoint.

PTK (L4): Allows the user to specify a parallel offset distance for non-procedure segments of the active flight plan. The range of parallel offsets will be from 20NM left of track to 20NM right of track in 1NM increments.

INSERT / ADD (R2): Allows the user to 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 will read "ADD," otherwise the tile will read "INSERT." When the highlighted waypoint is the second or subsequent waypoint of a procedure, the tile will not appear. This prevents corruption of IFR approaches, STARs and DPs. When activated, the user will be 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 will be searched.

For waypoints, if there is a single result from the search, that result will be inserted or added to the active flight plan. If there is no result from the search, the user will be re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers will be presented and, upon selection, the selected waypoint will be inserted or added to the active flight plan. An "**INFO**" tile giving access to the information function for the highlighted result will appear at this level to aid in selection.

For airways, a search will be performed for all airways that go through the highlighted waypoint and match the entered identifier (i.e., to get a list of all Victor airways that go through the highlighted waypoint, enter an identifier string of "V"). If there is a single result from the search, then a list of airway waypoints will be shown so that the user can select the desired exit point. If there is no result from the search, the user will be re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching airway identifiers will be presented and, upon selection, a list of airway waypoints will be shown so that the user can select the desired exit point. Upon selecting the desired exit point, all airway waypoints from the previous waypoint to the desired exit point will be inserted or added to the active flight plan.

NRST APT (L2): This option performs a search for 20 airports within 240NM that are nearest 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), a “NO RESULTS” message button 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. An “INFO” tile giving access to information for the highlighted result appears at this level to aid in selection. Highlighted result information includes datalinked weather information when available. 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.

NRST FIX (R2): This option performs a search for 20 fixes within 240NM that are nearest 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), a “NO RESULTS” message button 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. An “INFO” tile giving access to information for the highlighted result appears at this level to aid in selection.

NRST NDB (L4): This option performs a search for 20 NDBs within 240NM that are nearest 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), a “NO RESULTS” message button 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. An “INFO” tile giving access to information for the highlighted result appears at this level to aid in selection.

NRST USR (R3): This option performs a search for 20 User Waypoints within 240NM that are nearest 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), a "**NO RESULTS**" message button 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. An "INFO" tile giving access to information for the highlighted result appears at this level to aid in selection.

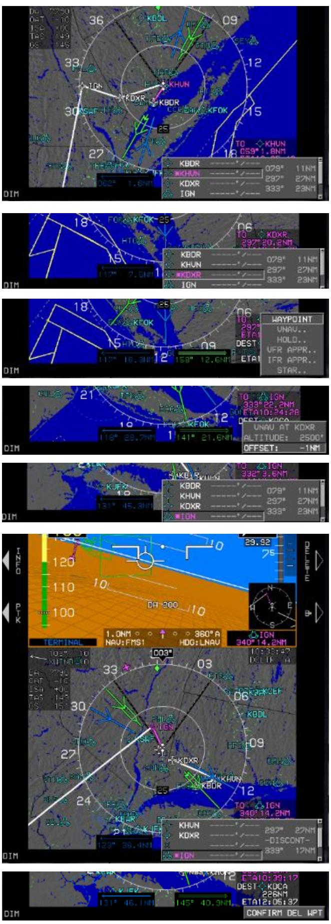
NRST VOR (L3): This option performs a search for 20 VORs within 240NM that are nearest the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no VORs within 240NM), a "NO RESULTS" message is displayed. 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. An "INFO" tile giving access to information for the highlighted result appears at this level to aid in selection.

Identifier Entry Box: The user has the option to enter an identifier. Performing a search for waypoints requires the entry of at least two characters. If there is a single result from the search, that result is inserted or added to the active flight plan. If there is no result from the search, the user is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented and, upon selection, the selected waypoint is inserted or added to the active flight plan. An "INFO" tile giving access to the information function for the highlighted result appears at this level to aid in selection. Highlighted result information includes datalinked weather information when available. With optional datalink, WX LGND and EXPND WX tiles is available at this level to show a weather symbol legend and highlighted result METAR and TAF text respectively.

DELETE (R3): If the highlighted waypoint is a non-procedure waypoint, then the function will delete the highlighted waypoint from the active flight plan. If the highlighted waypoint is part of a procedure, then the function will delete the entire procedure from the active flight plan after confirmation. This tile will 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 will not appear when the highlighted waypoint is suppressed or when the highlighted position is one position past the end of the active flight plan.

Direct (R8): Inserts a phantom waypoint at the current aircraft location and makes the highlighted waypoint active. The phantom waypoint will be a fly-over defined entry waypoint and the leg prior to the phantom waypoint will be designated a discontinuity. This assures that the skyway will be “re-centered” to provide guidance to the new active waypoint. This tile will not appear when the highlighted waypoint is suppressed or when the highlighted position is one position past the end of the active flight plan.

5.13. 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 and push to enter.
4) As one option, a VNAV setting is entered

Figure 5-21: Active Flight Plan Menu options (Step-By-Step)

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

1) With the desired flight plan selected and activated
2) Press **ACTV (L2)** to view ACTIVE flight plan
3) Scroll to desired waypoint option and Push to enter
4) As one option, a VNAV setting is entered Push to enter
5) Scroll to **OFLY/AUTO** and Push to enter
6) After selecting **NO RADIUS** Push to enter
7) View ACTIVE flight plan with waypoint characterization indicated
8) Scroll to desired option and push to enter

Figure 5-21a: Active Flight Plan Menu (Step-By-Step)

5.13.2. 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.

Figure 5-21b: Active Flight Plan Options NRST Menu option (Step-By-Step)

5.14. Information (INFO) Menu

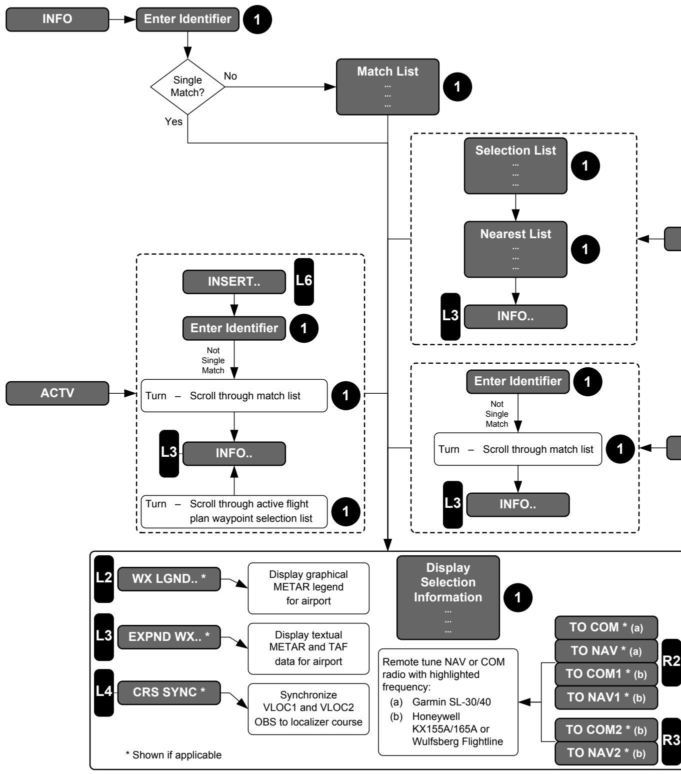


Figure 5-22: Information Menu

If the **INFO** tile is activated from within the **ACTV**, **NRST** or **Direct menus**, then information on the highlighted waypoint from the applicable selection list will be shown directly. Otherwise, the function will check for a current active waypoint. If there is an active waypoint, then the active waypoint becomes the default entry. If there is no active waypoint, then the nearest airport will become the default entry. If the default entry is accepted, then information for the default entry will be shown. If the user rejects the default entry by entering identifier characters, then a search for matching identifiers will be performed. If there is a single result from the search, information for that result will be shown. If there is no result from the search, the user will be re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers will be presented to allow the user to select the desired identifier.

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

- Waypoints
- Identifier
- Type
- Elevation (if available)
- Long Name
- Bearing and distance
- Latitude/Longitude
- Navigation Aides
- Frequency
- Airports
- Communication frequencies
- Runway data

For remote tuning, a single frequency is associated with the waypoint, tiles are to allow transmission of the frequency to remote NAV or COM radios. A “**TO COM1**” or “**TO NAV1**” (**R2**), while a “**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 118MHz, the tiles read “**TO NAV#”** and the transmission is addressed to NAV radios. If the frequency is greater than or equal to 118MHz, the tiles read “**TO COM#”** and the transmission will be addressed to COM radios.

When the information is being presented for an ILS or localizer waypoint and the current VLOC1 or VLOC2 omnibearing selectors are not synchronized with the localizer course, a “**CRS SYNC**” (**L4**) will be shown to allow one-touch synchronization of the VLOC1 and VLOC2 omnibearing selectors to the localizer course (as seen below).

Figure 5-23: "CRS SYNC"

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

1) Press **INFO (L3)** to view current Active waypoint

2) Push ❶ to view information

Figure 5-24: Information (Step-By-Step)

5.15. Omnibearing Selector (OBS) Menu

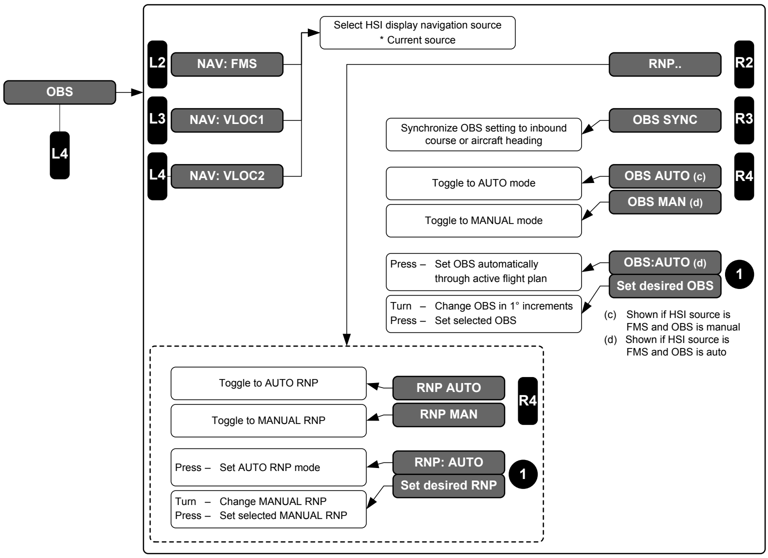


Figure 5-25: Omnibearing Selector (OBS) Menu

The OBS menu will allow the user to control the setting of the omnibearing selector for purposes of showing course deviations. The OBS for **FMS (L2)** will allow the user to specify either a manual OBS setting, or an automatic OBS setting in which the current active OBS is controlled by the active flight plan. The OBS for VLOC1 will allow the user to specify the active OBS setting for the VLOC1 navigation function. The OBS for VLOC2 will allow the user 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)** will be available to synchronize 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)** will be available to enable quick toggling between automatic and manual OBS settings.

With VOR symbology enabled, the OBS function will also permit the user 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 will also permit the user to select between manual and automatic RNP settings. Upon selecting the RNP tile, an “**RNP AUTO**/**RNP MAN**” tile will be available to enable quick toggling between automatic and manual RNP settings. Manual RNP will be selectable between 0.10NM and 15NM as follows:

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

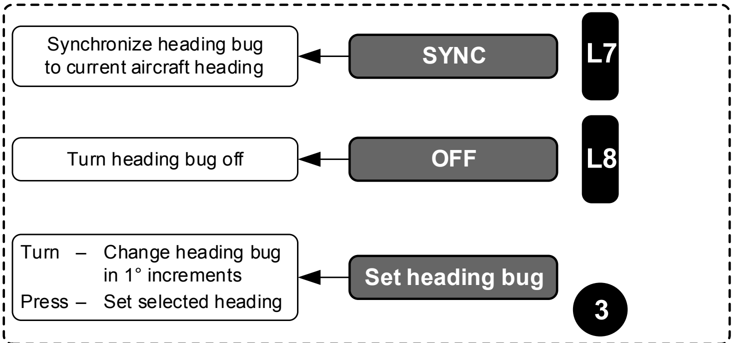
5.15.1. Omnibearing Selector (OBS) Menu (Step-By-Step)

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

2) Press **OBS (L4)** then make HSI source selection or change to **OBS MANUAL (R4)**

Figure 5-26: Omnibearing Selector (OBS) (Step-By-Step)

5.16. Heading Bug (HDG) Menu



IDU-680P showing PFD Page only

Figure 5-27: Heading Bug (HDG) Menu

The heading bug menu will allow the user to set the heading bug in increments of 1°, synchronize the heading bug to current heading, or turn off the heading bug.

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

1) Turn ❸ to enter Heading mode.

2) Turn ❸ to change heading bug in 1° increments

3) Push ❸ to select new heading or Press **SYNC** to sync current heading

Figure 5-28: Heading Bug (HDG) Menu (Step-By-Step)

5.17. Nearest (NRST) Menu

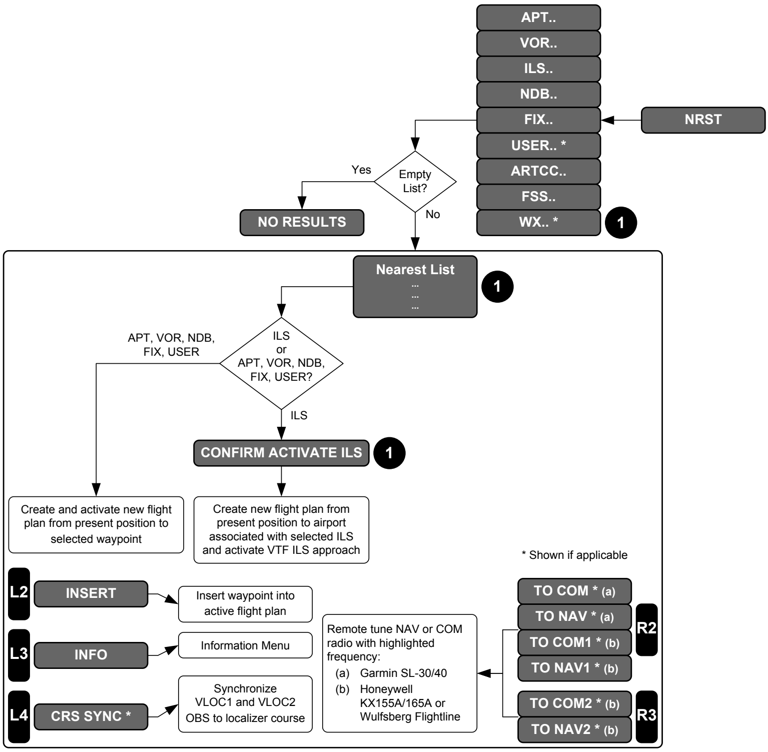


Figure 5-29: Nearest (NRST) Menu

Upon activating the nearest menu, an option list appears to allow the user to select from a list of the nearest airports, nearest VORs, nearest ILSs, nearest NDBs, nearest fixes, nearest user waypoints (if user waypoints exist), nearest ARTCC frequencies, nearest 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), a "**NO RESULTS**" message button is displayed. The selection list includes identifier, bearing and distance to the item. The selection list for airports will also contain an indication of the longest runway length at the airport. The selection lists for airports will contain 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 118MHz, the tiles read “**TO COM#**” and the transmission is addressed to COM radios. If the frequency is less than 118MHz, the tiles read “**TO NAV#**” and the transmission is addressed to NAV radios. A “**TO COM1**” or “**TO NAV1**” (**R2**), while a “**TO COM2**” or “**TO NAV2**” (**R3**) position.

When the results for airports, VORs, NDBs, fixes and user waypoints are being displayed, an “**INSERT**” **(R2)** will be provided to allow the user to quickly insert a waypoint into the active flight plan at the current active waypoint position. This feature is intended to facilitate rapid clearance changes from air traffic control. The “**INSERT**” **(R2)** will 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, an “**INFO**” **(L3)** will be available to activate 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, a “**CRS SYNC**” **(L4)** tile will be presented to synchronize 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 will be created from present aircraft position to the selected waypoint. Upon selecting a waypoint of type ILS, a “**CONFIRM ACTIVATE ILS**” tile will be displayed. When the user confirms the ILS activations, the following actions will 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 there is only one NAV radio installed, the source for the selecting side is changed to **VLOC1**. The source for the other side does not change.

   b) If there are two NAV radios installed, then 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.

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

1) Press **NRST (R2)** 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 send frequency to **COMM1** or **COMM2**

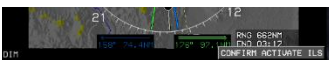
Figure 5-30: Nearest (NRST) Menu (Step-By-Step)

5.17.2. Nearest (NRST) Menu

1) Press **NRST (R2)** to enter Nearest Menu

2) Scroll to select ILS from list then Push to enter

3) Scroll to desired airport and ILS approach then push to select and enter



4) Push to confirm and activate ILS

Figure 5-31: Nearest (NRST) Menu ILS

5.18. Direct Menu

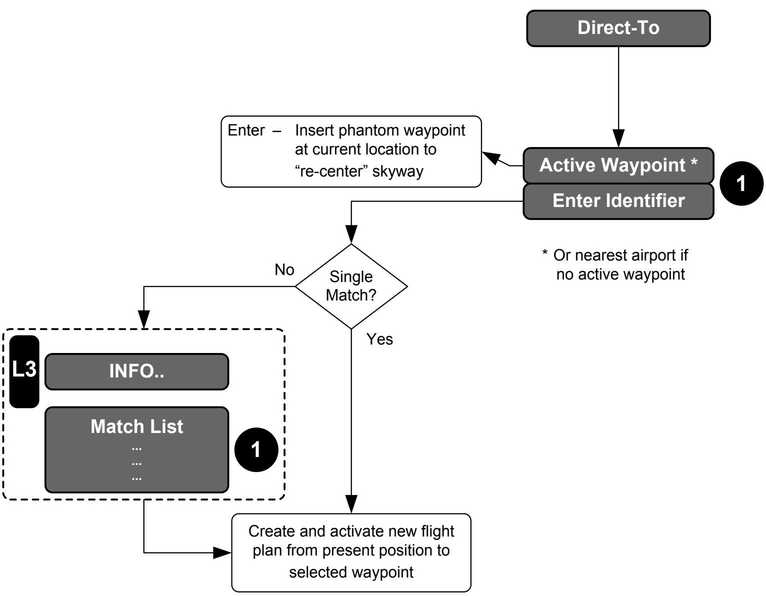


Figure 5-32: Direct Menu

Upon activating the direct menu from the top-level menu, the function will check for a current active waypoint. If there is an active waypoint, then the active waypoint will become the default entry. If there is no active waypoint, then the nearest airport will become the default entry.

If the default entry is the active waypoint and is accepted by the user, then a phantom waypoint will be inserted at the current aircraft location. The phantom waypoint will be a fly-over defined entry waypoint and the leg prior to the phantom waypoint will be designated a discontinuity. This assures that the skyway will be "re-centered" to provide guidance to the new active waypoint. The rest of the active flight plan will remain unchanged.

If the default entry is not the active waypoint and is accepted by the user, then 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 will be created from present aircraft position to the selected waypoint. If on the ground, a search will be conducted for a database airport within 6NM. If an airport is found, a new active flight plan will be created from the found airport to the selected waypoint. Otherwise, a new active flight plan will be created from present aircraft position to the selected waypoint.

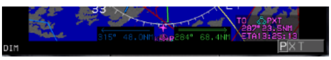
If the user rejects the default entry by entering identifier characters, then a search for matching identifiers will be performed. If there is a single result from the search, then the resulting action depends upon whether the aircraft is in the air or on the ground. If in the air, a new active flight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

If there is no result from the search, the user will be re-prompted to enter an identifier.

If there are multiple results from the search, a selection list with matching identifiers will be 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 will be created from present aircraft position to the selected waypoint. If on the ground, a search will be conducted for a database airport within 6NM. If an airport is found, a new active flight plan will be created from the found airport to the selected waypoint. Otherwise, a new active flight plan will be created from present aircraft position to the selected waypoint. An "**INFO**" tile giving access to the information function for the highlighted result will appear at this level to aid in selection.

5.18.1. Direct Menu (Step-By-Step)

1) Press  to enter the Direct menu.



2) The current active waypoint will appear

3) Either push ❶ to insert a phantom waypoint at the current aircraft location

4) Or scroll ❶ to begin entering new identifier

5) After creating new identifier scroll ❶ to the end and push to enter and a new active flight plan will be created from the present aircraft position

Figure 5-32a: Direct Menu (Step-By-Step)

5.18.2. Timer (TIMER) Menu

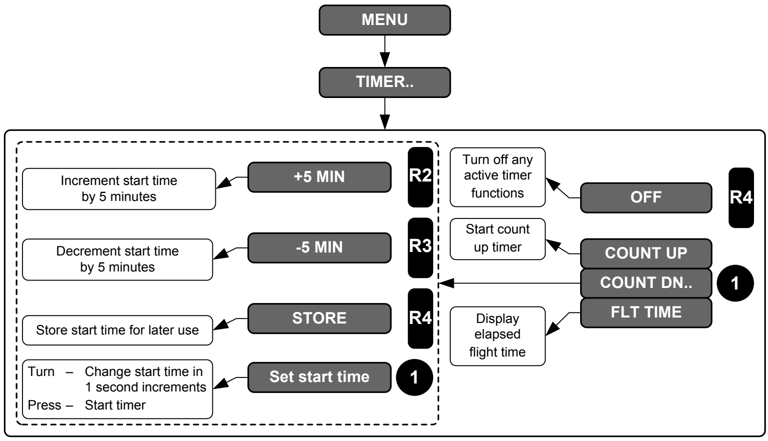


Figure 5-33: Timer Menu

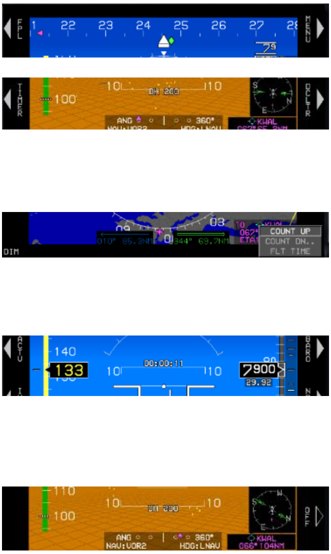
Upon selecting the timer menu, an option list will appear to let the user choose the count up timer, the countdown timer, or the flight time display. "**OFF**" (**R4**) will also appear at this level to allow the user to turn off any active timer functions.

If the user selects the count up timer, the count up timer will be activated.

If the user selects the countdown timer, the user will be prompted to enter a start time from which the countdown begins. Shortcut keys to quickly add or decrement by 5 minute increments are provided at this level. After entering a start time, the user is able to either start the countdown timer or select the "**STORE**" **(R4)** tile to store the start time for later use.

If the user selects the flight time display option, the current elapsed time since the aircraft transitioned from ground to air mode will be displayed for 10 seconds or until any key is pressed. If the aircraft has not yet transitioned from ground to air mode, upon selecting the flight time display option, the elapsed time will be displayed as "**FLT TM: 00:00:00**".

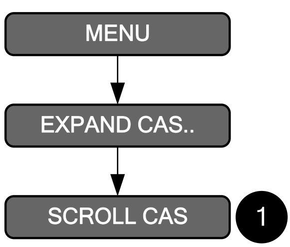
5.18.3. Timer (TIMER) Menu (Step-By-Step)



1) Press MENU (R1)
2) Press **TIMER (L4)** to enter the Timer menu
3) Scroll ❶ to select COUNT UP, COUNT DN.. or FLT TIME
4) If **COUNT UP** is selected, a timer appears on the PFD area below the bank scale
5) To turn off timer, Press **MENU** and **TIMER** then Press **OFF**

Figure 5-33a: Timer Menu (Step-By-Step)

5.19. EXPAND CAS MENU



The Expand CAS menu will change the display of CAS messages from a stacked presentation to a presentation using a CAS Display Box element. This allows scrolling to view off-screen messages when the message count exceeds 11. In the Expand CAS menu, encoder ❶ is dedicated to scrolling the CAS Display Box.

5.20. PFD Source (SOURCE) Menu

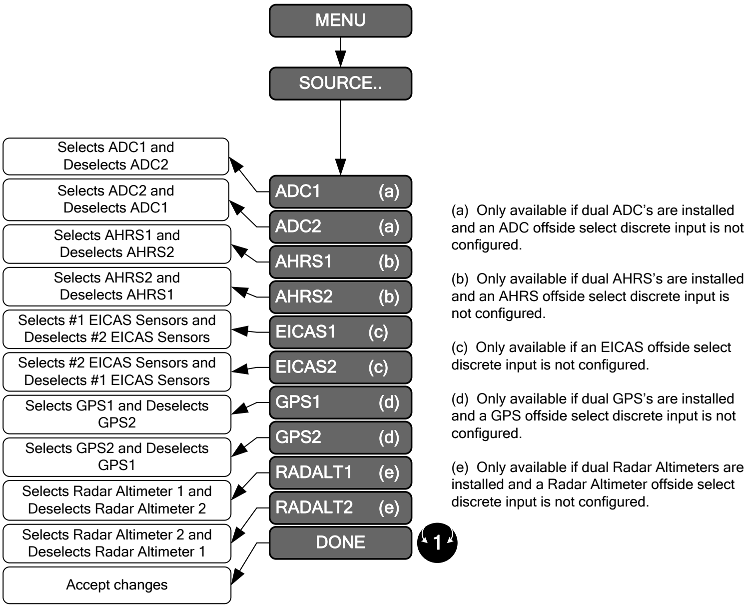
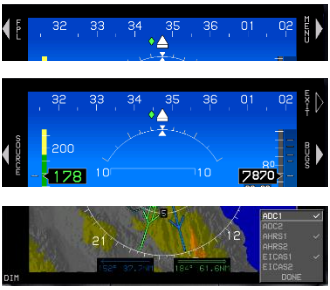


Figure 5-34: PFD Source Menu

Upon activating the PFD source menu, an option list of sensor sources will be shown. It will be possible 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

5.20.1. PFD Page First-Level Source selection (Step-By-Step)



1) Press **MENU (R1)**

2) Press **SOURCE (L2)**

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

Figure 5-34a: PFD Page First-Level Source Selection (Step-By-Step)

5.21. PFD Bug (BUGS) Menu

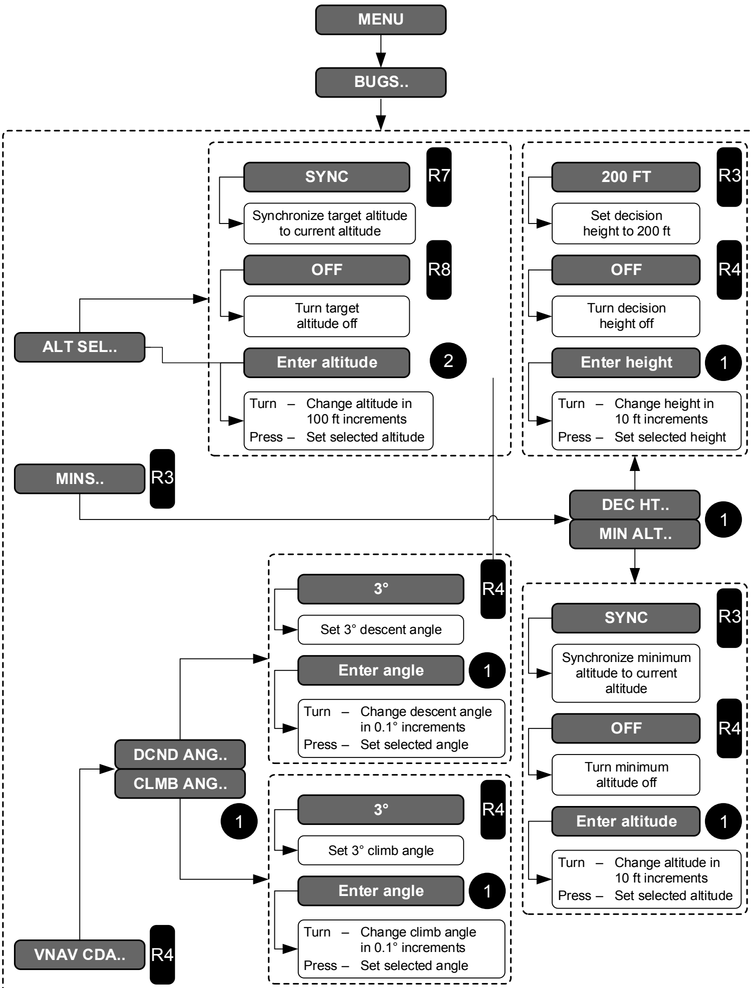


Figure 5-35: PFD BUGS (BUGS) Menu

5.22. PFD Bug (BUGS) Menu (Cont)

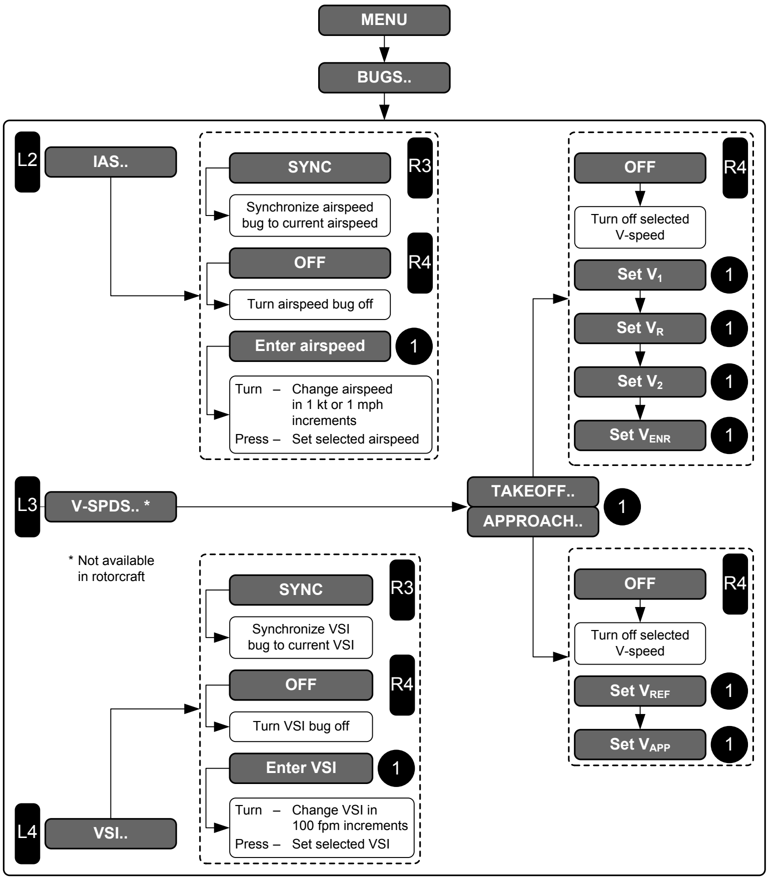


Figure 5-35a: PFD BUG (BUGS) Menu (continued)

Upon selecting the PFD bugs menu, the user will be presented with tiles to choose either setting minimums **(MINS) (R3)**, setting an airspeed bug **(IAS) (L2)**, setting the VNAV climb or descent angle (**VNAV CDA**) **(R4)**, setting V-speeds **(V-SPDS) (L3)** or setting vertical speed **(VSI) (L4)**.

Selecting the minimums option brings up a further option list for setting either decision height or minimum altitude. Selecting the minimum altitude option allows the user to either; synchronize the minimum altitude to current altitude, turn the minimum altitude off or set the minimum altitude in increments of 10 feet. Selecting the decision height option allows the user to either; 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.

Selecting the airspeed bug option will allow the user to either; 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 will be no less than 1.2 V_S or 60KIAS, whichever is higher. V_S will be derived from the higher of the V_S aircraft limits setting or the pilot-input V_{REF} value divided by 1.23. On the high end, airspeed bug settings will be limited to the aircraft redline.

Selecting the VNAV climb or descent angle option brings up a further option list for setting either climb angle or descent angle. At this further level, selecting either option allows the user to set the climb angle or the descent angle (as appropriate) in increments of 0.1° (note: a value of 0 is not allowed). Corresponding feet per nautical mile will be shown adjacent to the climb or descent angle setting in parentheses. In addition, a shortcut tile will be available to set the climb or descent angle to 3°.

Selecting the V-speed option will bring up a further option list for setting either takeoff V-speed (**V_1**, **V_R**, **V_2** and **V_{ENR}**) or approach V-speeds (**V_{REF}** and **V_{APP}**). Selecting the takeoff V-speed option will allow the user to set takeoff V-speeds (**V_1**, **V_R**, **V_2** and **V_{ENR}**) in sequence. Selecting the approach V-speed option will allow the user to set approach V-speeds (**V_{REF}** and **V_{APP}**) in sequence.

Selecting the VSI bug option allows the user to either; 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.

Note that the airspeed bug and VSI bug are mutually exclusive and therefore selecting one will turn off the other.

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

1) Press **MENU (R1)** then **BUGS (R2)** to enter the Bugs menu

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

3) If IAS was entered, either 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

Figure 5-36: PFD Bugs Menu (Step-By-Step)

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

2) If **DEC HT..** was selected scroll ❶ to create new Decision height and push to enter

3) The new DH will display on the PFI area below the FPM

4) If **VNAV CDA (R4)** was selected scroll ❶ to select either **DCND..** or **CLIMB..** and push to enter

5) If **DCND..** was selected, further scrolling of ❶ will create the descent angle

6) Push ❶ to enter new descent angle or select default 3°

Figure 5-36a: PFD Bugs (Step-By-Step)

5.23. Remote BUGs Panel

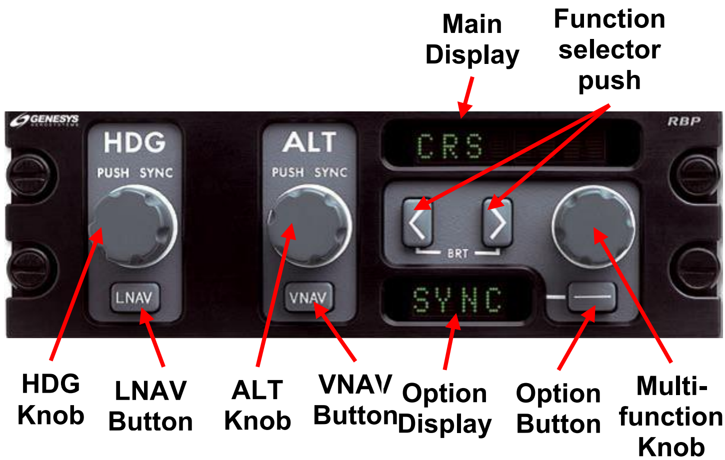


Figure 5-36b: Remote Bugs Panel

The Remote Bugs Panel (RBP) provides dedicated controls for frequently needed bugs, and additional controls for setting IDU parameters such as defined in the table below.

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. The two arrow buttons are pressed simultaneously to gain access for brightness control while the multifunction knob is used to make the brightness adjustments. Pressing the Option button to exit the brightness control program returns 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 knobs behave exactly as do the same encoders on the IDU-680 where they appear during most screen configurations. During initialization, the RBP will always begin with the GENESYS RBP displayed on the Main and Option display screens.

Table 5-3: Remote Bugs Panel (RBP)

Button/ Knob	Function	Turn	Press
Heading Knob	Heading Bug	Increment or decrement heading bug	Synchronize the heading bug to current heading
Altitude Knob	Altitude Bug	Increment or decrement the target altitude bug	Synchronize the target altitude bug to current altitude
Set Knob	GPS Course	Increment or decrement the GPS Course setting	Synchronize the GPS Course to current bearing to the active waypoint
Set Knob	VOR 1 Course	Increment or decrement the VOR 1 Course setting	Synchronize the VOR 1 Course to the current bearing to the station
Set Knob	VOR 2 Course	Increment or decrement the VOR 2 Course setting	Synchronize the VOR 2 Course to the current bearing to the station
Set Knob	Airspeed Bug	Increment or decrement the Airspeed Bug setting	Synchronize the Airspeed Bug to current Airspeed
Set Knob	Vertical Speed Bug	Increment or decrement the Vertical Speed Bug setting	Synchronize the Vertical Speed Bug to current VSI

Table 5-3: Remote Bugs Panel (RBP)

Button/ Knob	Function	Turn	Press
Set Knob	Climb Angle Set	Increment or decrement the Climb Angle setting	Set the Climb Angle Setting to 3 degrees
Set Knob	Descent Angle Set	Increment or decrement the Descent Angle setting	Set the Descent Angle Setting to 3 degrees
Set Knob	Decision Height Bug	Increment or decrement the Decision Height Bug	Set the Decision Height Bug to 200’ AGL
Set Knob	Minimum Altitude Bug	Increment or decrement the Minimum Altitude Bug	Set the Minimum Altitude to current altitude
Set “---“ Button	GPS Course	N/A	Change OBS mode (Manual or Automatic)
Set “---“ Button	VOR 1 Course	N/A	No Function
Set “---“ Button	VOR 2 Course	N/A	No Function
Set “---“ Button	Airspeed Bug	N/A	Toggle Airspeed Bug (On or Off)
Set “---“ Button	Vertical Speed Bug	N/A	Toggle Vertical Speed Bug (On or Off)
Set “---“ Button	Climb Angle Setting	N/A	No Function
Set “---“ Button	Descent Angle Setting	N/A	No Function

Table 5-3: Remote Bugs Panel (RBP)

Button/ Knob	**Function**	**Turn**	**Press**
Set “---“ Button	Decision Height Bug	N/A	Toggle Decision Height Bug (On or Off)
Set “---“ 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” rotary knob. Pressing both arrow buttons simulatanously places the RBP into dimming mode
VNAV Button	VNAV	N/A	Switch the EFIS autopilot pitch steering and commanded VSI between VNAV sub-mode and target altitude sub-mode
LNAV Button	LNAV	N/A	Switch the EFIS autopilot roll steering between LNAV sub-mode and heading sub-mode

5.24. PFD Declutter (DCLTR) Menu

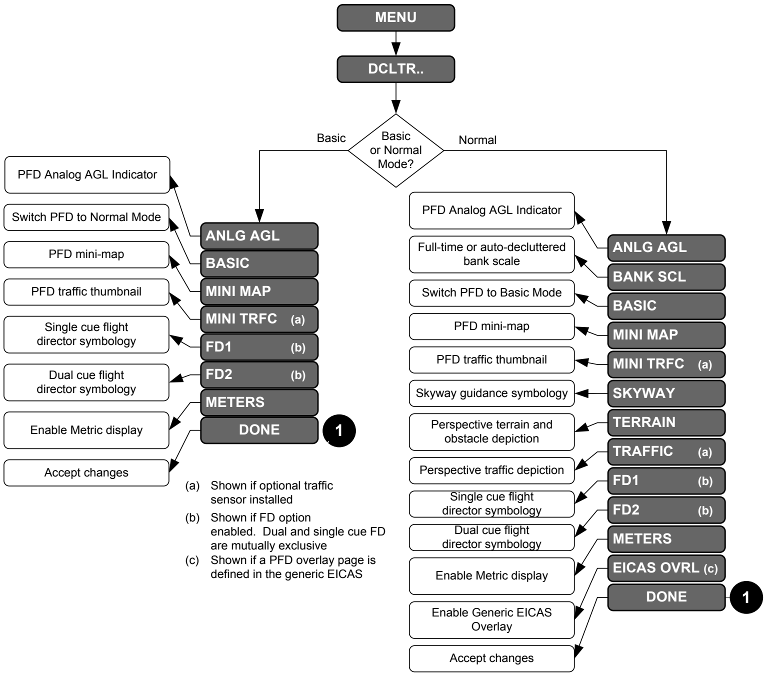


Figure 5-37 PFD Declutter (DCLTR) Menu

Upon activating the PFD declutter menu, an option list of declutter items will be shown. In Normal Mode, it will be possible to select or deselect the following items:

- PFD analog AGL indicator;
- Full-time or auto-decluttered bank scale display;
- Basic Mode (switches PFD to Basic Mode);
- PFD mini-map;
- Skyway guidance symbology;
- Perspective terrain and obstacle depiction;
- Single Cue Flight Director symbology and mutually exclusive with Dual Cue Flight Director symbology;

- Dual Cue Flight Director symbology and mutually exclusive with Single Cue Flight Director symbology;
- Metric display of barometric altitude and target altitude bug setting.

In Basic Mode, it will be possible to select or deselect the following items:

- PFD analog AGL indicator;
- Basic Mode (switches PFD back to Normal Mode);
- PFD mini-map;
- Single Cue Flight Director symbology and mutually exclusive with Dual Cue Flight Director symbology;
- Dual Cue Flight Director symbology and mutually exclusive with Single Cue Flight Director symbology; and
- Metric display of barometric altitude and target altitude bug setting.

Note:

When integrated with the Intelliflight 1950, it will only be possible to toggle between the single cue and dual cue flight director options (i.e., it is not possible to turn both OFF). This is because the display of the flight directors when integrated with the Intelliflight 1950 is controlled through the mode control panel.

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

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

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

3) If **BANK SCL** is unchecked and is scrolled to **DONE**, push to enter

4) The Bank Scale will be removed while in level flight

Figure 5-37a: PFD Declutter (DCLTR) Menu (Step-By-Step)

5.25. PFD Altimeter Menu

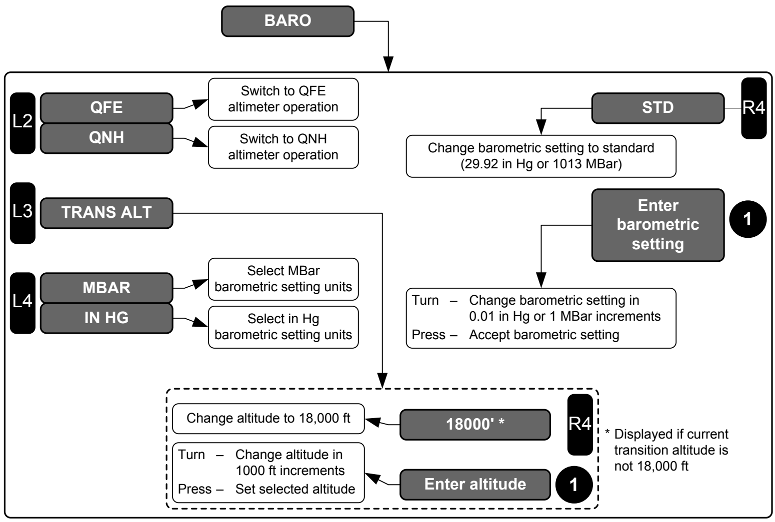


Figure 5-38: PFD Altimeter Menu

The altimeter menu is activated by pressing **BARO (R2)**. In the altimeter menu, turning the rotary encoder will increment (clockwise rotation) or decrement (counter-clockwise rotation) the barometric setting. Pressing the rotary encoder will accept the new barometric setting. In addition, the following options will be available in the altimeter menu:

QNH/QFE (L2): Toggles between QNH altimeter operation and QFE altimeter operation. When in QNH mode, QNE operation will automatically be selected when above the transition altitude with a standard altimeter setting. Note the following definitions:

QFE: Barometric setting that results in the altimeter displaying height above a reference elevation (i.e., airport or runway threshold).

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

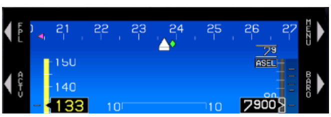
QNH: Barometric setting that results in the altimeter displaying altitude above mean sea level at the reporting station.

TRANS ALT (L3): Allows the user to change the transition altitude used by the system in units of 1000 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, an “18000’” tile will be available to quickly set 18,000 feet as the transition altitude.

MBAR/IN HG (L4): Will allow the user to select the barometric setting units (In. Hg. or MBar).

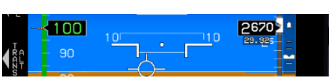
STD (R4): Will set the barometric setting to standard (29.92 in. Hg. or 1013 Mbar).

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



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

2) Scroll to set proper QNH and push to enter



3) Crosscheck proper QNH under altitude indication

Figure 5-38a: Altimeter Menu (Step-By-Step)

5.26. MFD Fault Display (FAULTS) Menu

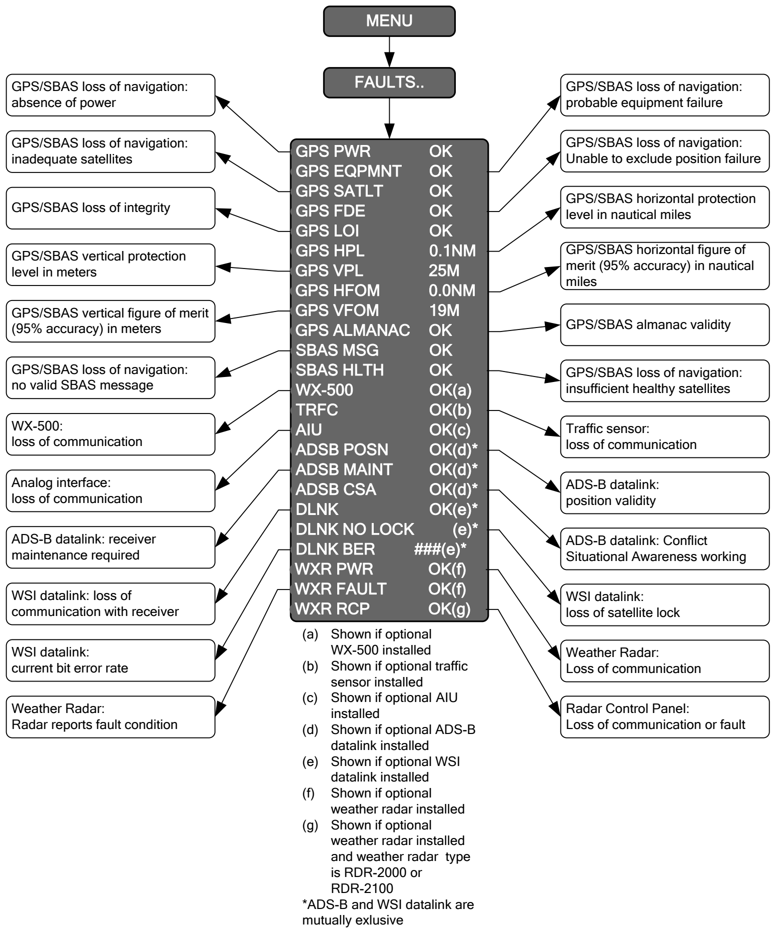


Figure 5-39: MFD Fault Display Menu

Upon selecting the MFD faults menu, the status of the following system parameters will be 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 can be used as the estimate of position uncertainty required in RNP airspace.
7) Readout of the current GPS/SBAS vertical protection level (“GPS VPL”) in meters.
8) Readout of the current GPS/SBAS horizontal figure of merit (“GPS HFOM”) in nautical miles. This value is an indication of the 95% confidence horizontal position accuracy.
9) Readout of the current GPS/SBAS vertical figure of merit (“GPS VFOM”) in meters. This value is an indication of the 95% confidence vertical position accuracy.
10) An indication of whether the GPS/SBAS receiver has a valid almanac in memory (“GPS ALMANAC”).
11) GPS/SBAS loss of navigation due to no valid SBAS message received for 4 seconds or more (“SBAS MSG”).
12) GPS/SBAS loss of navigation due to insufficient number of SBAS HEALTHY satellites (“SBAS HLTH”).
    - An Attitude or Range Fault Condition exists.
    - A Control Fault Condition exists.
    - 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 that any one of the following conditions are true:

- Loss of weather radar communication
- Weather radar mode is OFF.

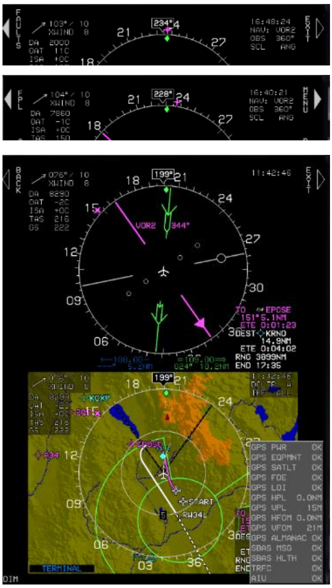
19) If weather radar is enabled, an indication of weather radar fault status (“WXR FAULT -,” “WXR FAULT X” or “WXR FAULT OK”). When weather radar power/communication status is failed, weather radar fault status will indicate that determination of weather radar faults is not possible (“WXR FAULT –“).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

- A Cooling Fault Condition exists
- For weather radar types ARINC 708-6 or Collins 800/840, a Display or Control Bus Fault Condition exists.
- For weather radar types ARINC 708-6, Collins 800/840 or Honeywell PRIMUS, a Calibration or Air Data Fault Condition exists.
- An Attitude or Range Fault Condition exists.
- A Control Fault Condition exists.
- 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.

5.26.1. 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

Figure 5-39a: MFD Fault Display Menu (Step-By-Step)

5.27. MFD FUEL Totalizer Quantity Setting (SET FUEL) MENU

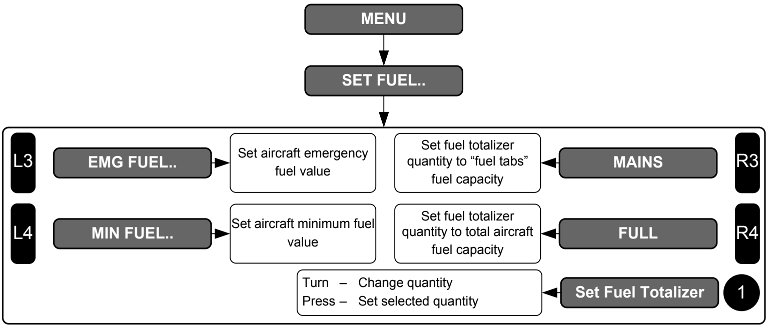


Figure 5-40: MFD Fuel Totalizer Quantity Menu

The fuel quantity setting menu will allow the user 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.

A “**MAINS**” (**R3**) quickly sets the quantity to the “fuel tabs” fuel capacity and a “**FULL**” (**R4**) is pressed to quickly set the quantity to the total aircraft fuel capacity. Units of measure and fuel flow will be shown in the quantity window when available.

5.28. MFD Page (PAGE) Menu

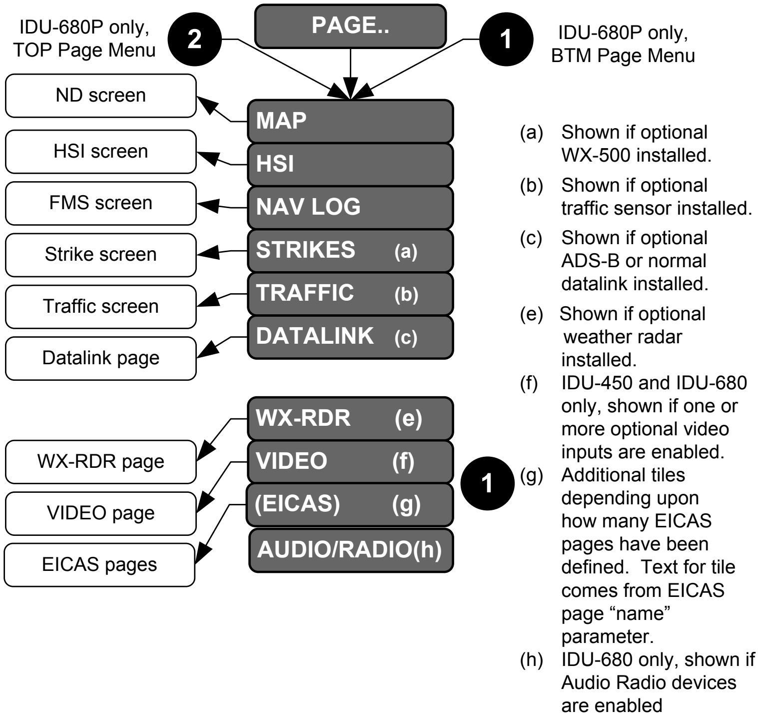


Figure 5-41: MFD Page (PAGE) Menu

The “**PAGE**” menu will allow the user to select which MFD page to display. Options will be:

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

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

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

4) **STRIKES:** Shows the Strike page.

5) **TRAFFIC:** Shows the Traffic page.

6) **DATALINK:** Shows the Datalink page.

7) **WX-RDR:** Shows the Weather Radar page.

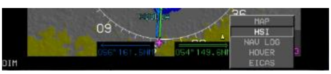
8) **VIDEO:** Shows the Video page.

9) **EICAS:** Shows the EICAS page. This option will only be available on the TOP Page Menu on a MFD.

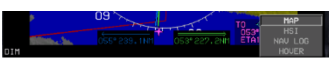
10) **AUDIO/RADIO:** Shows the Audio/Radio page.

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

1) Select either **Top** or **BTM** MFD to change pages



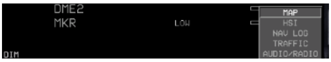
2) Push then scroll to select either **MAP**, **HSI**, **NAV LOG**, **STRIKES, TRAFFIC, DATALINK, WEATHER RADAR, VIDEO**, **EICAS or AUDIO / RADIO Page** and push to enter



3) Or push then scroll to select either **MAP**, **HSI**, **NAV LOG**, **STRIKES, TRAFFIC, DATALINK, WEATHER RADAR, VIDEO**, **EICAS or AUDIO / RADIO Page** and push to enter

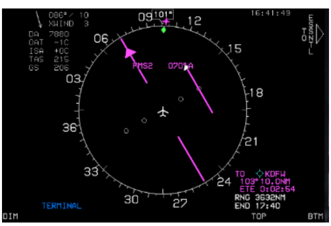
Figure 5-41a: MFD Page Menu (Step-By-Step)

5.28.2. MFD MAP ND Page



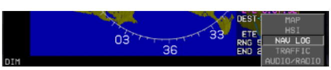
1) Push ❶ or ❷ and scroll to MAP and push to enter
2) Example shown is on PFD with MAP on bottom area

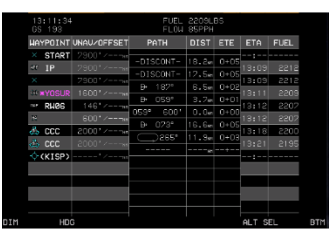
5.28.3. MFD HSI Page



1) Push ❶ or ❷ and scroll to **HSI** and push to enter
2) Example shown is on PFD with **HSI** on bottom area

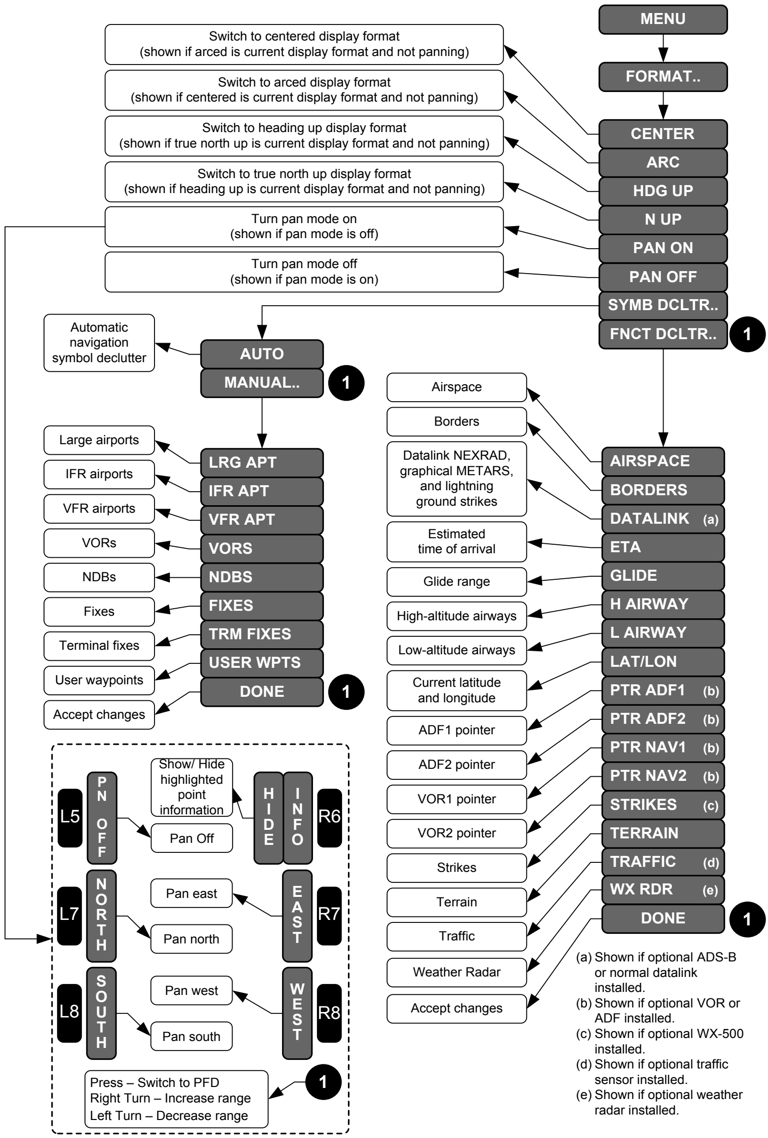
5.28.4. MFD NAV Log Page





1) Push ❶ or ❷ and scroll to **NAV LOG** and push to enter
2) Example shown is on PFD with **NAV LOG** on Bottom area
3) This **NAV LOG** page cannot be formatted or used for editing the active flight plan.

5.28.5. MFD ND Page Format (FORMAT) Menu



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

1) **CENTER / ARC**: Selecting this option toggles between a centered and arced ND display format (if not panning).

2) **HDG UP / N UP**: Selecting this option toggles between a heading up and a North up ND display format (if not panning).

3) **PAN ON / PAN OFF**: Selecting this option toggles ND page pan mode.

4) **SYMB DCLTR**: Selecting this option activates an option list that allows the user to choose either automatic navigation symbol declutter or manual navigation symbol declutter. If the user chooses manual navigation symbol declutter, a further option list will appear to allow the user to individually select:

- large airports;
- IFR airports;
- VFR airports;
- VORs;
- NDBs;
- fixes;
- terminal fixes; and
- user waypoints.

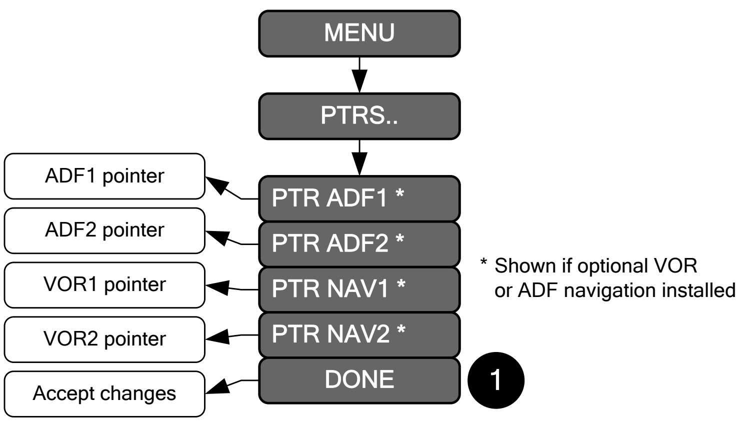
Turning on VFR airports will also turn on large airports and IFR airports. Turning on IFR airports will also turn on large airports. Turning off large airports will also turn off IFR airports and VFR airports. Turning off IFR airports will also turn off VFR airports.

5) **FNCT DCLTR**: Selecting this option activates an option list that allows the user to individually toggle display of:

- airspace;
- borders;
- datalinked NEXRAD, graphical METARs and lightning ground strikes (if datalink or ADS-B option is enabled);
- estimated time of arrival (“ETA”);
- glide range (if glide ratio is enabled and set in the limits, airplane configuration only);
- high-altitude airways;
- low-altitude airways;

- current latitude and longitude display of ADF #1 pointer (if ADF symbology is enabled);
- display of ADF #2 pointer (if dual ADF symbology is enabled);
- display of VOR1 pointer (if VOR symbology is enabled);
- display of VOR2 pointer (if dual VOR symbology is enabled);
- display of strikes (if WX-500 option is enabled);
- display of terrain;
- display of traffic (if traffic option is enabled); and
- display of weather radar (if weather radar option is enabled).

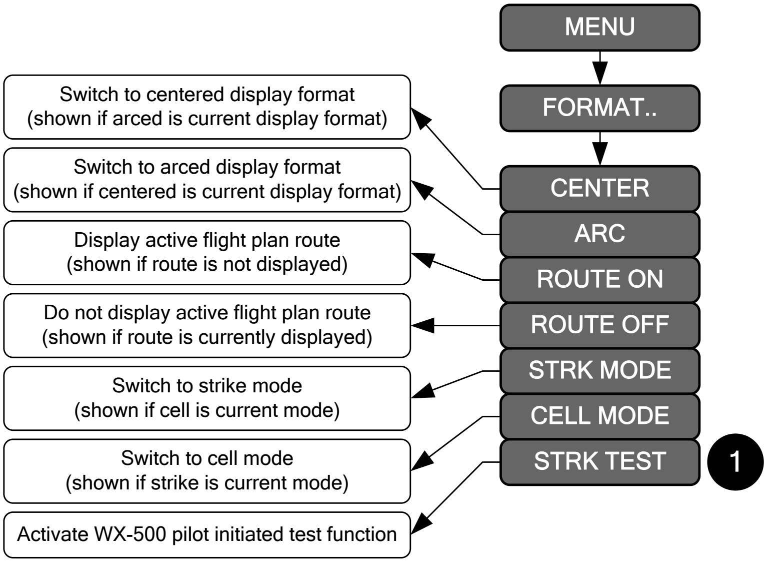
5.28.6. MFD HSI Pointer (PTRS) Menu



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

- display of ADF1 pointer (if ADF symbology is enabled);
- display of ADF2 pointer (if dual ADF symbology is enabled);
- display of VOR1 pointer (if VOR symbology is enabled); and
- display of VOR2 pointer (if dual VOR symbology is enabled).

5.28.7. MFD Strike Format (FORMAT) Menu



Upon selecting the MFD format menu when in the Strike page, the following option list will appear with the following options:

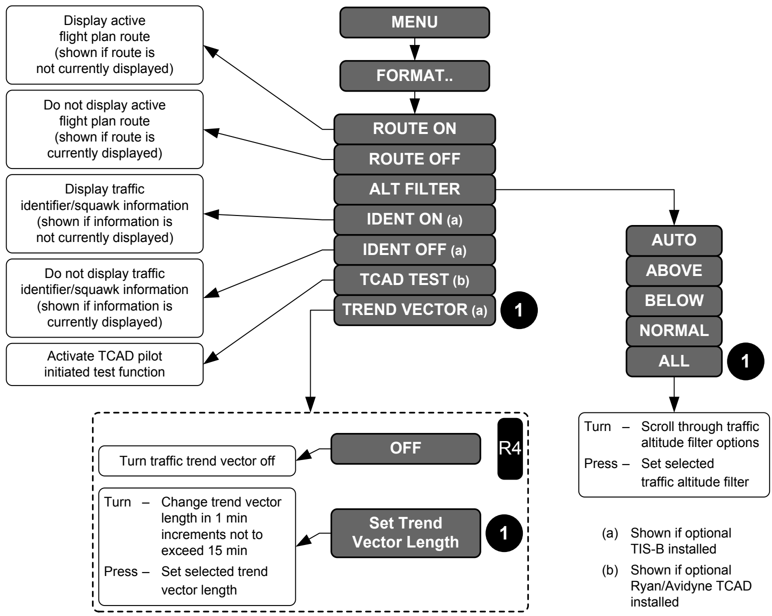
1) **CENTER / ARC**: Toggles between a centered and arced Strike page display format.

2) **ROUTE ON / ROUTE OFF**: Toggle 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.

5.28.8. 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**: Selecting this option toggles showing the active flight plan route on the Traffic page.

2) **IDENT OFF / IDENT ON**: When the TCAS flag is TIS-B, selecting this option toggles showing traffic identifier/squawk information.

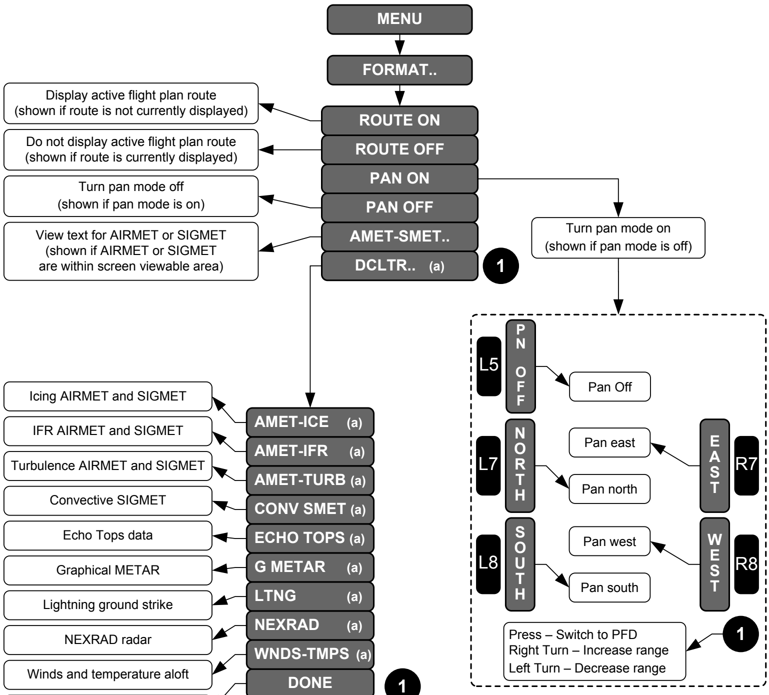
3) **ALT FILTER**: Selecting this option will allow the user to set the traffic altitude filter to either **AUTO**, **ABOVE**, **BELOW**, **NORMAL** or **ALL**.

4) **TCAD TEST**: When the TCAS flag is Ryan/Avidyne TCAD, selecting this option will activate the TCAD pilot initiated test function.

5) **TREND VECTOR**: When the TCAS flag is TIS-B, selecting this option allows the user to select the traffic trend vector length in

minutes. An “**OFF**” **(R4)** appears at this level to allow the user to quickly turn off the traffic trend vector.

5.28.9. MFD Datalink Format (FORMAT) Menu



(a) Shown if respective datalink products are available

Upon selecting the MFD format menu when in the Datalink page, an option list will appear with the following options:

1) **ROUTE ON / ROUTE OFF**: Toggles showing the active flight plan route on the Datalink page.

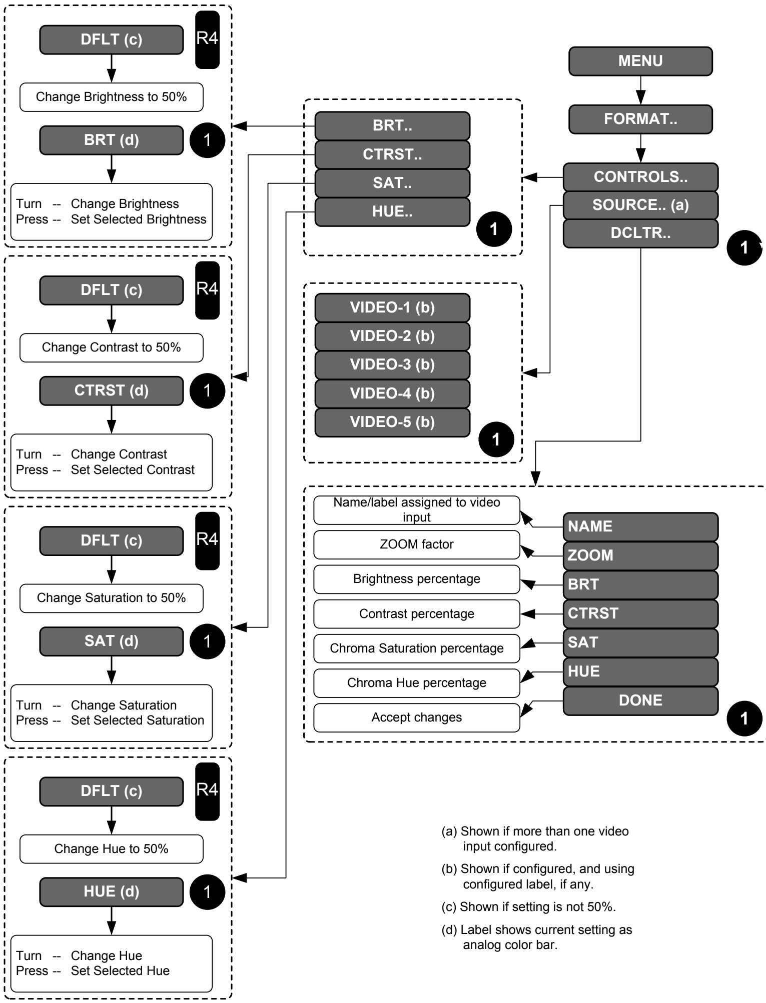
2) **PAN ON / PAN OFF**: Toggles Datalink page Pan mode.

3) **AMET-SMET**: This option will only be available when an AIRMET or SIGMET is within the Datalink page viewable area. Selecting this option will allow the user 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 will flash on the page.

4) **DCLTR**: This option will only be available when datalink weather products are available for display. Selecting this option will allow the user select individual datalink weather products for display. Note that only those datalink weather products that are available for display will appear in the selection box.

5.28.10. MFD Video Input Format (FORMAT) Menu



Upon selecting the MFD format menu when in the Video Input page, an option list will appear with the following options:

Table 5-5: Video Input Controls

Controls Settings	Definition	Notes
BRT	Adjust the brightness setting for the current Video input.	When not at the nominal default (50%) value, a "**DFLT**" **(R4)** tile appears for resetting brightness to nominal default value with single press of **(R4)**.
CTRST	Adjust the contrast setting for current video input	When not at the nominal default (50%) value, a "**DFLT**" **(R4)** tile appears for resetting contrast to nominal default value with single press of **(R4)**.
SAT	Adjust the chroma saturation (Color Intensity) setting for current video input.	When not at the nominal default (50%) VALUE, A "**DFLT**" **(R4)** tile appears for resetting to nominal default value with single press of **(R4)**.
HUE	Adjust the chroma hue (red-green balance) settings for current video input.	When not at the nominal default (50%) VALUE, A "**DFLT**" **(R4)** tile appears for resetting to nominal default value with single press of **(R4)**.
SOURCE	Selection of optional Video source.	Only available if more than one Video Input is enabled. Selecting this option allows for 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)

Table 5-5: Video Input Controls

Controls Settings	Definition	Notes
		d) CTRST: (Current contrast setting) e) SAT: (Current chroma saturation setting) f) HUE: (Current chroma hue setting)

1) **CONTROLS**: Selecting this option activates an option list that allows the user to individually select a Video Input setting to adjust. Each setting will be adjusted separately for each enabled Video Input. The settings are:

   a) **BRT**: Selecting this option will allow the user to adjust the brightness setting for the current Video Input. When the brightness setting is not at the nominal default (50%) value, a “**DFLT**” pushbutton will appear to allow the user to reset the brightness to the nominal default value with a single button press.

   b) **CTRST**: Selecting this option allows the user to adjust the contrast setting for the current Video Input. When the contrast setting is not at the nominal default (50%) value, a “**DFLT**” pushbutton will appear to allow the user to reset the contrast to the nominal default value with a single button press.

   c) **SAT**: Selecting this option allows the user to adjust the chroma saturation (color intensity) setting for the current Video Input. When the chroma saturation setting is not at the nominal default (50%) value, a “**DFLT**” pushbutton will appear to allow the user to reset the chroma saturation to the nominal default value with a single button press.

   d) **HUE**: Selecting this option allows the user to adjust the chroma hue (red-green balance) setting for the current

Video Input. When the chroma hue setting is not at the nominal default (50%) value, a “**DFLT**” pushbutton appears to allow the user to reset the chroma hue to the nominal default value with a single button press.

2) **SOURCE**: This option will only be available if more than one Video Input is enabled. Selecting this option activates an option list that allows the user to select a Video Input to be displayed.

3) **DCLTR:** Selecting this option activates an option list that allows the user to individually select which Video Input status settings are displayed. The declutter settings will be common to all Video Inputs. It is possible to select or deselect the following items:

   a) **NAME**: The video input label;

   b) **ZOOM**: The current amount of image expansion;

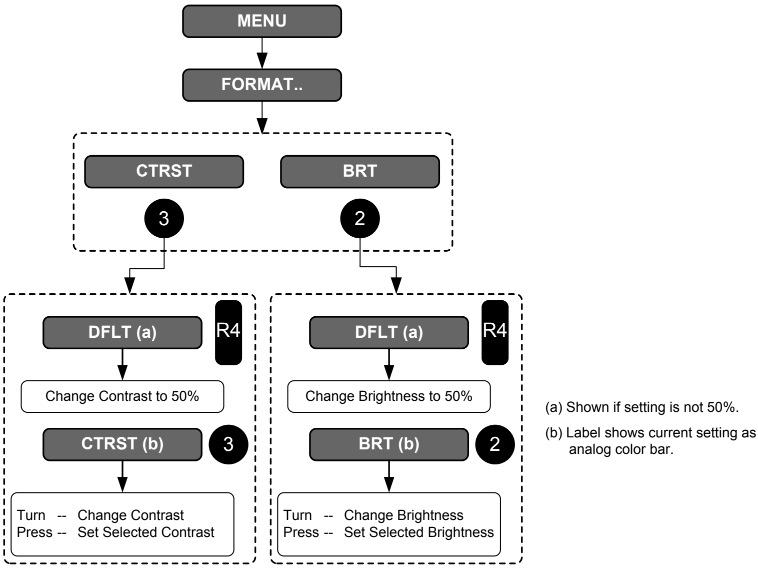
   c) **BRT**: The current brightness setting;

   d) **CTRST**: The current contrast setting;

   e) **SAT**: The current chroma saturation setting;

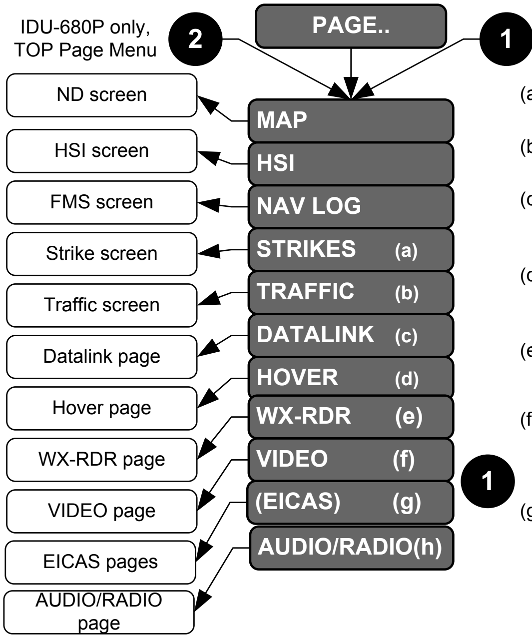
   f) **HUE**: The current chroma hue setting;

5.28.11. IDU-680 Center Rotary Encoder Controls



On the IDU-680, upon selecting the MFD format menu when in the Video Input page, encoder ❸ becomes a dedicated brightness control and encoder ❷ will become a dedicated contrast control. Moving these controls activates the **BRT** or **CTRST** menus.

5.28.12. MFD Page



(a) Shown if optional WX-500 installed.

(b) Shown if optional traffic sensor installed.

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

(d) Rotorcraft only, not available if in MFD-only operation.

(e) Shown if optional weather radar installed.

(f) IDU-450 and IDU-680 only, shown if one or more optional video inputs are enabled.

(g) Additional tiles depending upon how many EICAS pages have been defined. Text for tile comes from EICAS page “name” parameter.

(h) IDU-680 only, shown if Audio Radio devices are enabled

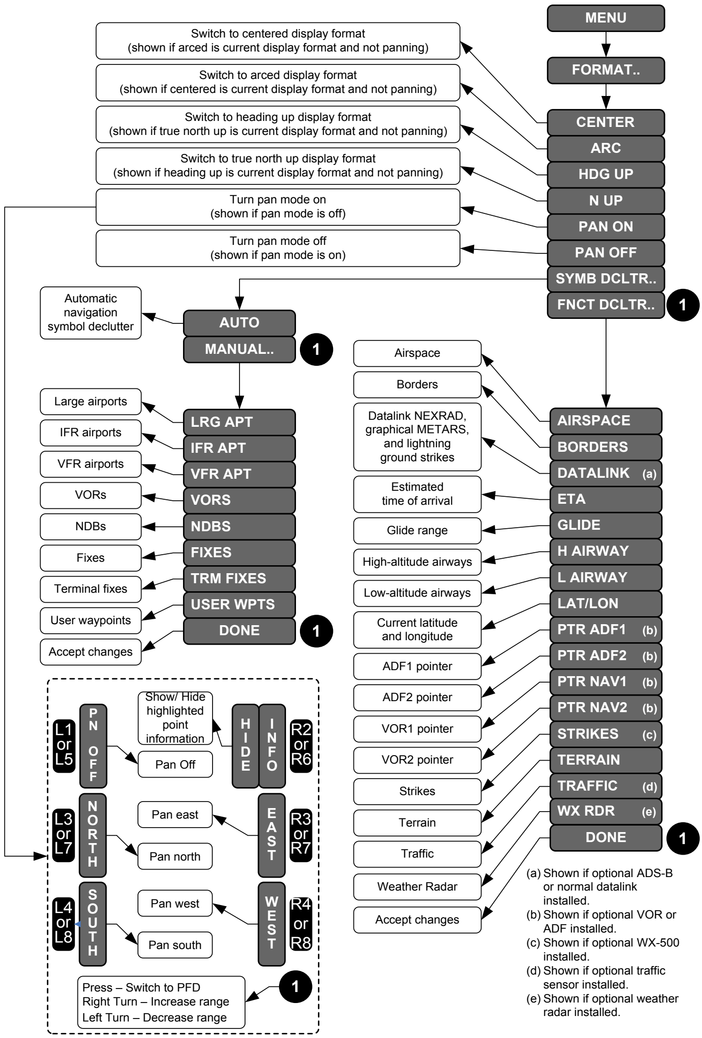


Figure 5-41b: MFD ND Page Format (FORMAT) Menu

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**: Allows selection of either, automatic navigation symbol declutter or manual navigation symbol declutter.

   (Automatic):

   A periodic increase in navigation symbols displayed on the map which happens every 5 minutes in automatic declutter mode is as follows:

   The system counts the navigation symbols being drawn on a continuous basis. If more than 35 symbols are being drawn, the declutter level is increased. There are 6 automatic declutter levels as follows:

   1) Large Airports, IFR Airports, VFR Airports, VORs, NDBs, Fixes and User Waypoints (all possible symbols).

   2) Large Airports, IFR Airports, VFR Airports, VORs, and NDBs.

   3) Large Airports, IFR Airports, VFR Airports and VORs.

   4) Large Airports, IFR Airports and VORs.

   5) Large Airports and VORs.

   6) Large Airports only.

   This automatic increasing of the decluttering level process is accomplished continuously and smoothly only as symbols are increasing. When the aircraft is flown into a less dense area; every 5 minutes the automatic declutter level is reduced by 1 and the system is allowed to re-seek the proper level. In the frame where this occurs, there can be a momentary large increase in the number of navigation symbols being drawn; this is a normal view change.

(Manual):

If the user chooses manual navigation symbol declutter, a further option list appears to allow the user to individually select:

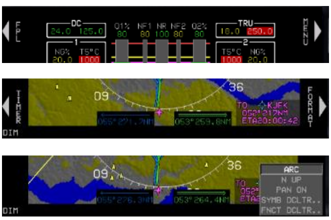
- Large Airports
- IFR Airports
- VFR Airports
- VORs
- NDBs
- Fixes
- Terminal Fixes
- User Waypoints

5) **FNCT DCLTR**: Selecting this option activates an option list that allows the user to individually toggle display of:

- airspace;
- borders;
- datalinked NEXRAD, graphical METARs and lightning ground strikes (if datalink or ADS-B option is enabled);
- estimated time of arrival (“ETA”);
- glide range (if glide ratio is enabled and set in the limits, airplane configuration only);
- high-altitude airways;
- low-altitude airways;
- current latitude and longitude display of ADF #1 pointer (if ADF symbology is enabled);
- display of ADF #2 pointer (if dual ADF symbology is enabled);
- display of VOR1 pointer (if VOR symbology is enabled);
- display of VOR2 pointer (if dual VOR symbology is enabled);

- display of strikes (if WX-500 option is enabled);
- display of terrain;
- display of traffic (if traffic option is enabled); and
- display of weather radar (if weather radar option is enabled).

5.28.13. MFD ND Page Format (FORMAT) Menu (Step-By-Step)



1) Press **MENU (R1)** and **FORMAT (R4 or R8)** to enter the format menu

2) Scroll ❶ or ❷ to either ARC, N UP, PAN ON, SYMB DCLTR.. or FNCT DCLTR.. and push to enter

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

5.29. MFD HSI Pointer (PTRS) Menu

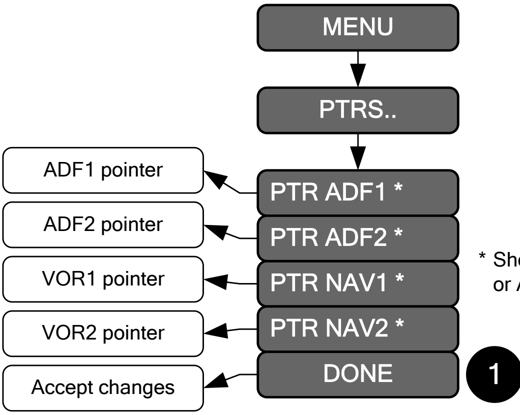
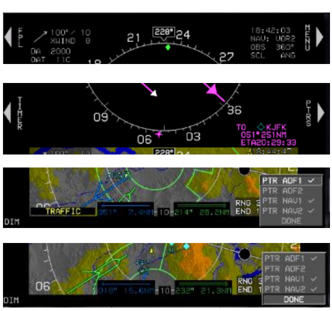


Figure 5-42: MFD HSI Pointer (PTRS) Menu

Upon selecting the HSI pointers menu when in the HSI page, an option list will appear to allow the user to individually select:

- ADF1 pointer
- ADF2 pointer
- VOR1 pointer
- VOR2 pointer

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



1) Press **MENU (R1)** then **PTRS (R4 or (R8)** to enter the Pointer menu
2) Scroll to either **PTR ADF, PTR NAV1**, or **PTR NAV2** and push to place check mark then scroll to DONE and push to enter

Figure 5-42a: MFD HSI Pointer (PTRS) Menu (Step-By-Step)

5.30. Audio/Radio (AR) Page Menu

The Bottom Area of all CPUs may show an AR Page in all modes. CPU's other than CPU#1 can also show the AR page in the Top Area when in Normal Mode.

5.30.1. AR Tune

AR page automatic pop up options are shown adjacent to the area in which the AR page resides.

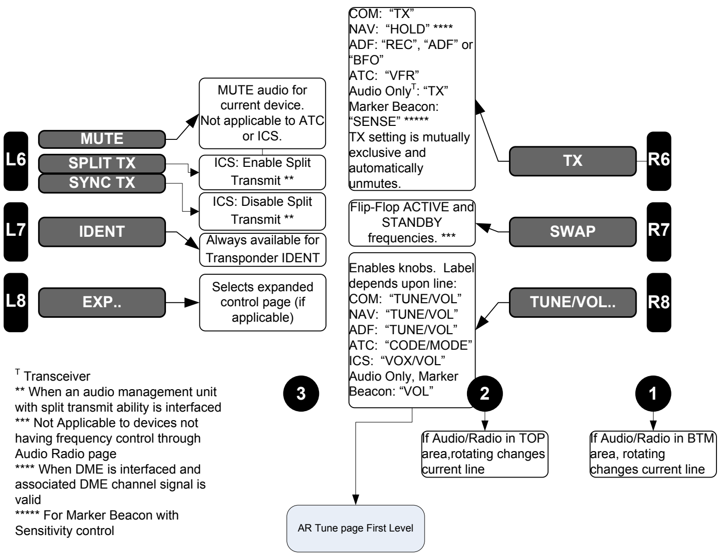


Figure 5-43: AR Tune Page First-Level Options

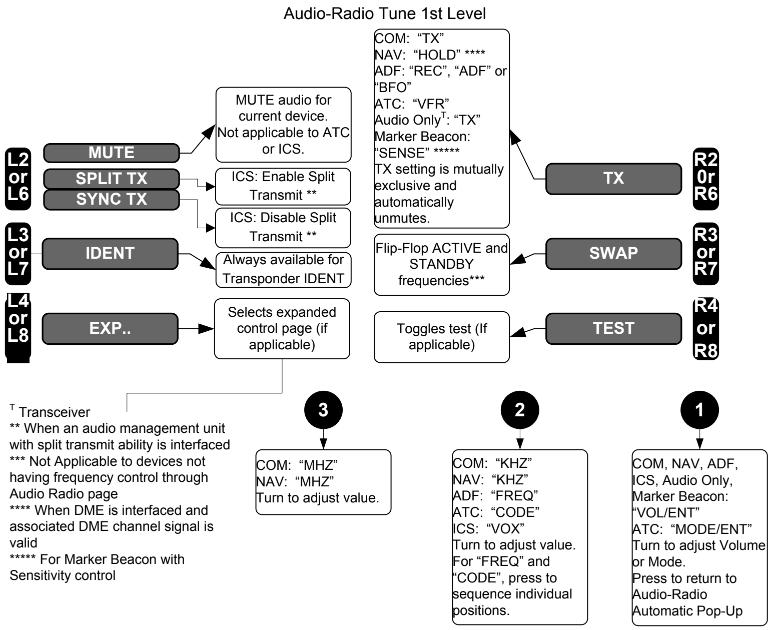


Figure 5-43a: AR Tune Page First-Level Options

When on the AR page, upon selecting **R4** or **R8** button for the display area will do the following based on selected AR device type:

Table 5-6: AR Page Functions

Device Type	Action
VHF COM Transceiver	When rotated, ❸ increments or decrements the standby frequency by 1 MHz, from 118 to 136. When rotated, ❷ increments or decrements the standby frequency by 25 kHz, from 0 to 975 kHz, if device is set to 25 kHz spacing. When rotated, ❷ increments or decremens the standby frequency by 8.33 kHz channels*, from 0 to 990, if device is set to 8.33 kHz spacing. When rotated, ❶ increments or decrements the volume level.
VHF NAV Receiver	When rotated, ❸ increments or decrements the standby frequency by 1 MHz, from 108 to 117. When rotated, ❷ increments or decrements the standby frequency by 50 kHz, from 0 to 950 kHz. When rotated, ❶ increments or decrements the volume level.

Table 5-6: AR Page Functions

Device Type	Action
ADF Receiver	When rotated, ❷ increments or decrements the selected digit of the standby frequency from 190.0 – 1799.5 kHz. Pushing ❷ selects the next standby frequency digit. When rotated, ❶ increments or decrements the volume level.
Transponder	When rotated, ❷ increments or decrements the selected digit of the standby code from 0 – 7. Pushing ❶ selects the next standby code digit. When rotated, ❶ increments or decrements the transponder mode from ‘Standby’ to ‘Ground’ to ‘On’ to ‘Altitude’
Audio-Only DME Receiver Marker Beacon	When rotated, ❶ increments or decrements the volume level.
Intercom System	When rotated, ❷ increments or decrements the VOX level. When rotated, ❶ the rightmost encoder shall **[SYS_MENU_566]** increment or decrement the volume level.

* 8.33 kHz channel spaces increment as .x00, .x05, .x10, .x15, .x25, .x30, .x35, .x40, .x50, .x55, .x60, .x65, .x75, .x80, .x85, .x90.

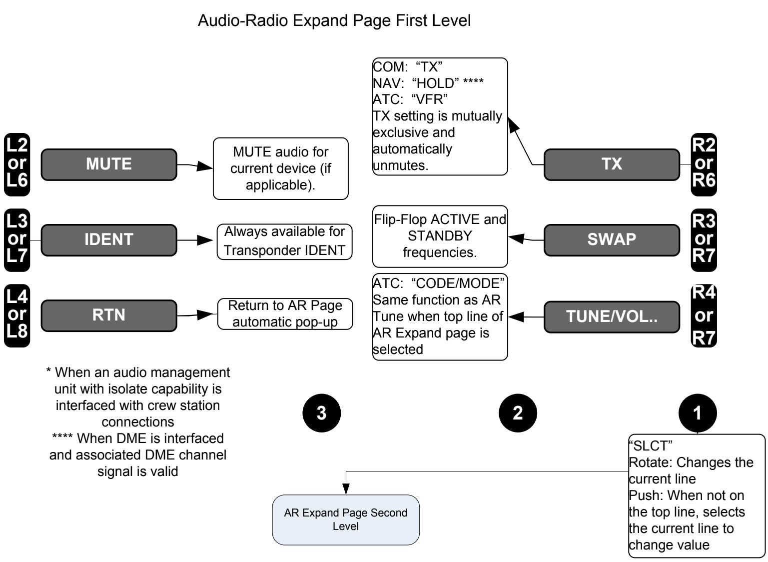
When an intercom or audio management unit (AMU) fails, the failure of the AMU may cascade across the other devices. When the AMU fails, only the devices having audio control through those devices' interfaces will increment or decrement the volume level.

5.31. AR Expand Page

The AR Expand page displays features for those devices that have more features than can be accessed from the AR automatic pop-up or AR Tune first level. These pages are device-specific, but they have a common menu interface. The first line of each device AR expand page will be drawn the same as the line for that device on the AR Tune page.

5.31.1. AR Expand Page First-Level Options

First-level options for AR Expand Page will be shown adjacent to the area in which the AR Expand page resides with the first-level options will be as follows:



5.31.2. AR Expand Page Second-Level Options

Second-level options for AR Expand Page are shown adjacent to the area in which the AR Expand page resides with the second-level options as follows:

Audio-Radio Expand Page 2nd Level

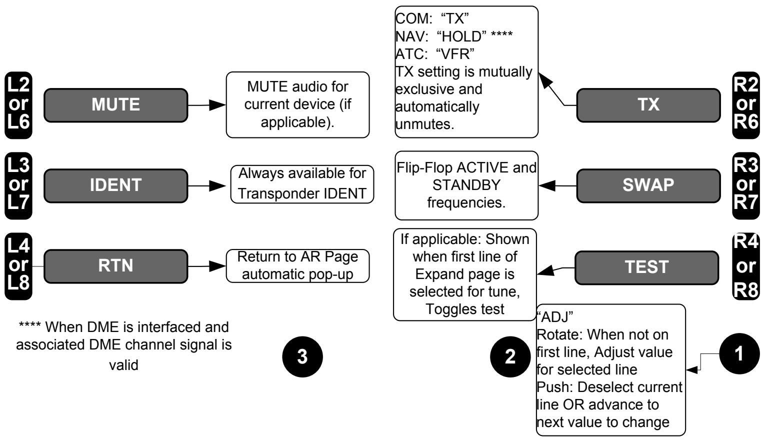


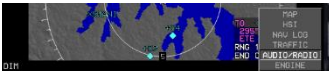
Table 5-6: ADR 7050 VHF Com Transceiver expanded page

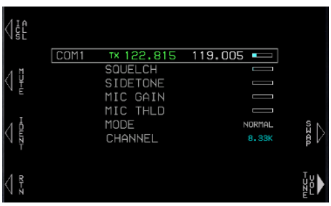
Highlighted Line	Encoder action	Encoder action to ADJ	End result of Encoder action
SQUELCH	➊ Push when **SLCT** is in encoder list	**SQUELCH** enabled for change	Rotate ➊ to increment or decrement squelch level.
SIDETONE	➊ Push when **SLCT** is in encoder list	**SIDETONE** enabled for change	Rotate ➊ to increment or decrement sidetone level.
MIC GAIN	➊ Push when **SLCT** is in encoder list	**MIC GAIN** enabled for change	Rotate ➊ to increment or decrement 1 gain level.
MIC THLD	➊ Push when **SLCT** is in encoder list	**MIC THLD** enabled for change	Rotate ➊ to increment or decrement 1 threshold level.
MODE	➊ Push when **SLCT** is in encoder list	**MODE** enabled for change	Rotate ➊ to cycle between “NORMAL” and “MONITOR”.
CHANNEL	➊ Push when **SLCT** is in encoder list	Channel space value enabled for change	Rotate ➊ to cycle between 25 KHz spacing and 8.33 KHZ spacing
AUDIO MODE	➊ Push when SLCT is in encoder list	**AUDIO MODE** is enabled for change	Rotate ➊ to cycle audio mode between “**VOICE**” AND “**IDENT**”.

Table 5-7: BXP 6402 Mode-S Transponder expanded page			
Highlighted Line	**Encoder action**	**Encoder action to ADJ**	**End result of Encoder action**
FLT ID	➊ Push when SLCT is in encoder list	**Transponder aircraft identification** is enabled for change.	Rotate ➊ to increment and decrement the selected character of the transponder aircraft ID from “A” tp “Z” (space) “0”-“9” Push ➊ to select the next character. (***The ID change can only occur when transponder is in standby mode***)
ALTITUDE	➊ Push when SLCT is in encoder list	**Altitude display mode** is enabled for change	Rotate ➊ to cycle the altitude display mode between “METERS” and “FL”
VFR	➊ Push when SLCT is in encoder list	**Transponder VFR code** is enabled for change	Rotate ➊ to increment and decrement the selected digit of the transponder VFR code from 0-7. Pushing ➊ will select the next VFR code digit.

5.32. Audio / Radio Controls

5.32.1. AUDIO / RADIO CONTROLS (Step-By-Step)





1) Push ❶ and scroll to **AUDIO/RADIO** and push to enter.

2) Scroll ❶ to select desired line to be highlighted.

3) Press  to swap standby with Active frequency or Sqawk code.

4) Press  button when desired line is highlighted for single line display.

5) Press  button to restore full display.

Figure 5-47: AUDIO/RADIO Controls (Step-By-Step)

1) When the Transponder line is highlighted the 

and 

tiles are present.

2) Press 

to change standby Squawk code to **VFR**.

3) Press 

to Squawk Ident.

4) When any line is highlighted other than the transponder, press 

for entering new frequency or set volume limits by scrolling ❶.

Figure 5-47a: AUDIO/RADIO Controls (Step-By-Step)

1) To change Transmitter selector, scroll to desired line by press **PRV** or NXT buttons and press 

.

2) To **MUTE** any receiver, press **PRV** or **NXT** buttons to highlight desired line and press 

to highlight volume slide bar then press 

to toggle on or off.

Section 6 Quick Start Tutorial

Begin by reading the EFIS Aircraft Flight Manual Supplement.

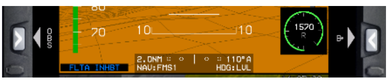
Power up the EFIS system. The system will perform a built-in test routine. If all tests are passed, the system will display a screen identifying the data base coverage. Press any button to acknowledge, and the system will begin a two-minute count down while awaiting sensor initialization (for the purposes of flight planning, etc, this countdown can be overridden by pressing any button).

3 2 1

The encoders are numbered 1-3 from the right side as noted. If necessary, adjust the heading bug setting by turning the #3 encoder at the bottom of the IDU bezel.

Press 

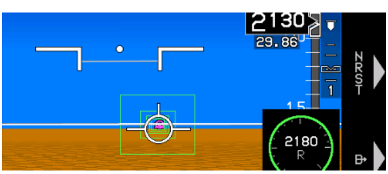
(R2) to enter the Altimeter menu for entering the proper QNH. Scroll the #1 encoder to proper setting and push to enter value.



Press  **(R4)** to enter a destination Active Waypoint.

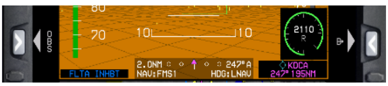
Use ➊ to scroll to the desired alpha or numerical character, push to confirm and advance to the next position. Push to enter once, until all five spaces have been either entered or viewed.

A magenta bearing to the waypoint symbol will be displayed on the directional scale.



A direct route to the Active Waypoint will be activated and will appear as magenta tethered balloon on the PFD as shown.

The Active waypoint information, including waypoint type and Identifier, elevation or crossing altitude and bearing and distance will be 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. A FMS/VLOC CDI is located on the bottom. The VSI appears on the right side of the altitude tape.

Pressing 

(R5) will change the Pilot PFD to a display with Primary flight information on top and EICAS on the bottom display.

Pressing 

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

On the MFD press 

(R5) to change displays to PFD on the top view and EICAS on the bottom view.

On the MFD press 

(R5) to change displays to MFD page on top and bottom view.

On the MFD press 

(R5) to display Primary flight information on top and EICAS on the bottom view.

On the MFD press 

(R5) to bring EICAS on top and MAP displays or as later configured by pushing ❶ or ❷.

Flight Plans (Stored Routes)

Activate a stored flight plan on PFD

1) Press **FPL (L1)**
2) Turn ❶ to scroll through stored flight plans
3) Push ❶ to activate desired flight plan

Activate flight plan on MFD

1) Press **FPL (L1)**
2) Push ❶ to display list of stored flight plans
3) Select desired flight plan to activate as described above
4) Push ❶ to activate desired flight plan

Create flight plan on MFD

1) Press **FPL (L1)**
2) Scroll ❶ to **CREATE-EDIT..** and push to enter
3) Select **CREATE FLIGHT PLAN** and push to enter
4) Press **ADD (R8)** to begin creating first waypoint with #1 encoder by entering waypoints from beginning to end
5) Press **SAVE EXIT (R5)** to save flight plan
6) Press **EXIT (R1)** to exit Flight Planner

Waypoints

Edit a User Waypoint (MFD only)

1) Press **FPL (L1)**

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

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

4) Scroll ❶ to highlight waypoint to be edited and push to enter

5) Edit waypoint and 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

1) Press **ACTV (L2)**

2) Scroll ❶ to location on waypoint list where added waypoint is to be inserted above

3) Press the **INSERT (R2)**

4) Enter waypoint identifier using ❶ and push to enter

Delete Waypoint from an Active Route

1) Press **ACTV (L2)**

2) Scroll ❶ to highlight waypoint to delete (if this is part of a published procedure, pressing **DELETE (R3)** will 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 **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

(The active flight plan must contain an eligible airport for runway selection and VFR approach creation)

1) Press **ACTV (L2)**

2) Scroll ❶ to highlight the desired airport or user waypoint, push to enter

3) Scroll ❶ to highlight **VFR APR..** and push to enter

4) Scroll ❶ to select desired runway and push to enter

Change runway during VFR Approach

1) Press **ACTV (L2)**

2) Scroll ❶ to highlight the following and push to enter:

    a) Destination airport
    b) **VFR APR..**
    c) Desired runway, push to enter

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

Change runway on IFR approach

1) Press **ACTV (L2)**

2) Scroll ❶ to destination airport and push to enter

3) Pick **APPR:** scroll ➊ to desired approach and push to enter

4) Pick **Trans:** scroll ➊ to desired transition and push to enter

5) Pick **RW:** scroll ➊ to desired runway and push to enter

6) (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)

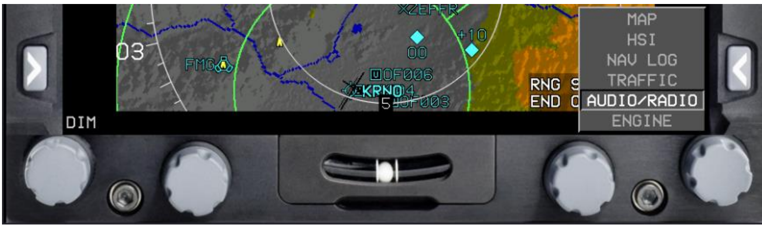
1) During crossfill inhibited operation, a **XFILL INHBT** advisory label will appear on the PFD in the lower left corner.

2) When the pilot and co-pilot systems are not synchronized, a **XFILL ARM** advisory label will appear on the PFD in the lower left corner.

3) When the pilot and co-pilot systems are not synchronized, pressing **MENU (R1)** then **XFILL SYNC (L2)** will synchronize the pilot and co-pilot active flight plan parameters to the system where the button press occurred.

Audio / Radio Tuning

1) To control the Audio and Radios, push ❶ and scroll to **AUDIO / RADIO** and push to enter



2) Scroll Down and Up list by scrolling ❶

3) Press  to swap Standby to Active frequency or Squawk code.

4) Press 

to expand the current highlighted line or 

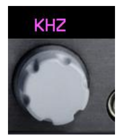
to restore full display.

5) Press 

to **MUTE** highlighted frequency.

6) Press 

and 

and or 

to step through highlighted line for entry options.

7) Scroll ➊ to change selected frequency.

8) Transponder Mode. Press 

to change Squawk code in Standby position to 1200.

9) Press 

to Squawk Ident.

10) Press 

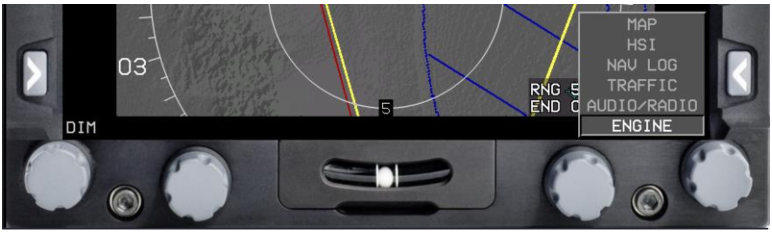
to change Code or Mode. Scroll 

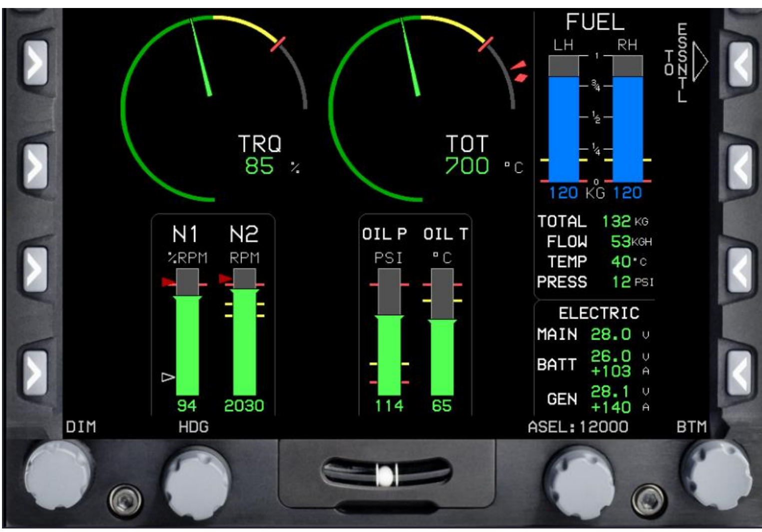
to change the code and or 

to change transponder mode.

EICAS

1) While in Normal Mode scroll ➊ to **ENGINE** and push to enter.





Section 7 IFR Procedures

Table of Contents

List of Figures and Tables

7.1. IFR Procedures

7.2. Overview of Approaches

This Genesys Aerosystems EFIS provides three-dimensional 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 new charting format for Instrument Approach Procedures (IAPs) has been designed to avoid confusion and duplication of Instrument Approach Charts.

Use of this GPS receiver provides a level of certified service that supports 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 new procedures called 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 can be flown using an electronic Glidepath, which eliminates the errors that can be introduced by using Barometric altimetry.

In addition to the LNAV/VNAV procedures, the APV approach has been 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, titles 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 new non-precision GPS/SBAS Approach has been certified as an LP (Localizer Performance) approach where terrain or obstructions prohibit the certification of the LPV vertically guided approach. This new 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 will guide the pilot through every step of the approach procedure with Highway in the Sky 3 dimensional symbology. The system will define a desired flight path based upon the active flight plan. The current position of the aircraft will be determined relative to that desired path in order to determine lateral deviation for display on the GPS/SBAS CDI and VDI. The IDU will normally auto-sequence from one waypoint to the next in accordance with the flight plan along the flight path with the following exceptions as described:

1) The operator has selected a manual GPS/SBAS OBS (SUSPEND flag shown)

2) The active waypoint is the missed approach waypoint and the missed approach procedure has not been armed ("**ARM**" tile) or initiated ("**MISS**" tile) (SUSPEND flag shown)

3) The aircraft is in a published or manually created holding pattern and the pilot has not chosen to continue ("**CONT**" tile) out of the holding pattern (SUSPEND flag shown)

4) The active waypoint is the last waypoint of the active flight plan (no flag shown)

7.2.1. Waypoint Sequencing

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

- 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);

- Aircraft location is within two turn diameters (based upon current True Airspeed and 15° angle of bank) of the active waypoint location; and

- Aircraft heading is within 90° of the current course (i.e., generally pointed in the correct direction).

The desired flight path will be 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 will be composed of up to nine segments. Radius for turning segments (other than DME arc or Radius to a Fix segments) will be automatically calculated with the parameter speed determined as follows:

- If the waypoint is part of a DP and within 30NM of the departure runway, Speed is the preprogrammed Procedure Speed

- If the waypoint is part of a STAR and within 30NM of the arrival runway, Speed is the preprogrammed Procedure Speed

- If the waypoint is part of an IAP or VFR Approach Procedure, Speed is the preprogrammed Procedure Speed

- If the waypoint is part of a Holding Pattern, Speed is the preprogrammed Procedure Speed

- Otherwise, Speed is the current True Airspeed or Preprogrammed Programmed, whichever is higher

In all cases, if navdata derived speed limit is associated with the waypoint, Speed will be the lower of the navdata derived speed limit or the speed determined above.

7.2.2. Fly-Over Waypoints

For purposes of creating the desired flight path, each waypoint will be designated a fly-by waypoint or a fly-over waypoint. Waypoints will be further subdivided into waypoints having a defined entry heading and waypoints having a defined exit heading. Waypoint auto-sequencing for fly-by waypoints will occur at the bisector of the turn. Waypoint auto-sequencing for fly-over waypoints will occur over the waypoint.

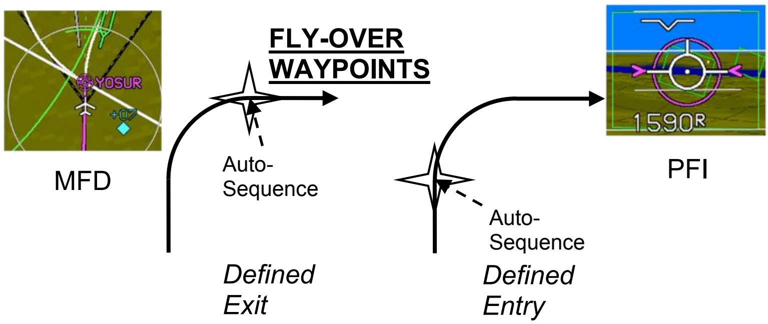


Figure 7.1: Fly-Over Waypoints

The following waypoints will be type Fly-Over with Defined Entry Heading:

Exit from holding pattern;

Exit from procedure turn;

Entry into holding pattern;

Missed Approach Point;

Phantom Waypoint (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);

Last waypoint;

Start waypoint (waypoint created by creating a new active flight plan with the Direct-To function – avoids S-Turns);

Reference (takeoff runway end) waypoint of a DP;

Waypoint leading into discontinuity; and

Altitude, DME or Radial termination legs (ARINC 424 path types CA, FA, VA, CR, VR, CD, FD and VD).

Waypoints that are marked as overfly in the navigation database.

See 7.3 RNAV Path Terminator Leg Type table below for definition of leg type designators

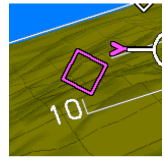
7.3. RNAV Path Terminator Leg Type Table

Table 7-1: RNAV Path Terminator Leg Type			
Path	**Designator**	**Designator**	**Terminator**
Constant DME arc	A	A	Altitude
Course to	C	C	Distance
Direct Track	D	D	DME Distance
Course from a Fix to	F	F	Fix
Holding Pattern	H	I	Next Leg
Initial	I	M	Manual Termination
Constant Radius	R	R	Radial Termination
Track Between	T		
Heading To	V		

Examples: **CF**= Course to Fix, and **FM**= Course from a Fix to a Manual Termination, etc.

7.3.1. Fly-By Waypoints

MFD



PFI

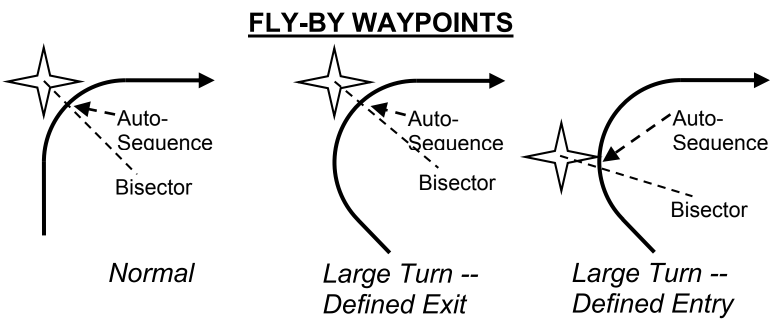


Figure 7-1: Fly-By Waypoints

The following waypoints will be type Fly-Over with Defined Exit Heading:

- Entry into procedure turn; and
- Waypoint exiting a discontinuity with the exception of phantom waypoints or DP reference waypoints;
- First waypoint with the exception of start waypoints or DP reference waypoints
- Course to a fix legs that are not to the FAF/FAWP will be type Fly-By with defined Entry Heading. All other waypoints will be type Fly-By with Defined Exit Heading.

Leg segments for paths will be constructed by the IDU as follows:

Table 7-2: Leg segments for paths constructed by the IDU			
Path Type	**Entry Waypoint**	**Exit Waypoint**	**# 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 7-2: Leg segments for paths constructed by the IDU			
Path Type	**Entry Waypoint**	**Exit Waypoint**	**# of Segments and Description**
	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.

Table 7-2: Leg segments for paths constructed by the IDU			
Path Type	**Entry Waypoint**	**Exit Waypoint**	**# of Segments and Description**
Proce-dure Turn	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 Geodesic path from Entry Waypoint on outbound heading for 30 seconds. Turn to procedure turn heading (45°). Outbound on procedure turn heading for 72 seconds. Turn to inbound heading (135°). WGS-84 Geodesic path to Exit Waypoint. Note that 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

Table 7-2: Leg segments for paths constructed by the IDU			
Path Type	**Entry Waypoint**	**Exit Waypoint**	**# of Segments and Description**
			turn to holding pattern heading for parallel entries. Turn to holding pattern heading for parallel entries. This leg is not used for direct and teardrop entries. Turn to holding pattern outbound leg (180°). Holding pattern outbound leg (length based upon either time or distance as specified by navigation database). Turn to holding pattern inbound leg (180°). Holding pattern inbound leg (length based upon either time or distance as specified by navigation database).

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 will be placed between the waypoints. When a discontinuity exists, no path or skyway will be drawn between the waypoints and it is not possible to activate the waypoint exiting the discontinuity due to inability 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 and VM).

7.3.2. Direct-To

The IDU can generate a WGS-84 geodesic path to a designated "To" fix and the aircraft will capture this path without "S-turning" and without 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) The leg prior to the Phantom waypoint is designated a discontinuity.

3) The Phantom waypoint is designated a Fly-Over Defined Entry Heading waypoint where the 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) The "Start" waypoint is designated a Fly-Over Defined Entry Heading waypoint where the entry heading is current aircraft track.

7.3.3. Magnetic Course

The source of magnetic variation used for paths that are defined using magnetic course will be 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 that flight operations may be conducted using Magnetic North reference. The assigned magnetic variation is calculated using the NIMA GEOMAG algorithm and the World Magnetic Model appropriate to the 12-year cycle.

7.3.4. 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 12 year cycle.

7.3.5. Dead Reckoning

The EFIS provides a Dead Reckoning capability and is active whenever a valid position is not being sent by the GPS/SBAS sensor. The EFIS will project 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.

7.3.6. 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.

7.3.7. 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 point is located so that it lies 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 if there is a route discontinuity or end of route. In this case, the offset reference point will be located abeam of the original flight plan waypoint at the offset distance. The parallel offset function will not propagate through route discontinuities, unreasonable path geometries (defined as turns greater than 120°), flight plan holding patterns, procedures (IFR Approach, VFR Approach, STAR or DP), or waypoints that only have context as an aircraft starting position (i.e., reference waypoint in a DP or Start/Phantom waypoints created by the Direct-To function).

The EFIS will provide 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 is 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. The fact that the IDU is operating in offset mode will be clearly indicated with Blue letters on a Black background advisory label e.g., PTK = L 6NM. 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.

7.4. Default GPS/SBAS Navigation Modes

In the default GPS/SBAS operating mode, the IDU has En Route, Terminal, LNAV Approach, LNAV/VNAV Approach, LP Approach, LPV Approach, VFR Approach and Departure navigation modes. Mode annunciation, alert limits (horizontal and vertical) and CDI FSD (horizontal and vertical) will automatically be determined by navigation mode as follows:

Table 7-3: Default GPS/SBAS Navigation Modes

Navigation Mode	Annunciation
En Route	None
Terminal	TERMINAL
LNAV Approach	LNAV APPR
LNAV/VNAV Approach	LNAV/VNAV APPR
LP Approach	LP APPR
LPV Approach	LPV APPR
VFR Approach	VFR APPR
Departure	TERMINAL

The system will automatically switch to default navigation modes based upon region of operation as follows:

Table 7-4: Default Navigation Modes Based Upon Region of Operation

Default Navigation Mode	**Definition of Region**
Departure	Selected when the active waypoint is the first waypoint of a departure or Missed Approach Procedure and the active leg heading is aligned (±3°) with the active runway heading. Also set when the active waypoint is the MAWP but a missed approach has been manually activated*.
VTF Approach (LNAV, LNAV/VNAV, LP or LPV)	VTF IFR Approach has been selected; and within 30NM of the active runway*; and the FAWP is the active waypoint*; and the bearing to the FAWP is within 45° of the final approach segment track (treated as a mode entry criteria)*; and the desired track to FAWP is within 45° of the final approach segment track (treated as a mode entry criteria).

Table 7-4: Default Navigation Modes Based Upon Region of Operation	
Default Navigation Mode	**Definition of Region**
Approach (LNAV, LNAV/VNAV, LP or LPV)	IFR Approach has been selected; <u>and</u> within 30NM of the active runway*; <u>and</u> the MAWP or the FAWP is the active waypoint; <u>and</u> if the FAWP is the active waypoint: the bearing to the FAWP is within 45° of the final approach segment track (treated as a mode entry criteria)*; <u>and</u> the desired track to FAWP is within 45° of the final approach segment track (treated as a mode entry criteria)*; <u>and</u> either the segment leading into the FAWP is not a holding pattern or the pilot has elected to continue out of holding.
VFR Approach	VFR Approach has been selected*; <u>and</u> within 30NM of the active runway*; <u>and</u> the active runway is the active waypoint.
Terminal	Not in Departure Mode; <u>and</u> Not in Approach Mode; <u>and</u> The active waypoint is part of a departure <u>or</u> the active waypoint and previous waypoint are parts of an arrival or approach <u>or</u> within 30NM of the departure airport, arrival airport or runway.
Enroute	Not in Departure, Approach or Terminal Modes.

7.5. GPS/SBAS CDI Scale

Table 7-5: 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 the departure procedure.	

7.6. Approach type selection

The IDU will automatically select the approach type (LNAV, LNAV/VNAV, LP or LPV) when entering approach mode. The automatically-selected approach type will be selected with the following order of precedence and prerequisites:

1) LPV:

- LPV Enable is enabled;
- ARINC-424 “Level of Service” indicates LPV minimums are published;
- Valid long-term, fast and ionospheric SBAS corrections are available and being applied to at least 4 GPS satellites;
- Final Approach Segment data block exists and passes CRC check; and
- Horizontal and vertical alert limits from Final Approach Segment data block are predicted to be supported.

2) LP:

- LPV Enable is enabled;
- ARINC-424 “Level of Service” indicates LP minimums are published;
- Valid long-term, fast and ionospheric SBAS corrections are available and being applied to at least 4 GPS satellites;
- Final Approach Segment data block exists and passes CRC check; and
- Horizontal alert limit from Final Approach Segment data block is predicted to be supported.

3) LNAV/VNAV:

- ARINC-424 “Level of Service” indicates LNAV/VNAV minimums are published;
- If a Final Approach Segment data block exists, LPV Enable is enabled;

- If a Final Approach Segment data block exists, it passes CRC check; and
- Horizontal alert limit of 556m 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 be available and applied to at least 4 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**: This is the default approach type and is selected when none of the above selections are made. There are no prerequisites for selecting LNAV.

The IDU will continuously display the approach type (mode indication) after selection. The IDU will not degrade the approach type after selection unless the approach procedure is reselected or changed.

Note:

These are GPS/SBAS modes and will still appear during a ground based approach such as an ILS approach.

7.6.1. Approach Path Definition

Normal IAP path definitions will be 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. VTF IFR Approach

In addition, the IDU provides the capability for the pilot to manually select a VTF IFR approach, indicating that the pilot does not intend to fly the entire procedure. When a VTF IFR approach is selected, the IDU will create an “IP” waypoint on the extended final approach course so as to provide deviations relative to the extended final approach course. The “IP” will be designated a fly-over defined exit heading waypoint, and the leg prior to the “IP” will be designated a discontinuity. Until the FAWP has been sequenced, the IDU will indicate that a VTF IFR approach has been selected (using the mode annunciation "**VECTORS**") to advise the pilot that guidance is not relative to a published approach path and TERPS clearances are not assured.

7.8. VTF VFR Approach

The IDU will also provide the capability for the pilot to manually select a VFR approach to a runway or user waypoint with a defined approach bearing. When a VFR approach is selected, the IDU will create an "IP" waypoint approximately 12 NM on the extended final approach course so as to provide deviations relative to the extended final approach course. The "IP" will be designated a fly-over defined exit heading waypoint, and the leg prior to the "IP" will be designated a discontinuity.

7.9. Missed Approach and Departure Path Definition

The IDU will allow the pilot to initiate the missed approach with manual action. Once on the final approach segment, the pilot will have the option to initiate an immediate missed approach or to arm the system to execute the missed approach at the MAWP. When arming the missed approach, it will be possible to take this action before crossing the MAWP, in which case the equipment will arm the missed approach for automatic initiation at the MAWP. If a missed approach is not initiated prior to crossing the MAWP, the IDU will automatically switch to FROM mode at the MAWP and continue on the same course.

If the pilot initiates the missed approach, the IDU will provide guidance relative to the procedure. If a missed approach is armed prior to crossing the MAWP; the desired path, to and after the MAWP will be 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 will change to terminal mode FSD (±1NM) when the missed approach is initiated. Otherwise, the FSD will change to ±0.3 NM when the missed approach is initiated (DEPARTURE mode), and will change to terminal mode FSD (±1NM) at the turn initiation point of the first waypoint in the missed approach procedure.

DP guidance can be manually selected by the pilot and If the first leg in the DP is not a straight path aligned within 3° of the runway heading, terminal mode FSD (±1NM) will be used. Otherwise, the

FSD will be ±0.3 NM (DEPARTURE mode) and will change to terminal mode FSD (±1NM) at the turn initiation point of the first waypoint in the DP.

7.10. Loss of Navigation Monitoring

The IDU will continuously monitor; independent of any operator action, for loss of navigation capability.

In Manual RNP mode or Automatic RNP mode prior to sequencing the FAWP, the loss of navigation caution will be displayed using a 10 second time to alert if the RNP value is less than 2NM and a 30 second time to alert otherwise. The FAULTS menu will enable the user to distinguish the cause of the loss of navigation caution. The caution will return to its normal state upon termination of the responsible condition.

7.11. 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 will be placed between the waypoints. When a discontinuity exists, no path or skyway will be 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 will 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 will be 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).

7.12. Selection of an Instrument Procedure

When an instrument procedure is selected and active, the receiver will notify the pilot of the most accurate level of service supported by the combination of the GPS/SBAS signal, the receiver, and the selected approach; using naming conventions on the minima lines of the selected approach procedure. Once the level of service has been given, the EFIS will operate in this mode for the duration of the procedure, unless that level of service becomes 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 the following procedures serving as sample Step-By-Step procedures:

- STAR
- ILS Instrument Approach
- LOC BC Instrument Approach
- RNAV GPS Instrument Approach to LPV minima
- NRST ILS Instrument Approach
- VOR DME Instrument Approach

7.12.1. Standard Terminal Arrival Route (STAR)

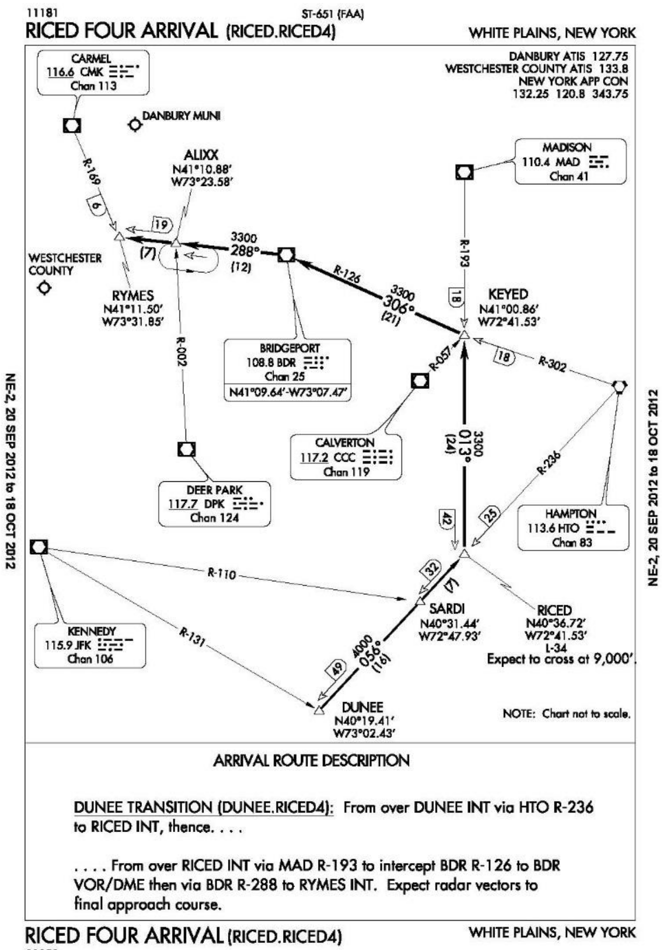
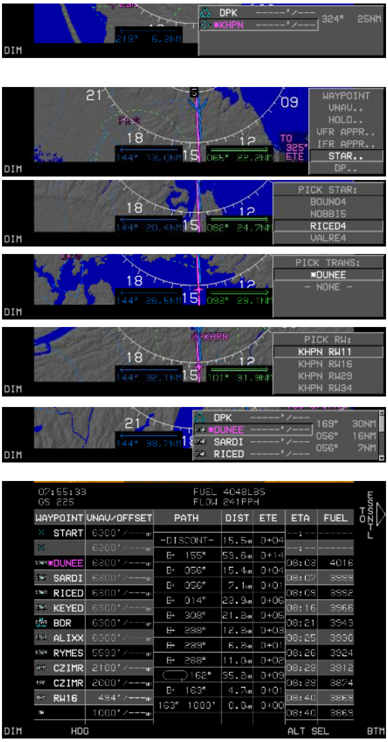


Figure 7-3 Standard Terminal Arrival Route (STAR)

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 will be created and displayed on the MAP page. Activating a STAR will automatically delete any pre-existing STAR and will be inserted prior to any approach waypoints if previously entered.

7.12.2. Standard Terminal Arrival Route (STAR) (Step-By-Step)



1) The arrival airport must be entered as a waypoint
2) Push 1 with Desired airport highlighted
3) Scroll 1 to **STAR..** and push to enter
4) Scroll 1 to desired STAR and push to enter
5) Scroll 1 to desired transition and push to enter
6) Scroll 1 to desired Runway and push to enter
7) Scroll 1 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 will follow with altitude, bearing, distance and ETE/ETA values

7.12.3. Standard Terminal Arrival Route (STAR) (Step-By-Step)

1) The STAR route can be viewed on the MAP page

2) If ATC issues a clearance to another waypoint on the STAR, Press **ACTV (L2)** and scroll ➊ to desired waypoint and press **(R4)** then Push ➊ Encoder to enter

3) ATC has issued a clearance to HOLD at RICED intersection on course left turns.

4) Course guidance and turn anticipation will be provided on the PFD with HITSs boxes which will connect waypoints throughout the procedure.

Figure 7-4: STAR Procedure (Step-By-Step)

STARS normally terminate at a FIX near the airport, then 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 will be inserted after the STAR.

7.12.4. ILS Instrument Approach

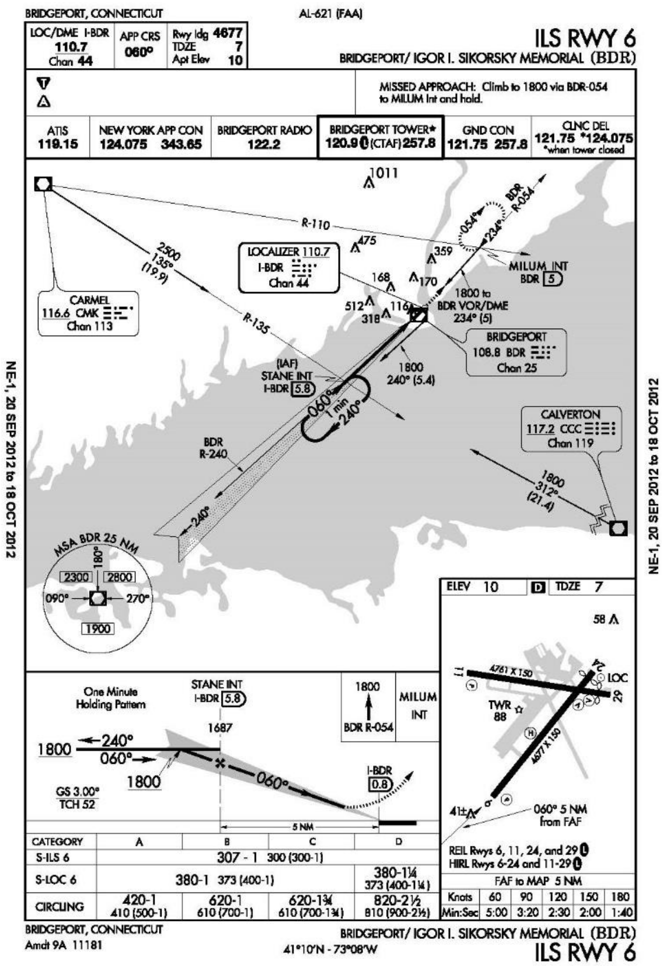


Figure 7-5: ILS RWY 6 (BDR)

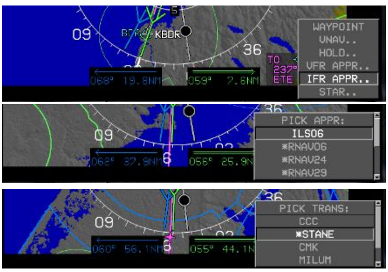
All approach operations will typically begin with the same basic steps:

(This example selects the ILS RWY 6 at Bridgeport / IGOR I. Sikorsky (KBDR))

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

1) Press **ACTV (L2)**

2) The intended landing airport must be selected as the Active waypoint



3) Turn ❶ to select the desired airport, then push to enter

4) Turn ❶ and select **IFR APPR..** then push to enter

5) Turn ❶ to select desired approach then push to enter

6) Pick Transition by scrolling ❶ to desired Transition (the * indicates the most logical from current position) then push to enter

7) Turn ❶ to desired landing Runway then push to enter

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

1) If instructed to Hold at STANE, auto waypoint sequencing will be suspended and a CONT tile will be presented until ready for the approach
2) The Outer Marker is displayed on the PFD
3) Decision Height has been set to 300' and the MDA for the Localizer minima has been set to 380' MSL
4) Nav #1 is tuned to the I-BDR Localizer frequency and The Final Approach Course is set to 060°

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

1) Inside the FAF with Auto waypoint sequencing suspended again until the ARM tile button is pressed
2) After the ARM tile button is pressed, the SUSPEND advisory will disappear and auto waypoint sequencing will continue through the full Missed approach procedure
3) The VDI will disappear upon passage of the MAP

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

1) On short final slightly below Glideslope
2) Below Localizer Minimums and not yet at Decision Height
3) The LNAV APPR advisory label is present as a default type of approach

Figure 7-5a: ILS Instrument Approach (Step-By-Step)

7.12.9. LOC Back Course Instrument Approach

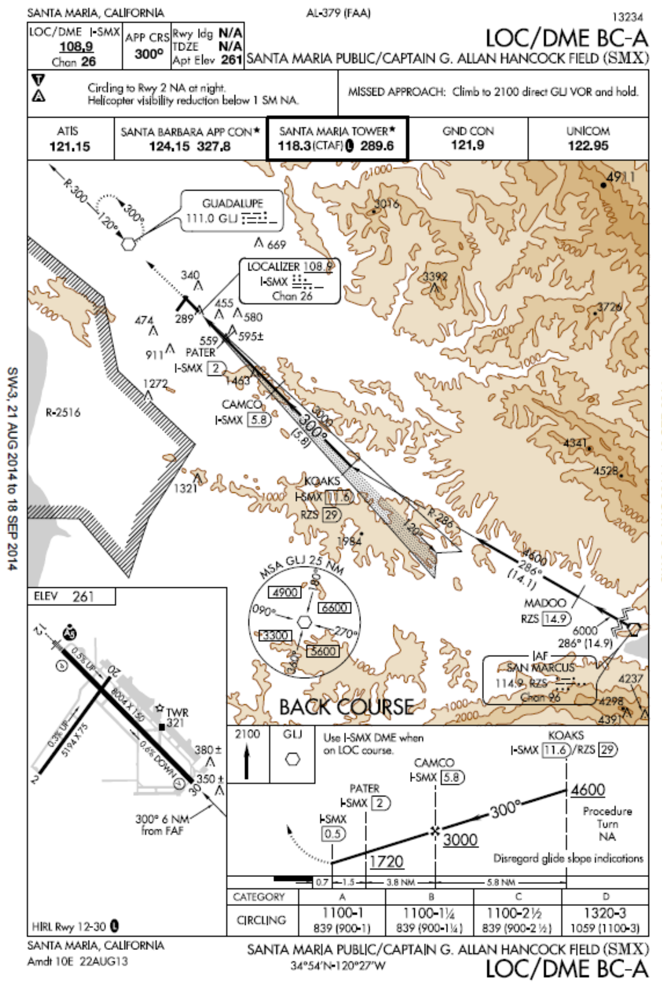
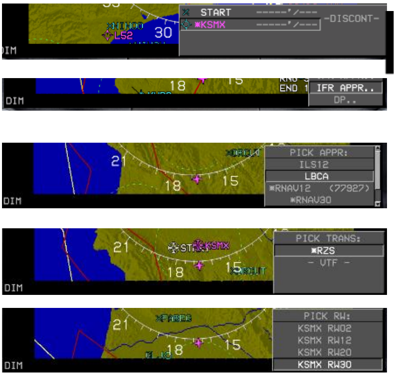
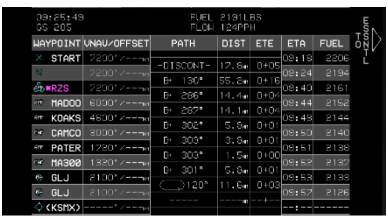


Figure 7-6: LOC Back Course Approach (Step-By-Step)





1) Press **ACTV (L2)**

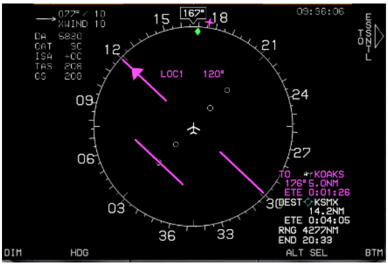
2) Scroll ➊ to desired airport active waypoint and push to enter

3) Scroll ➊ to IFR APPR.. and push to enter

4) Scroll ➊ to LBCA and push to enter

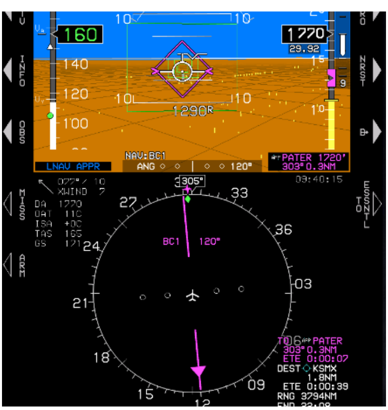
5) Scroll ➊ to desired Transition (the * indicates the most logical from current position) then push to enter

6) Scroll ➊ to desired runway and push to enter



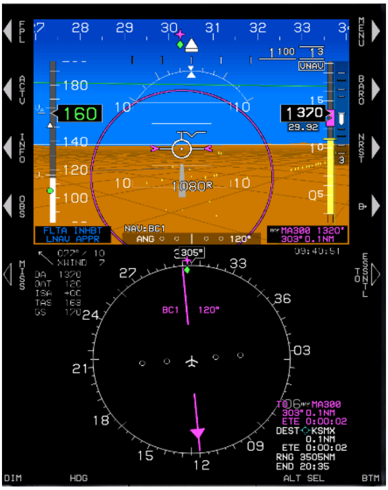
9) Set Minimums by pressing **MENU (R1)**, **BUGS (R2)**, **MINS (R3)**, **scroll** to **MIN ALT..** and push to enter and scroll to set desired Minimum altitude and push to enter

10) Set 108.9 MHz in Nav #1 or #2 as applicable and Press **OBS (L4)** and Press **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)** as applicable and **scroll** to set front course bearing of 120 **°** and push to enter. This will result in proper sensing of Back Course CDI indications



11) Due to aircraft heading being more than 105° beyond the front course bearing of 120°, the HSI will indicate a BC1 120° setting. Back Course sensing is therefore automatic with reversal of the CDI presentation for natural tracking guidance.

12) Approaching step down fix PATER Press **ARM (L6)** to arm the Missed approach procedure



13) The Missed Approach procedure will automatically sequence when passing the MAWP or MISS (L5) can be pressed at any time

14) During the Missed Approach procedure, the FMS will automatically change to FMS guidance

Figure 7-6a: LOC Back Course Approach (Step-By-Step)

7.12.10. RNAV (GPS) Instrument Approach to LPV minima

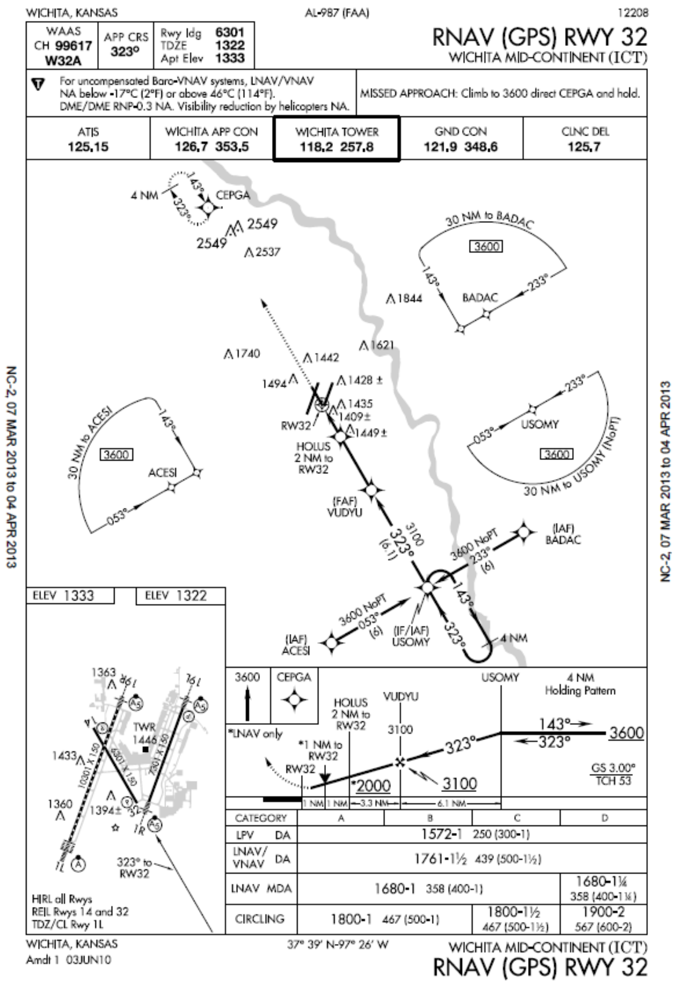
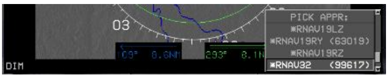
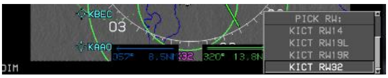
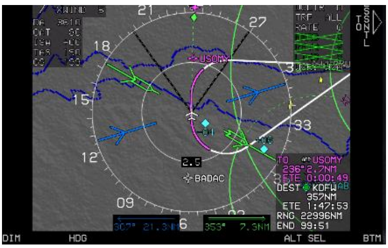


Figure 7-7: RNAV (GPS) Instrument Approach to LPV minima

7.12.11. RNAV (GPS) Instrument Approach to LPV minima (Step-By-Step)







1) Select airport as in previous example
2) In this example turn ❶ to **RNAV32 (99617)** then push to enter
3) Turn ❶ to desired transition, and runway then push to enter as described in previous example
4) Turn 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.

7.12.12. RNAV (GPS) Instrument Approach to LPV minima (Continued)

6) Inside FAF ARM (L6) prior to Step down FIX, HOLUS

7) Upon passing SIVYO with ARM (L6) pressed, auto waypoint sequencing will continue

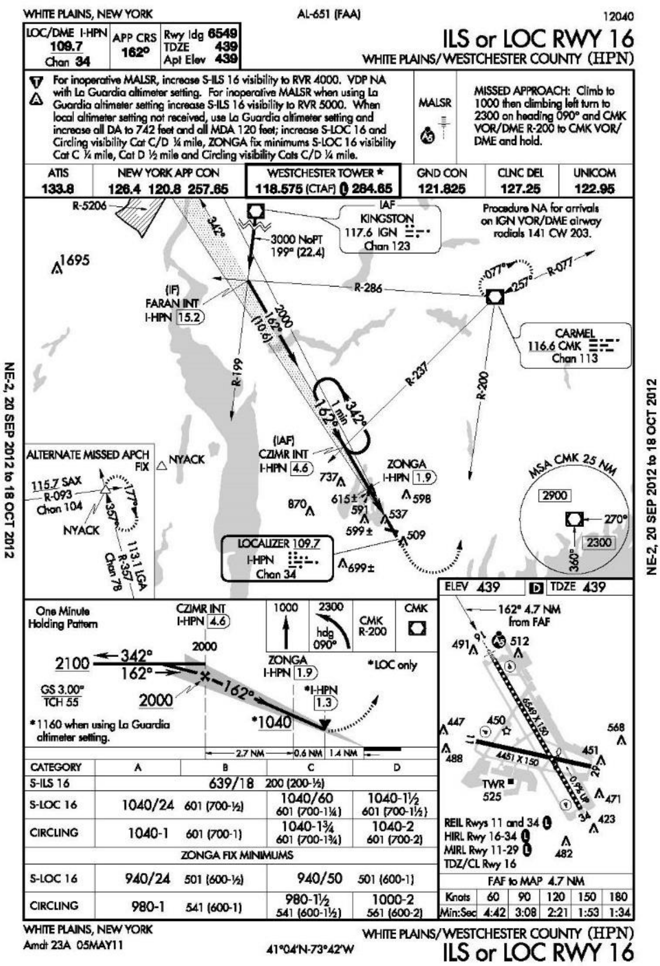
8) The VDI will display vertical guidance for the LPV vertical profile based on GPS/SBAS

9) Obstructions appear on PFD and MAP page

10) The bottom example shows the Flight Path Marker lined up on the active runway after passing through Minimums and on Glidepath

Figure 7-8: RNAV (GPS) Instrument Approach to LPV Minima (Step-By-Step)

7.12.13. NRST ILS Instrument Approach

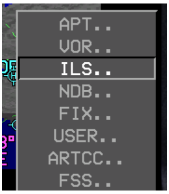


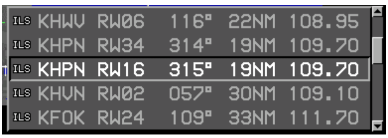
CATEGORY	A	B	C	D
S-ILS 16	639/18 200 (200-½)			
S-LOC 16	1040/24 601 (700-½)		1040/60 601 (700-1¼)	1040-1½ 601 (700-1½)
CIRCLING	1040-1 601 (700-1)		1040-1¾ 601 (700-1¾)	1040-2 601 (700-2)
ZONGA FIX MINIMUMS				
S-LOC 16	940/24 501 (600-½)		940/50 501 (600-1)	
CIRCLING	980-1 541 (600-1)		980-1½ 541 (600-1½)	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

Figure 7-9: NRST ILS Instrument Approach

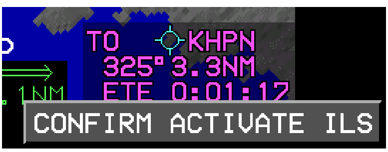
7.12.14. NRST ILS Instrument Approach (Step-By-Step)





1) Press **NRST (R3)** then scroll ❶ to **ILS..** and push to enter

2) Scroll ❶ to desired airport and runway and push to enter (ILS must precede Airport)



3) Push ❶ to **CONFIRM ACTIVATE ILS**

The following actions will occur:

1) A direct flight plan to the ILS Airport is created

2) A Vectors-to-Final ILS approach is activated

3) The Heading Bug is activated to the current heading

4) The VLOC 1 and VLOC 2 OBS settings are set to the Associated Localizer course

5) HSI source is switched as follows for Airplanes:

6) The ILS is automatically switched to NAV #1

7) HSI source is switched as follows for Fixed Wing aircraft:

8) The ILS is automatically switched to NAV#1

7.12.15. NRST ILS Instrument Approach (Step-By-Step)

1) The EFIS automatically changes to LOC1 and the VDI indicates source of Glideslope GS1

2) Inside the **FAF, ARM (L6)** and **MISS (L5)** appear with auto waypoint suspended

3) Once **ARM (L6)** has been pressed, auto waypoint sequencing will continue

4) During the Missed Approach, the HSI is automatically reset to FMS1 and dashed magenta and white lines lead the flight to the Holding Waypoint

5) Scroll ➊ to scale the MAP for desired view of published Missed Approach Procedure.

Figure 7-10: Nearest ILS Instrument Approach (Step-By-Step)

7.12.16. VOR/DME Instrument Approach

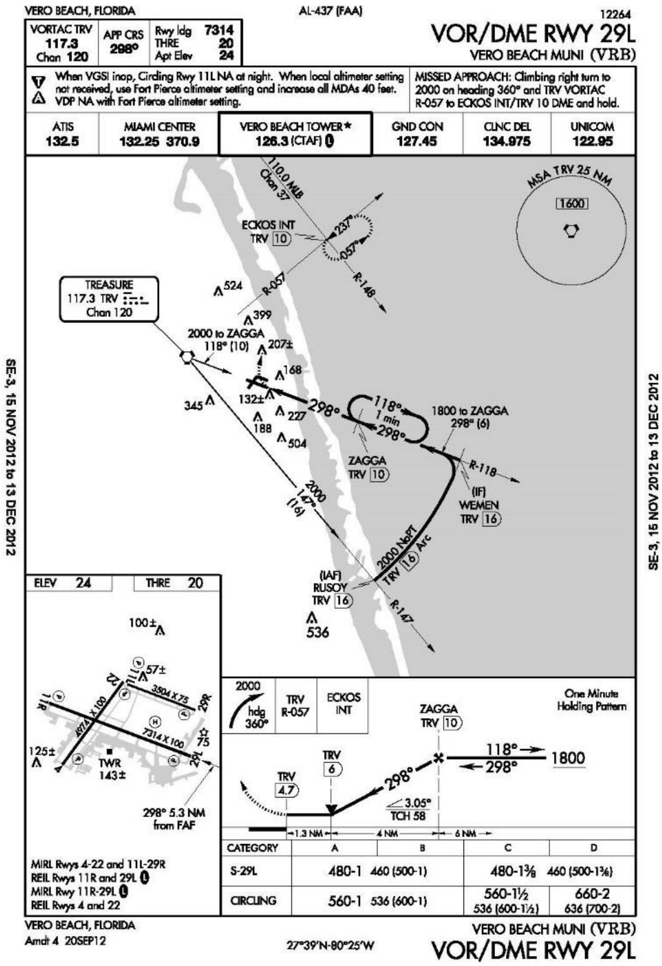
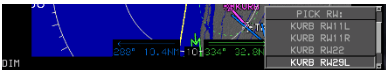


Figure 7-11: VOR/DME Instrument Approach

7.12.17. VOR/DME Instrument Approach (Step-By-Step)



1) With the destination airport entered as the waypoint select the **IFR APPR..** and type of approach

2) Scroll ➊ to select desired runway and push to enter

3) View **ACTV** flight plan and press **EXIT (R1)** to remove menu

4) Scroll ➊ to view procedure with desired MAP scale

7.12.18. VOR/DME Instrument Approach (Step-By-Step)

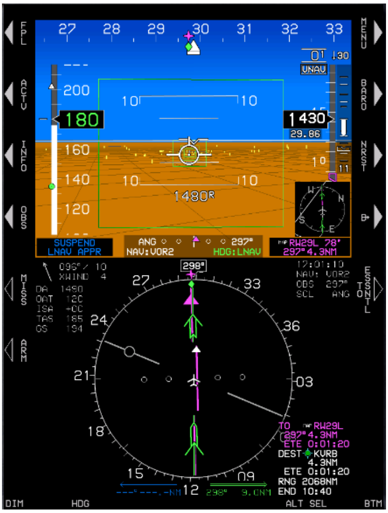
1) Minimums are set to 480’ as the aircraft tracks along the DMW ARC to WEMEN at 2000’

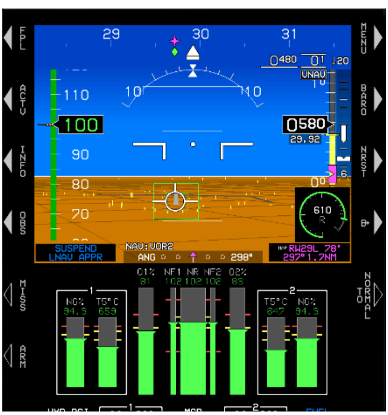
2) The full procedure is shown on the MAP page including MAP on dashed white line

3) Approaching the FAF on Glide Path

4) The HSI has been changed to NAV: VOR2 with CDI centered on the Final Approach Course

7.12.19. VOR/DME Instrument Approach (Step-By-Step)





1) PFD with HSI page selected inside of FAF and MAP not armed.

2) The Auto waypoint sequencing has been suspended

3) The PFD view has been changed to Zoom mode

4) The PFD has been changed to ESSENTIAL mode to reveal EICAS information

7.12.20. VOR/DME Instrument Approach (Step-By-Step)

1) PFD below MINIMUMS and beyond the MAWP

2) MAP Page in ARC view displaying MAP routing to MAHWP and terrain rendering with Obstructions

Figure 7-12: VOR/DME Instrument Approach (Step-By-Step)

Note:

Navigation databases are expected to 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. Traditionally, this has been accomplished by verifying electronic data against paper products. One acceptable means is to compare aeronautical charts (new and old) to verify navigation fixes prior to departure. If an amended chart is published for the procedure, the database must not be used to conduct the operation.

Note:

Pilots may notice a slight difference between the navigation information portrayed on the chart and their primary navigation display heading. Differences of three degrees or less may result from equipment manufacturer's application of magnetic variation and are operationally acceptable.

Note:

GPS Receivers do not "Fail Down" to lower levels of service once the approach has been activated. If only the VERT LON flag appears, the pilot may elect to 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 will be necessary since there is no way to reset the lateral alarm limit while the approach is active.

Section 8 Terrain Awareness Warning System

All Airplane TAWS Classes

Table of Contents

List of Figures and Tables

8.1. TAWS A, B, and C

8.2. TAWS B (Terrain Awareness and Warning System) Functions

The IDU provides TSO-C151b TAWS functionality. The following description is for a TAWS Class A, B and C depending on aircraft configuration and external sensors/switches.

Functions provided by TAWS are:

1) **Terrain Display**: Display of terrain and obstacles on the PFD and ND.

2) **Forward Looking Terrain Awareness** (“**FLTA**”): A warning function that uses a terrain database and an obstruction database to alert the pilot to hazardous terrain or obstructions in front of the aircraft.

3) **Premature Descent Alert** (“**PDA**”): A warning function that alerts the pilot when descending well below a normal approach glidepath on the final approach segment of an instrument approach procedure.

4) **Excessive Rate of Descent** (**GPWS Mode 1**): A warning function that alerts the pilot when the rate of descent is hazardously high as compared to height above terrain (i.e., descending into terrain).

5) **Excessive Closure Rate to Terrain** (**GPWS Mode 2**): A warning function that alerts the pilot when the rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain).

6) **Sink Rate after Takeoff or Missed Approach** (**GPWS Mode 3**): A warning function that alerts the pilot when a sink rate is detected immediately after takeoff or initiation of a missed approach.

7) **Flight into Terrain when not in Landing Configuration** (**GPWS Mode 4**): A warning function that alerts the pilot when descending into terrain without properly configuring the aircraft for landing.

8) **Excessive Downward Deviation from an ILS Glideslope** (**GPWS Mode 5**): A warning function that alerts the pilot when an excessive downward glideslope deviation is detected on the final approach segment of an ILS approach.

9) **500 foot Wake-up Call**: A single voice callout when descending through 500 feet AGL.

Table 8-1: TAWS Functions Provided by the EFIS

Aircraft Type	Airplane				Airplane	Airplane
	RG + F	RG	FG + F	FG		
TAWS Class	A	A	A	A	B or C	B or C
Terrain Display	X	X	X	X	X	X
FLTA	X	X	X	X	X	X
PDA	X	X	X	X	X	X
GPWS Mode 1	X	X	X	X	X	X
GPWS Mode 2	X	X	X	X		
GPWS Mode 3	X	X	X	X	X	X
GPWS Mode 4	X	X	X			
GPWS Mode 5	X	X	X	X		
500’ Call	X	X	X	X	X	X

Notes: RG + F = Retractable Gear with Defined Landing Flaps Position

RG = Retractable Gear

FG + F = Fixed Gear with Defined Landing Flaps Position

FG = Fixed Gear

8.2.1. Terrain Display

The display of terrain on the PFD and ND are described in sections 3 and 5 of this Pilot Guide where applicable.

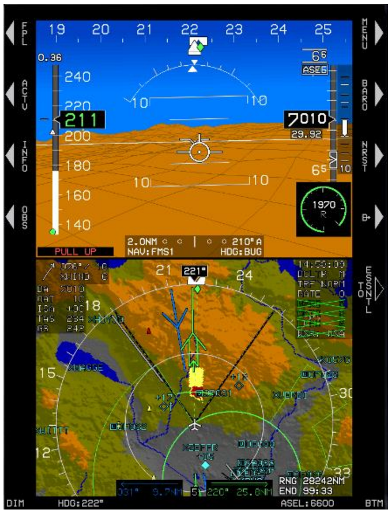


FIGURE 8-1: Terrain Display

8.3. Forward Looking Terrain Alert Function

The FLTA function will use the following information to alert the pilot to hazardous terrain or obstructions within a search envelope in front of the aircraft:

- Terrain database
- Obstruction database
- Airport and Runway database
- Aircraft position
- Aircraft track
- Aircraft groundspeed
- Aircraft bank angle
- Aircraft altitude
- Aircraft vertical speed

Figure 8-2: FLTA INHBT

8.3.1. FLTA Modes

The EFIS FLTA mode will either be 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 user can 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 EFIS allows the user to 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 will be the reference point for automatic FLTA inhibiting. The advantage of this scheme is that 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 will be slaved to the default FLTA navigation mode.

The order of precedence is:

1) Departure Mode;

2) Approach Mode;

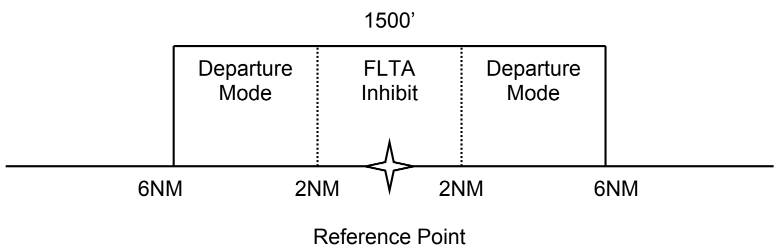
3) Terminal Mode; and

4) Enroute Mode.

These modes are as follows:

1) **Departure Mode**. This mode will be enabled when in Ground Mode

2) The reference point for automatic FLTA inhibiting and mode envelope definition will be the last point at which the ground definition was satisfied (this will be near the liftoff point). The Departure Mode will end upon climbing through **1500 feet** above or traveling more than **6NM** from the reference point.

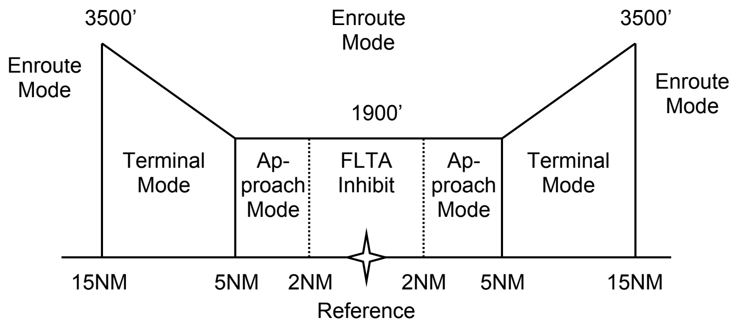


3) **Other Modes**. For other default FLTA modes, the reference point for automatic FLTA inhibiting and mode envelope definition will be the nearest runway threshold or the nearest user waypoint with a defined approach bearing. The TAWS system will continuously search all runway thresholds at the nearest three airports to determine the nearest runway threshold. The TAWS system will perform 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**. This mode exists when within **1900 feet and 5NM** of the reference point.

   b) **Terminal Mode.** This 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**. This mode exists when not in any other mode.



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 (described above), aircraft groundspeed, aircraft bank angle and aircraft vertical speed. Basic envelope parameters are as follows:

TAWS Type: The TAWS type determines the value of several parameters used to calculate the search envelope. These parameters are described below:

Table 8-2: FLTA Search Envelope for Class A TAWS Retractable Gear and Flaps

Envelope	**Parameter**	**Notes**
Level-Off Rule:	**20% (Class A and B) and 10% (Class C)** of vertical speed	Used for level off leading
Range:	**60 seconds** of the forward range search envelope	After calculations GPS/SBAS HFOM will be added to range.
Enroute Mode Level / Climbing Flight RTC:	700 feet (Class A and B) 250 feet (Class C)	
Terminal Mode Level / Climbing Flight RTC:	350 feet (Class A and B) 250 feet (Class C)	

Table 8-2: FLTA Search Envelope for Class A TAWS Retractable Gear and Flaps

Envelope	Parameter	Notes
Approach Mode Level / Climbing Flight RTC:	150 feet	
Departure Mode Level / Climbing Flight RTC:	100 feet	
Enroute Mode Descending RTC:	500 feet (Class A and B) 200 feet (Class C)	
Terminal Mode Descending RTC:	300 feet (Class A and B) 200 feet (Class C)	
Approach Mode Descending RTC:	100 feet	
Departure Mode Descending RTC:	100 feet	

1) **Aircraft Track**: The terrain search envelope is aligned with aircraft track.

2) **Aircraft Groundspeed**: Aircraft groundspeed is 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 will be 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 will be 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 will be 0.3NM either side of track.

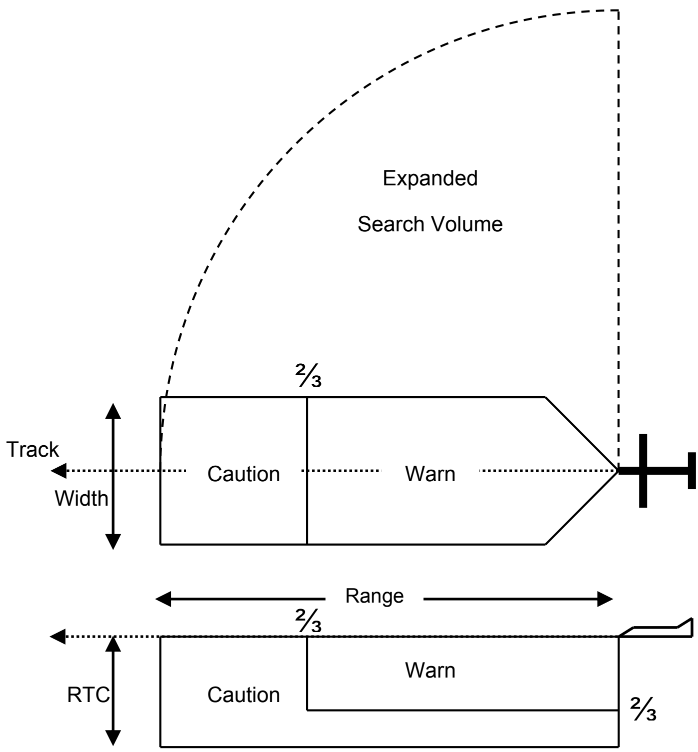
d) **Departure Mode**: Search volume width is based upon a 10° change in track followed by **30 seconds** of flight at aircraft groundspeed. Maximum width will be 0.3NM either side of track.

After calculating search volume width as described above, the GPS/SBAS HFOM will be added to search volume width.

1) **Aircraft Bank Angle**: Aircraft bank angle is 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 debounced such that at 10° of bank, the bank angle must be continuously held for **3.25 seconds**. The amount of debouncing is reduced linearly with increased bank angle such that at **30°** of bank there is no debounce time. Debouncing is intended to reduce nuisance search volume expansions when experiencing bank angle excursions due to turbulence.

2) **Aircraft Vertical Speed**: Aircraft vertical speed is used to determine which RTC values should be used. At vertical speeds above **-500fpm**, level and climbing flight RTC values will be used. At vertical speeds less than or equal to **-500fpm**, descending flight RTC values will be used. In addition, vertical speed is used to increase the descending flight RTC value used by the system. The increase in descending flight RTC will be based upon a **3 second** pilot reaction time and VSI leading according to the level-off rule parameter.

8.4.1. 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 will be enabled when an FLTA warning is initiated or upgraded as follows:

- On PFD screen, terrain rendering is enabled;
- On navigation display screen, terrain rendering is enabled only if TAWS Inhibit is not enabled (i.e., TAWS Inhibit prevents terrain from being automatically enabled on the navigation display).

In addition, when an FLTA warning is initiated or upgraded; an automatic popup mode will be engaged as follows:

- Display (bottom area) switched to navigation display.

- Display (bottom area) switched to aircraft centered and heading up.
- Display (bottom area) panning disabled.
- Display (bottom area) scale set to: 10NM (groundspeed > 200 knots);
  5 NM (groundspeed <= 200 knots and groundspeed > 100 knots); or
  2NM (groundspeed <= 100 knots).

After the popup mode is engaged, the pilot is able to manually change any setting that was automatically changed by the popup mode. In addition, a “**RESET**” button will appear for 20 seconds to allow the pilot to reset the previous screen configuration with one button press. Popups will only occur on CPU #0 or CPU #2 and will not occur:

- If TAWS Inhibit is enabled;
- On an IDU-680 in Essential Mode if an Essential EICAS page is shown.

The following screen capture shows an example of the ND in popup mode.

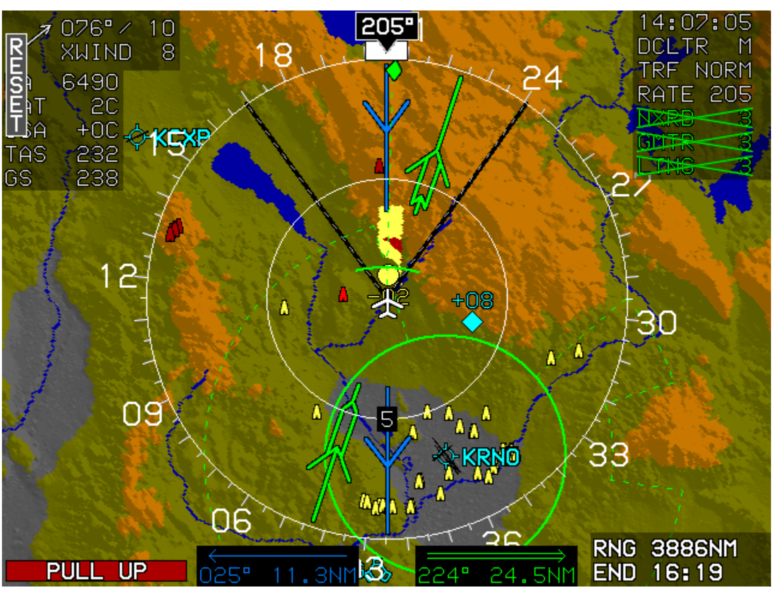


FIGURE 8-3: Popup Mode

8.5. Premature Descent Alert Function:

This function applies to this airplane TAWS system and will use the following:

- GPS/SBAS navigation database
- GPS/SBAS navigation mode
- Aircraft position
- Aircraft altitude

This is done to alert the pilot when descending well below a normal approach glidepath on the final approach segment of an instrument approach procedure.

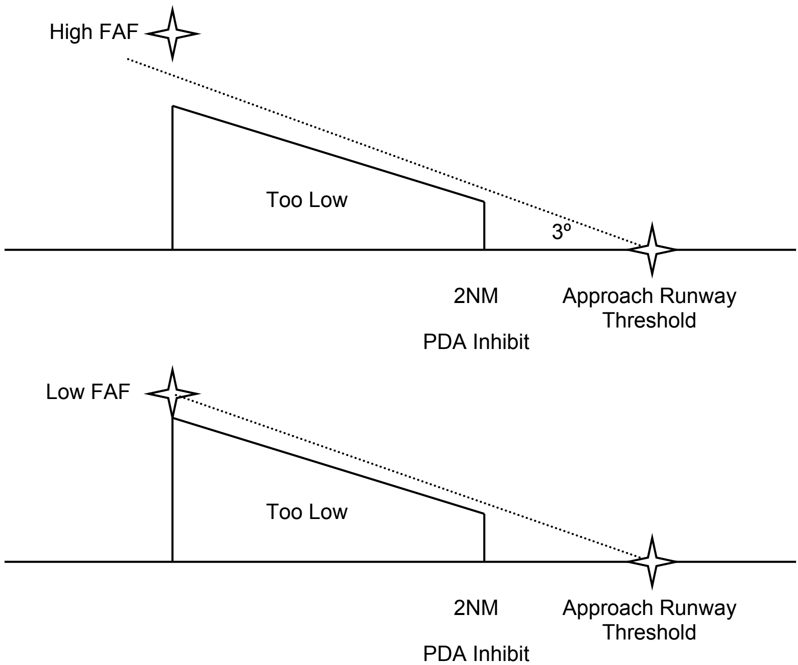
The PDA function is armed when on the final approach segment of an IFR approach procedure and below the FAF crossing altitude. The alerting threshold for the PDA function will be 0.5º less than the lower of:

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

2) 3º

When the aircraft descends below the threshold, a PDA warning is generated.

The PDA alert threshold is depicted below:



8.6. Excessive Rate of Descent (GPWS Mode 1)

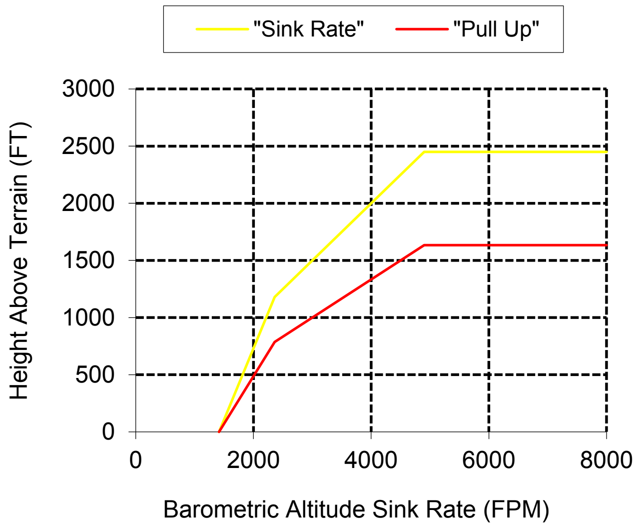
The **GPWS Mode 1** function will use aircraft vertical speed information and AGL altitude to alert the pilot when the rate of descent is hazardously high as compared to height above terrain.

GPWS Mode 1 has a caution and a warning threshold. When below the thresholds, a GPWS Mode 1 warning is generated.

The curve is shown below:

System	Sink Rate Range	"Sink Rate" AGL	"Pull Up" AGL
TAWS	Below 2360	1.25 * (sink rate - 1416)	.66 * "Sink Rate" AGL
	2360 to 4900	MIN (2450, .5 * sink rate)	

Fixed Wing Mode 1



8.7. Excessive Closure Rate to Terrain (GPWS Mode 2)

This function is present in Class A TAWS system. The GPWS Mode 2 function will use filtered AGL rate and AGL altitude to alert the pilot when the rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain). AGL rate filtering is based upon a 10 second sampling time.

There are two Mode 2 envelopes: Mode 2A which is active when not in landing configuration; and Mode 2B which is active when in landing configuration. Envelope selection will be determined as follows:

Table 8-3: Mode 2 Envelopes

Aircraft Type	**Mode 2A**	**Mode 2B**
Airplane RG + F	Flaps NOT in landing configuration.	Flaps in landing configuration.
Airplane RG	Landing Gear UP	Landing Gear DOWN

Table 8-3: Mode 2 Envelopes		
Aircraft Type	**Mode 2A**	**Mode 2B**
Airplane FG + F	Flaps NOT in landing configuration	Flaps in landing configuration
Airplane FG	AGL Altitude > 500’ OR IAS > V_{FE}	AGL Altitude <= 500’ AND IAS <= V_{FE}

Notes: RG + F = Retractable Gear with Defined Landing Flaps Position

RG = Retractable Gear

FG + F = Fixed Gear with Defined Landing Flaps Position

FG = Fixed Gear

When the GPWS Mode 2 envelope is pierced, a GPWS Mode 2 warning is generated. Envelopes

Table 8-4: Mode 2A (NOT in Landing Configuration)			
System	**AGL Rate Range**	**“Caution, Terrain” AGL**	**“Pull Up” AGL**
TAWS	Below 3900	.8 * (AGL rate - 2000)	.66 * “Caution, Terrain” AGL
	Above 3900	1520 + .15 * (MIN (Note 1, AGL rate) - 3900)	

Note 1: 6000 FPM below 220KIAS

6000 + 50 * (IAS - 220) from 220KIAS to 300KIAS

10000 FPM above 300KIAS

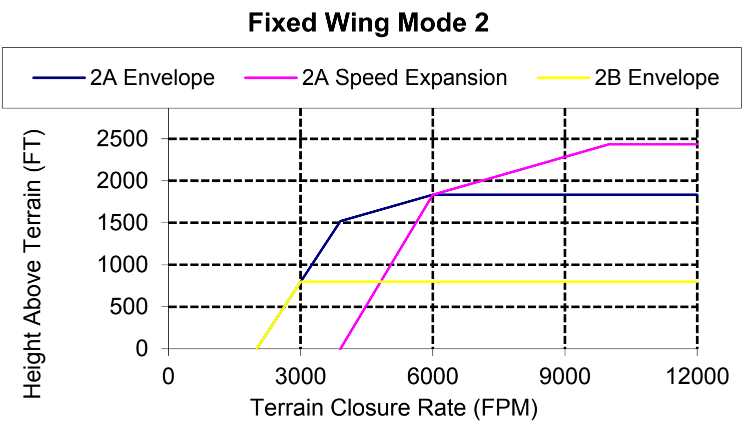
Note 2: 3120 FPM below 90 KIAS

3120 + 72 * (IAS - 90) from 90KIAS to 130KIAS

6000 FPM above 130 KIAS

Table 8-5: Mode 2B (Landing Configuration)		
System	**“Caution, Terrain” AGL**	**“Pull Up” AGL**
TAWS	MIN (800, .8 * (AGL rate - 2000))	.66 * “Caution, Terrain” AGL

Envelope Depictions Mode 2 envelopes are shown below:

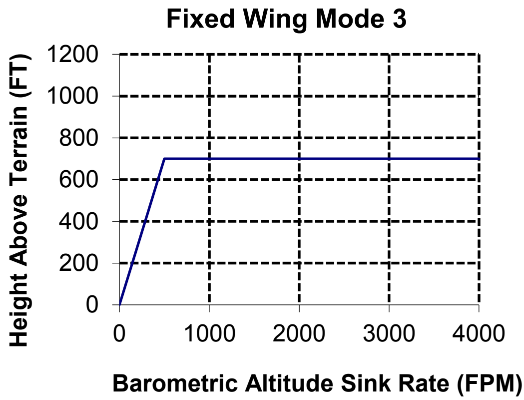


8.8. Sink Rate after Takeoff or Missed Approach (GPWS Mode 3)

The GPWS Mode 3 function uses aircraft vertical speed information and AGL altitude to alert the pilot when a 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 will be 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 = 1.4 * sink rate



8.9. Flight into Terrain when not in Landing Configuration (GPWS Mode 4)

This function is present in Class A TAWS systems. The GPWS Mode 4 function uses aircraft speed information and AGL altitude to alert the pilot when descending into terrain without properly configuring the aircraft for landing. There are two Mode 4 envelopes: Mode 4A which gives cautions when landing gear is in other than landing configuration; and Mode 4B which gives cautions when landing gear or flaps are in other than landing configuration. Applicability of Mode 4 envelopes to aircraft types are as follows:

Table 8-6: Mode 4 envelopes

Aircraft Type	Mode 4A	Mode 4B
Airplane RG + F	Landing Gear UP	Landing Gear UP OR Flaps not in landing configuration.
Airplane RG	Landing Gear UP	Landing Gear UP
Airplane FG + F	Not Applicable	Flaps not in landing configuration
Airplane FG	Not Applicable	Not Applicable

Notes: RG + F = Retractable Gear with Defined Landing Flaps Position

RG = Retractable Gear

FG + F = Fixed Gear with Defined Landing Flaps Position

FG = Fixed Gear

Mode 4 alerting criteria requires that the Mode 4 envelope be entered from above so that changing aircraft configuration while within a Mode 4 envelope will not generate an alert.

Airplane Mode 4 envelopes consists of a low-speed region and a high-speed region. When Mode 4A alerting criteria are met in the low-speed region, an amber “**TOO LOW**” caution flag is presented in conjunction with a single “**Too Low Gear**” voice alert. When Mode 4B alerting criteria are met in the low-speed region, an amber “**TOO LOW**” caution flag is presented in conjunction with either a single “**Too Low Gear**” voice alert (if landing gear is UP) or a single “Too Low Flaps” voice alert (if landing gear is DOWN). When either Mode 4 alerting criteria are met in the high-speed region, an amber “**TOO LOW**” caution flag is presented in conjunction with a single “**Too Low Terrain**” voice alert.

Table 8-7: Mode 4 parameters

System	Segment	Speed Range	Envelope AGL
TAWS	4A Low-Speed	Below 182.5 KIAS	500’
	4A High-Speed	At or Above 182.5	MIN (800’, 8 * (IAS - 120))
	4B Low-Speed	Below 138.75 KIAS	150’
	4B High-Speed	At or Above 138.75	MIN (800’, 8 * (IAS - 120))

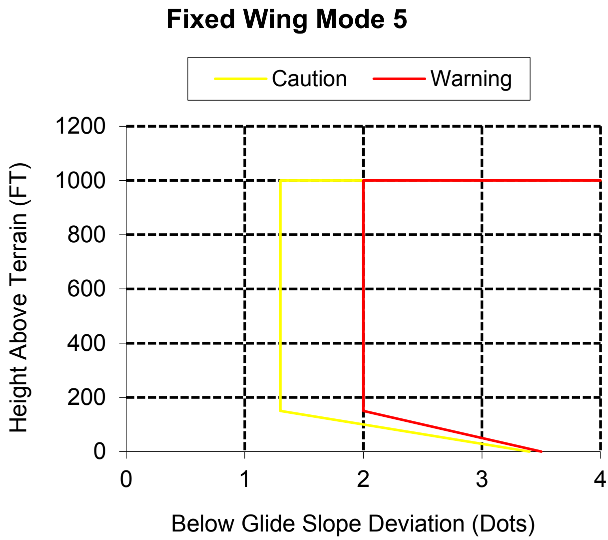
8.10. Excessive Downward Deviation from an ILS Glideslope (GPWS Mode 5)

The GPWS Mode 5 function will use ILS glideslope deviation information and AGL altitude to alert the pilot when an excessive downward glideslope deviation is detected on the final approach segment of an ILS approach. GPWS Mode 5 will be 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 shown below:

(Reference: RTCA/DO-161A Mode 5 for TAWS systems)

Caution Threshold	Warning Threshold
MAX (1.3, 1.3 + .014 * (150 - AGL)) Dots	MAX (2, 2 + .01 * (150 - AGL)) Dots



8.11. 500-Foot Wake-Up Call

This function is present in all TAWS classes. The **500-foot** function will include an arming deadband of **500 feet** to prevent nuisance warnings during low altitude operations. Thus, the aircraft must climb above **1000 feet** AGL to arm the **500-foot** function and generate a **500-foot** annunciation.

8.12. External Sensors and Switches

The EFIS TAWS system requires a variety of inputs from external sensors and switches to perform its functions. These inputs are as follows:

1) **GPS/SBAS receiver**. The GPS/SBAS receiver is the 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 the TAWS. The GPS/SBAS receiver connects directly to the EFIS IDU.

2) **Air Data Computer (ADC).** The air data computer is the source of barometric altitude, outside air temperature, and vertical speed for the TAWS and connects directly to the EFIS IDU.

3) **ILS Receiver**. A glideslope receiver is the source of glideslope deviation for the TAWS.

4) **Radar Altimeter (RA)**. A radar altimeter is the 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 the TAWS.

6) **Flap Position Sensor**. A flap position discrete, as configured in the system limits is the source of flap position for the TAWS.

7) **TAWS Inhibit Switch**. A TAWS Inhibit Switch, as configured in the system limits, is used for manual inhibiting of TAWS alerting functions. The TAWS Inhibit Switch is of the latching type and gives an obvious indication of actuation (i.e., toggle / rocker or pushbutton with indicator light).

8) **Audio Mute Switch**. An Audio Mute Switch is used for silencing active voice alerts. The 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 voice alerts is desired.

9) **Glideslope Deactivate Switch**. A Glideslope Deactivate Switch, as configured in the system limits, is used for inhibiting the GPWS Mode 5 function. The 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 system is as follows:

Table 8-9: External Sensors and Switches for the Applicable TAWS System

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

Table 8-9: External Sensors and Switches for the Applicable TAWS System

GPS/SBAS	X	X	X	X	X	X
ADC	X	X	X	X	X	X
Gear Position Sensor	X	X				
TAWS Inhibit Switch	X	X	X	X	X	X
Audio Cancel Switch	X	X	X	X	X	X
Low Altitude Mode Switch						

Table 8-10: External Sensors and Switches for the Applicable TAWS System (Cont)

Aircraft Type	TAWS/ Class	ILS	Radar Alti-meter	Flap Position Sensor	Glideslope Deactivate Switch
Airplane RG + F	A	X	X	X	X
Airplane RG	A	X	X		X
Airplane FG + F	A	X	X	X	X
Airplane FG	A	X	X		X
Airplane	B or C				

Notes: RG + F = Retractable Gear with Defined Landing Flaps Position

RG = Retractable Gear

FG + F = Fixed Gear with Defined Landing Flaps Position

FG = Fixed Gear

8.13. TAWS System Basic Parameter Determination

The fundamental parameters used for TAWS system functions are:

Table 8-11: Airplane TAWS Basic Parameters Determination

Parameter	Source	Notes
Aircraft Position, groundspeed and track	GPS/SBAS	The HFOM must be less than or equal to the greater of 0.3 NM or the Horizontal alert limit (HAL) for the mode of flight
MSL Altitude	GPS/SBAS	Geodetic Height converted to MSL with the current EGM (Earth Gravity Model) database. In order for this to be considered valid for use as MSL altitude, the VFOM must be less than or equal to 106 feet. The secondary source of MSL altitude will be barometric altitude from an air data computer. Barometric altitude is determined based upon a barometric setting in the following order of preference: a) If either the pilot or co-pilot system is operating in QNH mode, then the QNH barometric setting is used (note: on-side barometric setting preferred); or b) If GPS/SBAS geodetic height has been valid within the last 30 minutes, a barometric setting derived from the

Table 8-11: Airplane TAWS Basic Parameters Determination

Parameter	Source	Notes
		GPS/SBAS geodetic height is used. If neither of the above conditions are met, MSL altitude will marked as invalid. When a reporting station elevation can be determined and outside air temperature is valid, a temperature correction will be applied. The TAWS system uses the lower of the barometric altitude or the temperature-corrected altitude. In the case of QNH-mode barometric setting, reporting station elevation is derived from waypoint or active runway elevations in the active flight plan using the following logic: • If the aircraft is in **TERMINAL, DEPARTURE**, **IFR APPROACH** or **VFR APPROACH** mode and an active runway exists, reporting station elevation will be the elevation of the active runway threshold. • Otherwise, if the aircraft is in **TERMINAL** mode, reporting station elevation will be the elevation of the

Table 8-11: Airplane TAWS Basic Parameters Determination		
Parameter	**Source**	**Notes**
		airport causing **TERMINAL** mode. • In **ENROUTE** mode, no reporting station elevation can be determined. In the case of GPS/SBAS geodetic height-based barometric setting, reporting station elevation will be the GPS MSL altitude reported at the time that the barometric setting was determined. Note the following definitions: • **QFE**: Barometric setting that results in the altimeter displaying height above a reference elevation (i.e., airport or runway threshold). • **QNE**: Standard barometric setting (29.92 in. Hg. or 1013 MBar) used to display pressure altitude for flight above the transition altitude. • **QNH**: Barometric setting that results in the altimeter displaying altitude above mean sea level at the reporting station.
Terrain Data	Terrain Database	In order for terrain data to be considered valid for use by the

Table 8-11: Airplane TAWS Basic Parameters Determination

Parameter	Source	Notes
		TAWS, the following conditions must be met: a) Aircraft position is valid; b) Aircraft position is within the boundaries of the terrain database; and c) The terrain database is not corrupt as determined by CRC-32 checks at system initialization and during runtime.
Obstacle Data	Obstacle Database	In order for obstacle data to be considered valid for use by the TAWS, the following conditions must be met: a) Aircraft position is valid; b) Aircraft position is within the boundaries of the obstacle database; and c) The obstacle database is not corrupt as determined by CRC-32 checks at system initialization.
AGL Altitude	Radar Altitude	The secondary source for AGL Altitude will be MSL altitude less terrain altitude.
Vertical Speed	Instantaneous vertical speed	IVSI values come from barometric vertical speed from an ADC “quickened” with vertical acceleration from an AHRS. The secondary source for vertical speed will be

Table 8-11: Airplane TAWS Basic Parameters Determination

Parameter	Source	Notes
		barometric vertical speed from an ADC. The tertiary source for vertical speed will be GPS/SBAS vertical speed providing the VFOM is less than or equal to 106 feet.
Terrain Closure Rate	The smoothed first derivative of AGL Altitude	Due to the multiple sources for altitude, there are multiple sources for terrain closure rate.
Runway / Reference point location	EFIS navigation database	In order to be considered valid for use, the following conditions must apply: a) Aircraft position is valid; b) Aircraft position is within the boundaries of the navigation database; and c) The navigation database is not corrupt as determined by a CRC-32 check at system initialization.

8.14. TAWS Automatic Inhibit Functions (Normal Operation)

The following automatic inhibit functions occur during normal TAWS operation to prevent nuisance warnings:

1) **The FLTA function** will be automatically inhibited when in the **Terminal**, **Departure**, **IFR Approach** or **VFR Approach** Modes and within **2NM** and **1900’** of the reference point.

2) **The PDA function** will be automatically inhibited when within **2NM** and **1900’** of the approach runway threshold.

3) **GPWS Modes 1 through 4** will be automatically inhibited when below **50 feet AGL** (radar altimeter AGL altitude) or below **100 feet AGL** (terrain database AGL altitude).

4) **GPWS Mode 5** will be inhibited below **200' AGL**. This form of automatic inhibit will remain active until the aircraft climbs above **1000' AGL**. The purpose of this form of inhibiting is to prevent nuisance alarms on missed approach when glideslope sidelobes are detected by the glideslope receiver.

8.14.1. TAWS Automatic Inhibit Functions (Abnormal Operation)

The following automatic inhibit functions occur during the specified abnormal operations:

System Sensor/Database Failures. System sensor failures, non-installation of optional sensors, database failures and combinations thereof will affect the TAWS system as follows:

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terr. Displ	FLTA	PDA	GPWS Mode					500' Wake-Up
					1	2	3	4	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						

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terr. Displ	FLTA	PDA	GPWS Mode					500' Wake-Up
					1	2	3	4	5	
GPS/SBAS (H) + Radalt	AC Position, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC	MSL Altitude, VSI	Inhibit	Inhibit	Inhibit	Inhibit		Inhibit			
TD + Radalt	Terrain Elev. AGL Altitude	Inhibit	Inhibit		Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
MSL + Radalt	MSL Altitude, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC + Radalt	MSL Altitude, VSI, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Notes:

1) The combinations listed give the minimum combinations with the worst consequences. Many other combinations are

possible, but their effects are subsumed within the combinations listed.

2) GPS/SBAS (H) = HFOM > max(0.3NM, HAL). 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 "**NO AIR DATA**" flag.

7) Radalt = Radar Altimeter. Indication is lack of radar altimeter source indication on radar altimeter display.

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.

8.14.2. TAWS Manual Inhibit Functions

The following manual inhibit functions can be selected by the pilot:

1) **The Terrain Display** function can be inhibited using an EFIS soft menu declutter control.

2) **All TAWS** alerting functions (including popup functionality) will be manually inhibited by actuation of the external TAWS Inhibit Switch. The Terrain Display function, including display of FLTA alarm (red) and caution (yellow) cells on the ND, will not be affected by the TAWS Inhibit Switch.

3) **GPWS Mode 5** will be manually inhibited by actuation of the momentary Glideslope Cancel Switch when below **1000' AGL**. GPWS Mode 5 manual inhibit will automatically reset by ascending above **1000'AGL**.

Section 9 Appendix

Table of Contents

List of Figures & Tables

9.1. Appendix

The appendix of this Pilot Guide contains a variety of useful information not found elsewhere in the document. This section includes operating tips, system specifications, feedback forms and failure modes.

9.2. Operating Tips

With Genesys Aerosystems EFIS being 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 becoming available with future releases of this publication.

9.2.1. 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 will assure the VNAV descent angle is maintained.

9.2.2. 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) the climb is sufficient for the present time and no further action is necessary until level off.

9.2.3. Departure airport information

On startup, all the information for the departure airport is readily available. The altimeter will automatically be set to the nearest IFR runway touchdown zone elevation. The NRST button when pushed will reveal the Nearest Airports when highlighted where all important data such as frequencies are displayed.

9.2.4. Unique names for Flight Plans

Multiple routes between the same airport pairs are numbered automatically (KCEW-KDHN) [0], (KCEW-KDHN) [1], etc.). Some ingenuity will allow pilots to work around this and apply easily remembered differentiation. If a route is routinely flown from one airport to another but different routing becomes necessary due to MOA areas being hot or weather, etc., two or more different flight plans can be created for the same destination.

Create two different user waypoints at the departure airport named KCEWN and KCEWS as an example for departing Sikes on a northern routing (KCEWN) or a southern routing (KCEWS) then followed by the different routing to clear the MOA or whatever creates the necessity for specific routing.

9.2.5. Altimeter Settings

Use caution when setting the altimeter and inadvertently changing the transition level. If this is reset to a lower than normal altitude, a CHECK BARO Advisory may appear due to the altimeter setting not on 29.92” Hg or 1013 Mb.

9.2.6. 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.

9.3. Altitude Miscompare Threshold

The altitude miscompare threshold is based upon the 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	50’
1,000’	50’
2,000’	50’

Table 9-1: Allowable Instrument Error	
Altitude	**Allowed Error**
3,000’	50’
4,000’	50’
5,000’	50’
8,000’	60’
11,000’	70’
14,000’	80’
17,000’	90’
20,000’	100’
30,000’	150’
40,000’	200’
50,000’	250’

Allowable installed system error will be 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	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 § 27.1325	At sea level, the greater of 30’ or 30% of the Calibrated Airspeed in knots. This increases proportionally to SAE AS8002A Table 1 at higher altitudes.
14 CFR § 29.1325	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.

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'

9.4. Airspeed Miscompare Threshold

The airspeed miscompare threshold is based upon the allowable airspeed error. There are two components to allowable airspeed error, instrument error and installed system error. Allowable instrument error is based upon the values of SAE AS8002A Table 3 as follows:

Table 9-3: Airspeed Error

Calibrated Airspeed	Allowed Error
50 knots	5 knots
80 knots	3 knots
100 knots	2 knots
120 knots	2 knots
150 knots	2 knots
200 knots	2 knots
250 knots	2.4 knots
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 V_{S1}): The greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.3 x V_{S1}).
14 CFR § 25.1323	Starting from (1.23 x V_{SR1}): The greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.23 x V_{SR1}). Note: System uses V_{S1} as a substitute for V_{SR1}.
14 CFR § 27.1323	Starting from (0.8 x V_{CLIMB}): The greater of 5 knots or 3%. Do not perform a comparison if either value is below (0.8 x V_{CLIMB}).
14 CFR § 29.1323	For Climbing Flight (VSI > 250 feet per minute): Starting from (V_{TOS} – 10): 10 knots Do not perform a comparison if either value is below (V_{TOS} – 10) For Other Flight Regimes: Starting from (0.8 x V_{TOS}) The greater of 5 knots or 3%. Do not perform a comparison if either value is below (0.8 x V_{TOS}). Note: System uses V_{CLIMB} as a substitute for V_{TOS}.

An allowable airspeed error is computed for each compared value and added together to create the airspeed miscompare threshold and accommodates for the values deviating in different directions.

9.5. 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 and more features. Many of the systems available today make it all too easy to forget that paper en route, 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.

9.6. Data Logging and Retrieval

The Genesys Aerosystems EFIS logs all data associated with a flight, including all flight instrument and navigation data. This data can be downloadfed for review after flight.

Data from the last 5 flights or 20 hours are logged at a one-second interval.

Selecting the “Download LOG Files” option on the IDU will create a “\log” directory on the USB Memory Key and copy the data logging files into the“\log” directory of the USB Memory Key. The data logging files contain recordings of flight and engine parameters of up to 5 hours each from the previous 5 operations of the system. During system operation, flight and engine parameters are recorded every 1 second. Each time the parameters are recorded, a Zulu time stamp followed by 3 lines of comma delimited ASCII text data are written where the first line contains flight parameters, the second line contains engine parameters.

9.7. Log Files

9.7.1. Delete LOG Files

1) Selecting “Delete LOG Files” option will cause the IDU to delete all of the 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 will not effect operations of the EFIS as the EFIS will automatically generate a new “LOG00.DAT” and “MSGLOG.DAT” file once a flight has started.

3) Pressing any button on the IDU or the right-hand encoder will return to the Ground Maintenance menu.

9.8. Routes and Waypoints

9.8.1. Download Routes and User Waypoints

1) Selecting “Download Routes and User Waypoints” option will download all routes and user waypoints stored in the IDU to the USB Memory Key card. This option is useful for fleet operations where multiple aircraft fly the same routes.

2) Routes are stored on the USB Memory Key card 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 Memory Key card as USER.DAT.

9.8.2. Upload Routes and User Waypoints

Selecting “Upload Routes and User Waypoints” option will copy all routes and user waypoints stored on a USB Memory Key card to the IDU. This option used in conjunction with the “Download Routes and User Waypoints” option enables the operator to store the same routes and user waypoints in multiple aircraft.

9.8.3. Delete Routes

Selecting the “Delete Routes” option will remove all routes and the user waypoint file USER.DAT from the IDU. This option is used to delete the contents of the route directory when corrupted routes cause the IDU to continually reboot.

These log files (*.dat) can be opened and manipulated (charting, graphing, etc.) in Microsoft Excel or other spreadsheet applications that support comma-delimited data format or using the applicable analysis software.

9.9. Service Difficulty Report

Service Difficulty Report

Photocopy, 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?).	

9.10. Certification basis

Applicable TSO's

The following TSO's 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

Document Number	Document Title	
TSO-C106	Air Data Computer	
TSO-C151b	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 equipement using the Global Positioning System (GPS) Augmented by the Wide Area Agumentation System (WAAS)	
N/A	Airplane Aerodynamics and Performance, Lan and Roskam, 1981.	

9.11. Environmental Requirements

The IDU-680 meets the requirements of RTCA/DO-160F as defined below:

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.	

Sec.	Condition	Cat.	Test Category Description	Notes
7.0	Operational Shocks & Crash Safety	B	Equipment generally installed in fixed-wing aircraft or helicopters and tested for standard operational shock and crash safety.	Aircraft Type 5, Test Type R for Crash Safety Sustained Test
8.0	Vibration	H + R + U	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

Sec.	Condition	Cat.	Test Category Description	Notes
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.	
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.	

Sec.	Condition	Cat.	Test Category Description	Notes
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, such as passenger cabin or cockpit	

Sec.	Condition	Cat.	Test Category Description	Notes
22.0	Lightning Induced Transient Susceptibility	A3J 33	Equipment interconnected with wiring installed within any airframe or airframe section when structural resistance is also a significant source of induced transients, (i.e., carbon fiber composite structures). Level 3 designates equipment and interconnecting wiring installed in a moderately exposed environment.	Level 4 for MSU and OAT Probe pins.
23.0	Lightning Direct Effects	X	Not Applicable	
24.0	Icing	X	Not Applicable	
25.0	Electrostatic Discharge (ESD)	A	Electronic equipment that is installed, repaired or operated in an aerospace environment.	
26.0	Fire, Flammability	C	Non-metallic equipment, component parts, sub-assemblies installed in pressurized or non-pressurized zones and non-fire zones with largest dimension greater than 50 mm.	By Analysis

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