Pilot Guide

GENESYS AEROSYSTEMS

3D SYNTHETIC VISION EFIS

HIGHWAY-IN-THE-SKY NAVIGATION

GRAPHICAL FLIGHT MANAGEMENT SYSTEM

INTEGRATED AUDIO/RADIO MANAGEMENT

IDU-450 Version 8.0E Pilot Guide (Rotorcraft)

Pilot Operating Guide and Reference

Document 64-000102-080E

(Rotorcraft)

EFIS Software Version 8.0E

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Record of Revisions	Retain this record in front of manual. Upon receipt of a revision, insert changes and complete table below.	
Revision Number	**Revision Date**	**Insertion Date/Initials**

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Section 1 Introduction

Revision Record

Rev	Notes	Date	Author
A	1. Deleted Figure 2-3 Primary IDU-450 PFD (pg. 2-22). Caused renumbering of Figure 2-3: Ground Maintenance Page (pg. 2-54).	Jan, 2016	G. Schmidt
	2. Deleted text regarding logged flags and custom CAS messages and Table 2-4: Log File Values (pg. 2-54).		
	3. Deleted “to Avoid Jumpiness” on page 3-29.		
	4. Deleted descriptive text, page 3-43.		
	5. Added “as” on page 3-48.		
	6. Added “-E” to “With HeliSAS-E” in Figure 3-67 on page 3-60.		
	7. Changed descriptive text and image in Figure 3-100 (pgs. 3-83 and 3-84).		
	8. Added second paragraph to 4.2.3. PFD Screen Auto Reversion (pg. 4-10).		
	9. Deleted redundant text, “Scroll ❶ to proper setting and push to enter value,” page 6-3.		
	10. Edited text in 7.3.2. Highway in the Sky (Skyway) (pgs. 7-10 to 7-12).		
	11. Edited text in 7.3.4. Fly-Over Waypoints, pages 7-16 to 7-17.		
	12. Deleted 7.4.4. Geodesic Path Computation Accuracy, page 7-24.		
	13. Edited text 7.7. Approach Type Selection, page 7-30.		
	14. Deleted 7.8. Approach Path Definition, led to renumbering of subsequent sections.		
	15. Renamed subheading of 7.8. Approach Path Definition as VTF IFR Approach, page 7-32.		
	16. Edited text in 7.9. VTF VFR Approach, page 7-32.		
	17. Edited text in 7.10. Missed Approach and Departure Path Definition, page 7-32.		

Rev	Notes	Date	Author
	18. Edited text in 7.12 Discontinuities, page 7-34.		
	19. Edited text in 7.13 Selection of an Instrument Procedure, page 7-35.		
	20. Changed button reference for ARM (L2) in step 7 on page 7-48.		
	21. Changed ACTV (L2) to ARM (L2) in step 9 on page 7-55.		
	22. Edited text and adjusted alignment of steps 10-13 on page 7-59.		
	23. Edited text of first paragraph of note on page 7-64.		
	24. Edited text in 8.3 8.3. FLTA Search Envelope on page 8-10.		
	25. Deleted Section 8.3.2. FLTA Search Volume and Figure 8-6: FLTA Search Volume, page 8-10. Subsequent sections and figures renumbered.		
	26. Edited text in 8.4. Excessive Closure Rate to Terrain (GPWS Mode 2) on page 8-13.		
	27. Deleted 6) Flap Position Sensor on page 8-18.		
	28. Edited text for 2) System Sensor/Database Failures on page 8-25.		
	29. Deleted Notes following Table 8-12 TAWS Automatic Inhibit Functions on page 8-27.		
	30. Added button references for WX LGND (L2) and EXPND WX (L3) on page D-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 carriers' trend toward "automation centered" systems. These sophisticated systems minimize pilot involvement and automate control of the aircraft and its systems to the greatest extent possible, thereby relegating the pilot to the role of manager and emergency backup. Examples are flight directors and fly-by-wire systems where the pilot is removed from the information loop.

The Genesys Aerosystems EFIS installed in this aircraft 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), which allows for highly automated approaches, but its predictive nature provides the pilot unprecedented awareness of upcoming maneuvers. Contrary to the traditional idea of overloading the pilot with information and options, this Genesys Aerosystems EFIS clearly and concisely presents only necessary information, which 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 advanced integrated system, the pilot will fly with more precision, awareness, and confidence.

1.2. EFIS/FMS Description

The IDU (Integrated Display Unit) is manufactured from machined, anodized aluminum and has eight pushbuttons along the vertical sides with dedicated buttons with imprinted legends.

Figure 1-1: IDU-450 Input Identification (Other Rotorcraft)

Figure 1-2: IDU-450 Input Identification (AW-109SP)

There are two encoders along the bottom with the left encoder only controlling the backlighting intensity. Neither encoder has an auto-repeat feature, but the right-hand encoder controls the heading menu on the PFD or map scale on the MFD.

References in Section 5 Menu Functions and Step-By-Step Procedures refer to the right encoder as “#1 Encoder” (❶) to push and or scroll for desired outcomes. Between the two 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 initiates the Ground Maintenance Mode necessary for gaining access to the maintenance program once a USB memory 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 and display lighting brightness. Panel lighting refers to the illumination of legends, buttons, and encoders (push and scroll clockwise to increase and counter clockwise to decrease). Display lighting refers to the illumination of the LCD display (without pushing and as described with panel lighting). This lighting may be controlled locally or remotely with a default state being with the local control.

NOTE:

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

Other Rotorcraft

AW-109SP

Figure 1-3: IDU-450 Primary Flight Display (PFD)

Other Rotorcraft **AW-109SP**

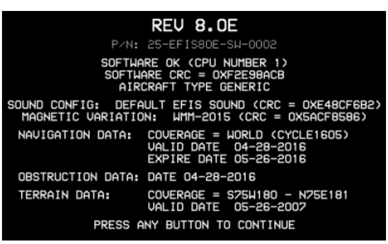
Figure 1-4**: IDU-450 Multifunction Display (MFD)**

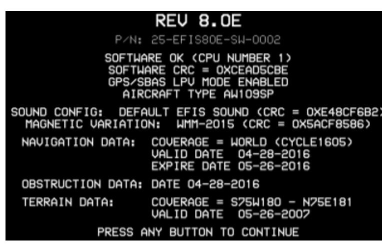
1.3. Run Demonstrator/Training Application

Using the built in Demonstration Application, the EFIS may be used to fly anywhere in the world while performing any procedure (except takeoff and landing) based on the current Jeppesen Navigation database. To use this feature:

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

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





Other Rotorcraft **AW-109SP**

Figure 1-5: Initialization Screen

With the demonstrator, the pilot gains familiarity of the EFIS menu structure and location of button tiles for each operation. Load an instrument procedure prior to take off to view the sequence of events to be expected with the aircraft flying the same speeds normally flown as read from the preset limits.

The demonstrator program automatically begins flying over Reno, Nevada, USA. The altitude begins at approximately 7900' MSL and may be changed with the menu and target altitude control. The airspeed remains relatively constant but may be controlled with the Airspeed IAS bug in the BUGS menu (N/A AW-109SP). The simulated aircraft may be positioned anywhere in the world due to the worldwide terrain database loaded in the system by activating a flight plan stored in the memory. However, the Jeppesen navigation database must be updated to match the area of the world navigation as anticipated since worldwide terrain is loaded.

All appropriate navigation signals are simulated, allowing for precision and non-precision instrument approaches found within the current navigation database. All obstructions in the latest obstruction database and all Caution, Warning, and Advisory System aural and flag annunciations are presented as appropriate during the simulated demonstration flights. During operation in this mode, each IDU operates independently of all sensors, Remote Bugs panel, and other displays.

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

1.4. EFIS Training Tool

The EFIS Training Tool (ETT) is an application entirely based on the EFIS code and is compatible with 32- or 64-bit versions of Microsoft Windows®. It serves as a multi-purpose tool for training pilots and provides features to record and capture images. This tool may be used to create routes and user waypoints for saving and uploading into the aircraft mounted IDUs. The ETT has a bezel with simulated buttons and encoders responsive to mouse and keyboard messages. Bezel graphics are derived from actual bezel design data, and the ETT presents an active display with 1:1 pixel correspondence to an actual IDU display. The audio output capability for the ETT matches the audio functionality in the actual IDU. This Training Tool simulates the functionalities of the IDU-450, which begins flight in Reno, Nevada at approximately 7900' MSL. See user guide distributed with the ETT install files as described in Section 9 Appendix for further details.

Flight plans may be created (on the MFD only), stored, and activated in the same manner as on the EFIS displays installed in the aircraft. This allows for moving the start point to anywhere in the world where loaded NavData is present for practicing published procedures. All applicable nav signals are simulated with localizer signals found on VLOC1 and VOR signals found on VLOC2. Once the start position has been moved from Reno, Nevada, the aircraft begins flying at approximately 7900' MSL intercepting the first leg at a 45° angle.

1.5. About This Guide

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

TABLE OF CONTENTS

Use this section to locate areas by topic…

INTRODUCTION (Section 1)

This section describes some differences between a generic rotorcraft and the AW-109SP rotorcraft.

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 appears, and on which position of each display under identified conditions.

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

DISPLAY SYMBOLOGY (Section 3)

This section provides identification of each screen element of the PFD and MFD (generic and AW-109SP rotorcraft). For each separate screen, every element of the symbology is identified on a sample screen. Immediately following the sample screens, all elements for that screen are listed.

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

REVERSIONARY MODES (Section 4)

This section provides views of the IDU-450 displays with various sensor failed conditions and resulting symbology. Examples of various configurations and display formats used with specific tables showing affected functions affected.

Use this section to understand what to expect when a particular sensor fails and what changes on the display immediately or after a specified amount of time…

MENU FUNCTIONS AND STEP-BY-STEP PROCEDURES (Section 5)

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

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

QUICK START TUTORIAL (Section 6)

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

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

IFR PROCEDURES (Section 7)

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

Use this section to gain familiarity with selection of departure, standard terminal arrival, and published instrument approach procedures. This section describes how ATC clearances may often change and how the active flight plan quickly reflects these changes. Additionally, this section defines 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-C194 Enhanced HTAWS and HTAWS functionality for this rotorcraft with all configurations.

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

APPENDIX (Section 9)

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

Use this section for understanding naming conventions used by the navigation database provider and flight data recorded information format; downloading routes and user waypoints; and sourcing a copy of the Service Difficulty Report form…

INDEX

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

Use to lookup key words and locate where it is used in the text.

GLOSSARY

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

Use to look up definitions for key words and terms.

1.5.1. Audio and Video Interactive Capabilities

Throughout this guide, references to audio annunciations and video demonstrations are indicated with the following icons. When viewing this guide on a computer or mobile device, click on the icons to hear the respective audio clip or watch a demonstration video via

Genesys Aerosystems' YouTube™ channel. Check the YouTube channel for additional videos as they become available.

Audio **Video**

Figure 1-6: Audio and Video Icons

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

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

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

Section 2 System Overview

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List of Figures and Tables

2.1. Abbreviations and Acronyms

µm Hg	Micrometer of Mercury
0R	No Radius
3-D	Three-Dimensional
AC	Advisory Circular
ACTV	Active
AD	Airworthiness Directive
A-D	Analog to Digital (converter)
ADAHRS	Air Data Attitude Heading Reference System
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADS-B	Automatic Dependent Surveillance-Broadcast
AFCS	Automatic Flight Control System
AFM	Aircraft Flight Manual
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AIRAC	Aeronautical Information Regulation and Control
AIRMET	Airmen's Meteorological Information
ALT	Pressure Altitude
ALT SEL	Altitude Selection
ALTA	Equal to "Selected Altitude Submode" (AW-109SP)
AMLCD	Active Matrix Liquid Crystal Display
ANP	Actual Navigation Performance
ANSI	American National Standards Institute
ANT	Antenna
APP	Waypoint is part of an Instrument Approach Procedure
APPR	Approach
APT	Airport
APV	Approach with Vertical Guidance
AR	Audio Radio
ARINC	Aeronautical Radio, Inc.
ARP	SAE Aerospace Recommended Practice

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

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

EFIS	Electronic Flight Instrument System
EGM	Earth Gravity Model
EGNOS	European Geostationary Navigation Overlay Service
EGPWS	Enhanced Ground Proximity Warning System
EIA	Electronics Industry Association
ESSNTL	Essential
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
ETT	EFIS Training Tool
EXCD	Exceedance
EXPND	Expand (also EXP)
F	Fahrenheit
FA	Course from a Fix to Altitude (ARINC-424 Leg)
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FAWP	Final Approach Waypoint (same as FAF)
FC	Course Fix to along Track Distance (ARINC-424 Leg)
FD	Course from a Fix to DME Distance (ARINC-424 Leg); Flight Director
FDE	Fault Detection and Exclusion
FG	Fixed Gear
FG + F	Fixed Gear with Defined Landing Flaps Position
FHA	Functional Hazard Analysis
FIFO	"First in, First out"
FIS	Flight Information Service
FIS-B	Flight Information Service-Broadcast
FL	Flight Level
FLTA	Forward Looking Terrain Awareness
FM	Course from Fix to Manual termination (ARINC-424 Leg)
FMEA	Fault Mode and Effects Analysis
FMS	Flight Management System

FOV	Field of View
FPE	Floating Point Emulation
FPL	Flight Plan
FPM	Feet per Minute; Flight Path Marker
FSD	Full Scale Deflection
FT	Feet
FTE	Flight Technical Error
FTP	Fictitious Threshold Point
FNCT	Function
GAGAN	India's GPS and GEO-Augmented Navigation System
GARP	GNSS Azimuth Reference Point
GBAS	Australia's Ground Based Augmentation System
GLONASS	Russian Global Navigation Satellite System
GLS	GNSS Landing System
GMETAR	Graphical METAR (also GMTR)
GMF	Ground Maintenance Function
GN	Gain
GND	Ground (potential)
GNSS	Global Navigation Satellite System
GPH	Gallons Per Hour
GPI	Glidepath Intercept
GPIP	Glide Path Intercept Point
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GRD	Grid; Ground
GS	Glideslope
H	Hold
HA	Terminates at an altitude (ARINC-424 Leg)
HF	Holding, Pattern to Fix (ARINC-424 Leg)
HM	Altitude or Manual Termination (ARINC-424 Leg)
HAL	Horizontal Alert Limit
HAT	Height Above Threshold
HDG	Heading

HFOM	Horizontal Figure of Merit
hh:mm:ss	Hours: Minutes: Seconds
HITS	Highway in the Sky
HORIZ	Horizontal
hPa	Hectopascal
HPL	Horizontal Protection Level
HSI	Horizontal Situation Indicator
HTAWS	Helicopter Terrain Awareness and Warning System
HUD	Head Up Display
HUL	Horizontal Uncertainty Limit
IAP	Instrument Approach Procedure; Initial Approach Point
IAS	Indicated Airspeed
IAWP	Initial Approach Waypoint (same as IAP)
IC	Integrated Circuit
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ID	Identity or Identification
IDENT	Identification (Transponder Ident)
IDS	Integrated Display System (AW-109SP)
IDU	Integrated Display Unit
IF	Initial Fix leg
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
INFO	Information
INHBT	Inhibit
inHg	Inches of Mercury
INIT	Initialize
IO	Input/Output
IP	Initial Point
IPV	Instrument Procedure with Vertical Guidance
ISA	International Standard Atmosphere
ISR	Interrupt Service Routine

IVSI	Instantaneous Vertical Speed Indicator
IWP	Intermediate Approach Waypoint
JAD	Jeppesen Aviation Database
JTAG	Joint Test Action Group (IEEE 1149.1 Standard)
K	Kilo=1000
KB	Kilobyte
kHz	Kilohertz
KIAS	Knots Indicated Airspeed
KT	Knot - Nautical Mile per Hour
KTAS	Knots True Airspeed
LAT	Latitude
LCD	Liquid Crystal Display
LCL	Local
LDA	Localizer-type Directional Aid
LED	Light Emitting Diode
LGND	Legend
LIFR	Low IFR conditions (Ceiling < 100’ or visibility < 1 mile)
LNAV	Lateral Navigation
LOC	Localizer
LOI	Loss of Integrity
LON	Loss of Navigation; Longitude
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
LRU	Line Replaceable Unit
LSB	Least Significant Bit or Byte
LTP	Landing Threshold Point
LVL	Level
MA	Waypoint is part of the missed approach segment of an Instrument Approach Procedure
MAGVAR	Magnetic Declination (Variation)
MAHP	Missed Approach Holding Point
MAHWP	Missed Approach Holding Waypoint (same as MAHP)
MAN	Manual

MAP	Missed Approach Point; Missed Approach Procedure
MASPS	Minimum Aviation System Performance Standard
MAWP	Missed Approach Waypoint
MAWPT	Missed Approach Waypoint
MB	Megabyte
mbar	Millibars
MDA	Minimum Descent Altitude
MEMS	Micro Electro Mechanical System
MESO	Mesocyclonic
METAR	Routine hourly weather report
MFD	Multifunction Display (IDU with software for showing multiple display screens)
MIN	Minimum
MM	Middle Marker
MOA	Military Operations Area
MOPS	Minimum Operational Performance Standard
MOT	Mark On Target
MSAS	Japan's MTSAT-based Satellite Augmentation System
MSB	Most Significant Bit or Byte
MSL	Mean Sea Level
MSU	Magnetic Sensor Unit
MTBF	Mean Time Between Failures
MVFR	Marginal Visual Flight Rules
NACO	National Aeronautical Charting Office
NAS	U.S. National Airspace System
NASA	National Aeronautics and Space Administration
NAV	Navigation
NAVAID	Device or system providing navigational assistance
ND	Navigation Display
NDB	Nondirectional Beacon
NED	National Elevation Dataset

NEXRAD	(Next-Generation Radar) network of weather radars operated by the National Weather Service (NWS) (also NXRD)
NI	Navigational Information
NIMA	National Imagery and Mapping Agency
NM	Nautical Mile
NPA	Non-Precision Approach
NRST	Nearest
nT	Nanoteslas (ref. World magnetic Model)
NTSC	National Television System Committee standard analog video system (30 frames per second) used in North America and most of South America
NWS	National Weather Service
NXT	Next
OASIS	Open Architecture Systems Integration Symbology
OAT	Outside Air Temperature
OBS	Omnibearing Selector
ODP	Obstacle Departure Procedure
OF	Over-fly
OM	Outer Marker
OT	Other Traffic (Traffic Function)
PA	Proximate Advisory (Traffic Function)
PAL	Predominant analog video system (25 frames per second) used outside North America and South America.
PDA	Premature Descent Alert
PDR	Preliminary Design Review
PFD	Primary Flight Display (display screen showing primary instrumentation -- also refers to the primary IDU with software that only shows primary instrumentation)
PFDE	Predictive Fault Detection and Exclusion
PFI	Primary Flight Information
PI	Procedure Turn (ARINC-424 Leg)
PIC	Peripheral Interface Controller
PLI	Pitch Limit Indicator

PLT	Pilot
PM	Personality Module
PN	Part Number; Pan
PRAIM	Predictive Receiver Autonomous Integrity Monitoring
PROC	Procedure
PRV	Previous
PSAC	Plan for Software Aspects of Certification
PSCP	Project Specific Certification Plan
PSP	Partnership for Safety Plan
PTK	Parallel offset (Parallel Track)
PTN	Problem Tracking Number
PTRS	Pointers
QA	Quality Assurance
QFE	Altimeter setting provides height above reference point
QM	Quality Management
QNE	Altimeter setting provides pressure altitude readout
QNH	Altimeter setting provides MSL altitude at a reporting point
RA	Resolution Advisory (Traffic Function)
RADALT	Radar Altimeter (also RALT)
RAD-DST	Radial and Distance
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RBP	Remote Bug Panel
RCP	Radar Control Panel
RDR	Radar
REC	ADF receiver in BFO or test mode
RF	Precision Arc to Fix (ARINC-424 Leg)
RFMS	Rotorcraft Flight Manual Supplement
RFP	Radio Frequency Panel
RG	Retractable Gear
RG + F	Retractable Gear with Defined Landing Flaps Position
RHT	Radar Height

RMI	Radio Magnetic Indicator
RNAV	Area Navigation
RNP	Required Navigation Performance
RS	EIA Recommended Standard
RTC	Real Time Computing
RTCA	Radio Telephone Commission for Aeronautics
RTD	Resistive Thermal Detector
RTL	Run Time Library
RTN	Return
RW	Runway
Rx	Receive
SA	Selective Availability
SAE	Society of Automotive Engineers
SAS	Software Accomplishment Summary
SAT	Saturation
SBAS	Satellite Based Augmentation System
SCC	System Configuration Card (personality module)
SCI	Software Configuration Index
SCMP	Software Configuration Management Plan
SCR	Software Conformity Review
SCS	Software Coding Standards
SDCM	System of Differential Correction and Monitoring
SDD	Software Design Document
SDP	Software Development Plan
SDS	Software Design Standards
SECAM	Analog color television system used in France
SECI	Software Environment Configuration Index
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Advisory
SLCT	Select
SMA	Sub-Miniature version A connector
SN	Serial Number
SNI	Serial Number Information

SOI	Stage of Involvement (FAA software audit)
SPR	Software Problem Report
SQA	Software Quality Assurance
SQAP	Software Quality Assurance Plan
SQAR	Software Quality Assurance Representative
SRD	Software Requirements Document
SRS	Software Requirements Standards
SRTM	Shuttle Radar Topographical Mission
SSA	System Safety Assessment
SSM	Sign Status Matrix
STAB	Stability
STAR	Standard Terminal Arrival Routes
STBY	Stand-by
STC	Supplemental Type Certificate
STP	Software Test Protocol
STRKS	Strikes (Lightning detection)
STS	Software Test Specification
SUA	Special Use Airspace
SV	Service Vehicle
SVCP	Software Verification Cases and Procedures
SVP	Software Verification Plan
SVR	Software Verification Results
SVS	Synthetic Vision System
SYMB	Symbol
SYNC	Synchronize (also SYNCH)
SYRD	System Requirements Document
TA	Traffic Advisory (Traffic Function)
TACAN	Ultra-High Frequency Tactical Air Navigational Aid
TAFs	Terminal Aerodrome Forecasts
TAS	Traffic Advisory System; True Airspeed
TAWS	Terrain Awareness and Warning System
TCA	Terminal Control Areas
TCAD	Traffic Collision Alert Device

TCAS	Traffic Collision Alert System
TCH	Threshold Crossing Height
TD	Traffic Display
T/D	Top of Descent
TERPS	Terminal Instrument Procedures
TF	Track to a Fix; Track from Fix to New Fix (ARINC-424 Leg)
TFR	Temporary Flight Restriction
TGT	Target
THLD	Threshold
TIS	Traffic Information Service
TIS-B	Traffic information Service-Broadcast
TLT	Tilt
TMS	Texas Instruments family of DSP processors
TQP	Tool Qualification Plan
TRANS	Transition
TRK	Track
TRNDO	Tornadic
TSO	Technical Standard Order
TSRA	Terminal Radar Service Area
TTA	Time to Alert
TURB	Turbulence
Tx	Transmit
UART	Universal Asynchronous Receiver-Transmitter
UIM	User Interface Module
USB	Universal Serial Bus, data storage device
USGS	United States Geological Survey
USR	User Waypoint
UTC	Universal Time Coordinated
VA	Heading to Altitude (ARINC-424 Leg)
V_A	Speed above which it is unwise to make full application of any single flight control
VAL	Vertical Alert Limit

V_{APP}	Target approach airspeed
VD	Heading to DME Distance (ARINC-424 Leg)
VDI	Vertical Deviation Indicator
VERT	Vertical
V_{FE}	Maximum flap extended speed
VFOM	Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
VI	Heading to Intercept (ARINC-424 Leg)
VLOC	VOR/Localizer
VLON	Vertical Loss of Navigation
VM	Heading to Manual Termination (ARINC-424 Leg)
V_{MIN}	Minimum speed for IFR for helicopters
V_{MO}	Maximum operating limit speed
VNAV	Vertical Navigation (also VNV)
V_{NE}	Never exceed speed
V_{NO}	Maximum structural cruising speed or maximum speed for normal operations
VOR	VHF Omnidirectional Radio
VORTAC	Collocated VOR and TACAN
VOX	Voice
VPL	Vertical Protection Level
V_{PROC}	Procedure Speed
V_R	Rotation speed
VR	Heading to Radial Termination (ARINC-424 Leg)
V_{REF}	Landing reference speed or threshold crossing speed
VSI	Vertical Speed Indicator
VTF	Vectors to Final
V_{TOS}	Minimum speed for a positive rate of climb with one engine inoperative
VUL	Vertical Uncertainty Limit
WAAS	Wide Area Augmentation System
WGS84	World Geodetic System 1984

WPT	Waypoint
WX	Weather
XFILL	Cross-fill

2.2. System Overview

The IDU-450 EFIS is a complete flight and navigation instrumentation system that intuitively provides information to the pilot via computer generated screen displays. The screen displays include three-dimensional, enhanced situational awareness Primary Flight Displays (PFD) and Multi-Function Displays (MFD). The MFD may be configured to show a moving map, an HSI, terrain, traffic, datalink weather, radar, or video.

At any given time, each system only has one IDU transmit enabled to send RS-232 and RS-422 system transmissions. By default, the PFD is “Transmit Enabled” and, if it subsequently fails, the respective MFD becomes transmit enabled.

2.2.1. Functional Integration and Display Redundancy

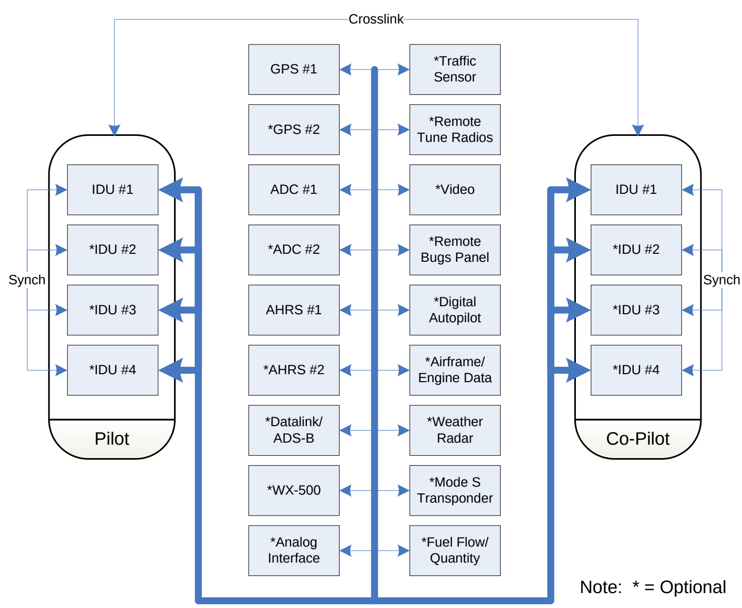


Figure 2-1: System Diagram

IDUs incorporate a high-brightness AMLCD screen; bezel pushbuttons; encoders and enter switches; central processing unit; numerous RS-232, RS-422, and ARINC 429 receive and transmit ports; and discrete IO ports. Hardware and software are identical for all IDUs, and functionality is determined by configuration settings setup during installation. The IDUs are independently connected to all external sensors and independently perform all integrated functions (e.g., TAWS, FMS, ADS-B In, Weather, Traffic, Audio/Radio Control, etc.). This provides an exceptional level of redundancy as compared to traditional display architectures where most of these functions were performed by external LRUs. Figure 2-1 depicts a typical architecture used by IDUs.

The IDUs depend upon intra-system (between IDUs on a side – depicted as “Synch” in Figure 2-1) and inter-system (between IDUs on opposite sides – depicted as “Crosslink” in Figure 2-1) to achieve synchronization of the integrated functions. The IDUs also depend upon intra-system communications to determine which IDU on a side takes over “Talker” responsibilities. The “Talker” IDU is the IDU providing data to external sensors and generating aural alerts.

2.2.2. IDU Initialization

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

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

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

Aircraft configurations are initially read from flash drive storage to provide the IDUs with a default configuration setup in the event of personality module failure. The Pilot System #0 or #1 IDU reads aircraft configuration from its personality module and, in the case of a multi-screen installation with a #1 IDU, transmits this configuration to the other IDUs, including all Co-Pilot System IDUs. Upon reception of the configurations transmission from the Pilot System

#0 or #1 IDU, the other IDUs save the transmitted configurations to flash drive storage.

Aircraft parameters (latitude, longitude, altitude), as they existed prior to the last system shutdown, are read to initialize the system, which allows for a good initialization, even if system sensors are failed or not yet initialized. For a future application update (i.e., updating software version 8.0D to 8.0X), all aircraft settings re-initialize to default values. Otherwise, aircraft settings, as they existed prior to the last system shutdown, are used to initialize the system with the exception of the following default values:

1) Active flight plan structure and associated values are cleared.
2) ADAHRS are set to slaved mode, and the slewing value is initialized to zero.
3) Timers are turned off.
4) Minimum altitude setting is turned off.
5) FMS OBS setting is set to automatic.
6) VOR/LOC 1 OBS setting is set to 360°.
7) VOR/LOC 2 OBS setting is set to 360°.
8) Parallel offset is set to 0 NM.
9) Airspeed bug is turned off.
10) Target altitude bug is turned off.
11) Vertical speed bug is turned off.
12) HSI navigation source is set to FMS.
13) Heading bug is set to 360° (HeliSAS-E) or turned off.
14) Datalink and map panning modes are set to off.
15) PFD zoom mode is set to off.
16) Manual RNP is set to off.
17) PFD skyway is set to on.
18) RDR-2000/2100 scale is initialized to 80NM.
19) Crosslink is initialized to on.

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

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

If booting on the ground, the following actions happen:

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

2) CRC-32 values for application executable, limitations files, NavData files, obstruction files, and terrain header files are checked within 1.5 to 3 minutes.

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

3) If the CRC-32 check fails, the program exits with an error message and creates a bit result file indicating failure. This results in the system rebooting, and the IDU is inoperable until the anomaly is resolved.

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

5) If "Baro Auto-Setting on Startup Flag" is enabled, the application auto-sets the altimeter based upon the terrain elevation at the startup point.

6) A logo screen displaying database versions and validity dates displays the message "**PRESS ANY BUTTON TO CONTINUE**."

   a) Software CRC-32;

   b) Aircraft Type;

   c) Database Versions and Validity Dates

7) If all critical sensors (GPS, ADC, and AHRS) are in normal condition, the display screens are shown immediately. The #1 IDU initializes to the PFD screen.

8) If any critical sensor is not in normal condition, a logo screen with a two-minute countdown timer is shown.

9) The display screen is shown at the earliest of:

   a) When two minutes have elapsed;

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

   c) When all critical sensors are in normal condition, the #1 IDU initializes to the PFD screen;

   d) Other IDUs: IDU #2 initializes to the MFD screen. All other IDUs initialize to the MFD screen;

   e) On the IDU#0 or #2 with fuel totalizer functions enabled, the fuel set menu activates to remind the pilot to set the fuel totalizer quantity. N/A for AW-109SP aircraft due to fuel quantity from the IDS.

If booting in the air, the following actions happen:

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

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

3) The display screens initialize immediately.

4) The display screens initialize as follows:

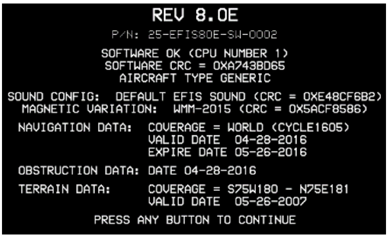
   a) IDU #1: PFD

   b) Other IDUs: IDU #2 initializes to display of LPV Enable and AFCS SW Part Number (AW-109SP)

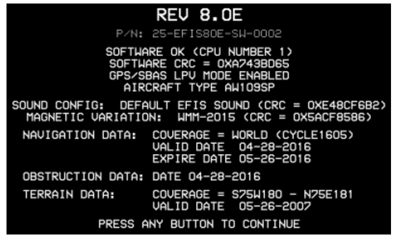
The status of the LPV Enable factory limits setting is displayed on the database version and validity screen. When connected to an AFCS, which sends software part number data, the AFCS software part number is displayed below the “Aircraft Type” line.

NOTE:

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



Other Rotorcraft



Display of LPV Enable and AFCS SW Part Number (AW-109SP)

Figure 2-2: Initialization Screen

2.3. General Arrangement

The IDU-450 is 6.375” W x 5.65” H x 4.75” D and weighs less than 7.5 lbs. The IDU-450 has the capacity to accommodate integrated peripherals mechanically attached to the CPU but have electrical isolation and redundancy. These modules may include:

1) Integrated ADAHRS Sensor Module
2) Integrated GPS/SBAS Sensor Module
3) Serial Protocol Converters
4) Video Format Converters

Data storage consists of two compact flash cards sufficiently sized to hold world terrain, navigational, and obstruction databases.

Because the receive ports of the IDU-450 are connected to the digital sensor modules in parallel, each IDU-450 is independent from all other IDU-450s. In an IFR installation, the software of the primary IDU-450 is configured so only the primary screen Primary Flight Display (PFD) display.

2.3.1. GPS Aiding Limitation

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

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

NOTE:

Not applicable for AW-109SP or other rotorcraft with other AHRS than Genesys ADAHRS installed.

2.3.2. Menu Philosophy

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

EXIT (R1): Whenever the menu system is beyond the top-level **EXIT (R1)** escapes to the top-level with acceptance of changed menu items.

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

Indication of further menu levels: Soft menu function tiles include an indication of further menu levels with a two-dot trailer, 

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2.3.3. IDU Intra-System Communications

IDUs on a system side (pilot side and co-pilot side individually) monitor each other using intra-system communications and perform the following checks:

1) Intra-system communications freshness
2) Screen counter incrementing (i.e., screen not frozen)
3) Airspeed agreement
4) Altitude agreement
5) Attitude agreement
6) Barometric setting agreement
7) GPS position, track, and groundspeed agreement
8) Heading agreement

9) Localizer and glideslope deviation agreement

10) Radar altitude agreement

2.4. Color Conventions

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

WHITE is used for items set by the pilot and held internally by the EFIS or items where device feedback is not expected, such as STBY frequency/codes, TX indicator when there is no TX feedback, or Marker Beacon Receiver High/Low sensitivity modes. Used for scales, associated labels and figures, pilot action, or data entry. Examples:

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

When used for an analog bar indication, light gray (low-intensity white) is used instead as a large white area on the screen may become overwhelming.

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

MAGENTA (light magenta for visibility) is used for pilot-set items sent to devices but awaiting feedback confirmation such as ACTV frequency/codes, operating modes, transmit enabled indications, and IDENT indication. Used to indicate electronically calculated or derived data and certain navigation database items. Examples:

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

GRAY is used as a figure background for airspeed and altitude readout and for conformal runway depiction (light gray for usable portion of the active runway, dark gray for other runway surfaces).

GREEN (light green used for visibility) is used for pilot-settable items confirmed as set via feedback from the device, such as ACTV frequency/codes, operating modes, transmit enabled indications, and IDENT feedback. Used for VOR #2 and to indicate normal or valid operation (airspeed, altitude tape coloring, status indication, etc.). Examples:

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

DARK GREEN is used for the terrain indication on the moving map. The slope between adjacent terrain pixels in an increasing longitude direction determines the shade used.

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

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

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

BLUE is used in a variety of shades to indicate the sky portion of the PFD, bodies of water on the moving map, and advisory text on black background (advisory background with white text for AW-109SP).

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

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

2.5. Warning/Caution/Advisory System

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

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

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

ADVISORY Displayed with black flag and blue letters with a single aural annunciation (Except AW-109SP).

ADVISORY Displayed with blue flag and white letters with a single aural annunciation (AW-109SP only).

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	**Aural Annunciation**	**Condition**
GLIDESLOPE	"Glideslope, Glideslope"	Within GPWS Mode 5 warning envelope. Half second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
LOW FUEL	"Fuel Low, Fuel Low"	One of the following conditions is true: 1) One of the low fuel warning discrete inputs is active. 2) One of the sensed fuel tank quantities is below its low fuel warning threshold. 3) Total aircraft fuel is below the pilot-set emergency fuel threshold. N/A for AW-109SP. 1-minute time delay.
OBSTRUCTION	"Warning Obstruction, Warning Obstruction"	Obstruction within TAWS FLTA warning envelope. Half second time delay.
PULL UP	"Pull Up, Pull Up"	Within GPWS Mode 1 warning envelope. Half second time delay.
	"Terrain, Terrain, Pull Up, Pull Up"	Within GPWS Mode 2 warning envelope. Half second time delay.
TERRAIN	"Warning Terrain, Warning Terrain"	Terrain cell within TAWS FLTA warning envelope. Half second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
TRAFFIC	"Traffic, Traffic"	Resolution advisory. Not given if own aircraft below 400' AGL nor if target is below 200'AGL (ground target). Audio not generated with TCAS-II system. No time delay.
CAUTIONS		
ADC1 FAIL	Alert Tone	Only active in dual-ADC installation. Indicates no valid indicated airspeed, pressure altitude, or VSI received from ADC #1 for more than 1 second. No time delay.
ADC2 FAIL	Alert Tone	Only active in dual-ADC installation. Indicates no valid indicated airspeed, pressure altitude, or VSI received from ADC #2 for more than 1 second. No time delay.
ADS-B FAIL	Alert Tone	Enabled by ADS-B out fail warning limits setting. Mode-S transponder indicates bad ADS-B out status. 2-second time delay.
AHRS1 FAIL	Alert Tone	Only active in dual-AHRS installation. Indicates no valid bank, pitch, or heading received from AHRS #1 for more than 1 second. No delay. Inhibited during and for 10 seconds after unusual attitude mode.

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

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
AUX SENSOR	"Auxiliary Sensor Failure, Auxiliary Sensor Failure"	No valid message or bad status received from installed optional sensors. Sensor status displayed in FAULTS menu. 5-second time delay. Inhibited during and for 10 seconds after unusual attitude mode. Applies to the following optional sensors: 1) RS-232 TAS System 2) ADS-B System 3) WSI Datalink System 4) WX-500 Lightning System 5) Analog Interface System 6) Weather Radar 7) Weather Radar Control Panel
CHECK GEAR	"Check Gear, Check Gear"	Activated if RG flag is set to 1, aircraft is below 150' AGL, aircraft is descending, and any landing gear is not down. N/A for AW-109SP. 2-second time delay.

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

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
CHECK RANGE	"Check Range, Check Range"	Less than 30 minutes buffer (at current groundspeed) between calculated range and distance to: 1) last waypoint if it is active; or 2) airport if on a missed approach; or 3) along-route distance to destination. Not activated in climbing flight nor if below 60 knots groundspeed. 5-minute time delay.
LOW FUEL	"Fuel Low, Fuel Low"	Low Fuel warning is not active and one of the following conditions is true: 1) One of the low fuel caution discrete inputs is active. 2) One of the sensed fuel tank quantities is below its low fuel caution threshold. 3) Total aircraft fuel is below the pilot-set minimum fuel threshold. N/A for AW-109SP. 1-minute time delay.

Table 2-2: Warnings, Cautions, and Advisories

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

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

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

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
GS MISCOMP	Alert Tone	Only active when two valid glideslopes are received. Indicates at least one glideslope is receiving a signal within 1 dot of center and difference between glideslope signals is beyond limits (0.25 Dots). 10-second time delay.
HDG MISCOMP	Alert Tone	Only active in dual-AHRS installation with neither AHRS in failure condition nor in DG mode. Indicates heading difference between AHRS is beyond the “Heading Miscompare Threshold” limit. 60-second delay. 10-second delay for AW-109SP. Inhibited during and for 10 seconds after unusual attitude mode. Inhibit for 5 minutes after startup.
IAS MISCOMP	Alert Tone	Only active in dual-ADC installation with neither ADC in failure condition. Indicates indicated airspeed difference between ADCs is beyond limits. Inhibit for 5 minutes after startup. 10-second time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
LOC MISCOMP	Alert Tone	Only active when two valid localizers are received. Indicates at least one localizer is receiving a signal within 1 dot of center and difference between localizer signals is beyond limits (0.25 Dots). 10-second time delay.
NO HEADING	Alert Tone	No valid heading received from selected AHRS for more than 1 second Inhibited during and for 10 seconds after unusual attitude mode. Disabled if in MFD-only operation. Not shown if PFD heading scale is red-X'd (Red-X provides sufficient pilot cue). No time delay.
NO TAWS	Alert Tone	Indicates aircraft is currently beyond extent of terrain database or a failure condition exists preventing the TAWS FLTA function from operating. Half second time delay. Inhibited during and for 10 seconds after unusual attitude mode.

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

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

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
PLT1 OVRTMP PLT2 OVRTMP PLT3 OVRTMP PLT4 OVRTMP CPLT1 OVRTMP CPLT2 OVRTMP CPLT3 OVRTMP CPLT4 OVRTMP	Alert Tone	IDU core temperature greater than 95°C. 2-second time delay.
PLT1 SCC PLT2 SCC PLT3 SCC PLT4 SCC CPLT1 SCC CPLT2 SCC CPLT3 SCC CPLT4 SCC	Alert Tone	Indicates SCC card (Personality Module) could not be read upon power-up. Limits internal to the IDU are in use by the system. Only active on the ground.
RADALT FAIL	Alert Tone	Only active in single-Radar Altimeter installation. For analog radar altimeter, indicates below 2000'AGL in Air Mode without a valid radar altimeter reading. For ARINC 429 radar altimeter, indicates an SSM of failure warning is transmitting. 2-second time delay.

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

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
RALT MISCOMP	Alert Tone	Only active in dual-Radar Altimeter installation with neither radar altimeter in failure condition. Indicates radar altitude difference between radar altimeters is beyond limits. Limits are as follows: >= 500’AGL Δ14% 100 – 500’AGL Δ10% < 100’AGL Δ10’ 10-second time delay.
SAME ADC	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-ADC installation with good inter-system communications, and neither ADC in failure condition. Indicates both systems are operating from same ADC source. No time delay.
SAME AHRS	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-AHRS installation with good inter-system communications, and neither AHRS in failure condition. Indicates systems are operating from same AHRS source. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
SAME GPS	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-GPS/SBAS installation with good inter-system communications, and neither GPS/SBAS in failure condition. Indicates both systems are operating from same GPS/SBAS source. No time delay.
SAME NAV	Alert Tone	Only active in dual-system (pilot and co-pilot) with good inter-system communications. Indicates both systems are operating from same navigation source. Alert inhibited if both systems are operating from GPS/SBAS in a single-GPS/SBAS installation. No time delay.
SAME RADALT	Alert Tone	Only active in dual-system (pilot and co-pilot), dual-radar altimeter installation with good inter-system communications, and neither radar altimeter in failure condition. Indicates both systems are operating from same radar altimeter source. No time delay.
SINK RATE	“Sink Rate, Sink Rate”	Within GPWS Mode 1 caution envelope. Half second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
TAWS AUTOROT	Alert Tone	TAWS Autorotation mode activated through use of discrete input. No time delay.
TRAFFIC	"Traffic, Traffic"	Traffic advisory. Not given if own aircraft below 400' AGL nor if target is below 200'AGL (ground target). Audio not generated with TCAS-II system. No time delay.
TCAS FAIL	Alert Tone	Only active with ARINC 735A-1 TCAS-II, TCAS-I, or TAS system. Indicates lack of communications with system or failure indication from system. No time delay.
TERRAIN	"Caution Terrain' Caution Terrain"	Terrain cell within TAWS FLTA caution envelope. Half second time delay.
		Within GPWS Mode 2 caution envelope. Half second time delay.
TOO LOW	"Too Low Terrain, Too Low Terrain"	Within GPWS Mode 3 envelope. Half second time delay.
		Within GPWS Mode 4 "Too Low Terrain" envelope. Half second time delay.
		Within TAWS PDA envelope. Half second time delay.
	"Too Low Gear, Too Low Gear"	Within GPWS Mode 4 "Too Low Gear" envelope. Half second time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
	"Too Low Flaps, Too Low Flaps"	Within GPWS Mode 4 "Too Low Flaps" envelope. Half second time delay.
TOTALZR QTY	Alert Tone	Compares the volume of sensed fuel to the fuel totalizer calculation. Issues a caution if the difference exceeds the Totalizer Mismatch caution threshold. Only performed if: 1) totalizer mismatch caution threshold is non-zero; 2) fuel totalizer is enabled; 3) unmonitored fuel flag is false; 4) fuel totalizer has a valid value; and 5) fuel levels are valid. 1-minute time delay.
XFILL FAIL	Alert Tone	Only active in dual-system (pilot and co-pilot). Indicates lack of inter-system communications. Inhibit for 30 seconds after startup. 2-second time delay.
HRZ SYNC	Alert Tone	Horizon Synchronization mode (AW-109SP only).

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
--	"Altitude, Altitude"	Deviation greater than 150' from selected altitude after capture. Altitude capture defined as within 100' of altitude. N/A for AW-109SP. 2-second time delay.
		If not on a descending VNAV profile, deviation greater than 150' from altitude of the current or prior VNAV waypoint after capture. Altitude capture defined as within 100' of altitude. N/A for AW-109SP. 2-second time delay.
--	"Decision Height"	Deviation from above to below decision height bug. Causes decision height readout to turn amber (yellow) and flash. N/A AW-109SP. No time delay.
--	"Minimums, Minimums"	Deviation from above to below minimum altitude bug. Minimum altitude readout turns amber (yellow) and flashes. (AW-109SP does not flash) No time delay.
ADVISORIES		
AHRS1 DG AHRS1 DG	Chime	Only active in dual-AHRS installation. Indicates AHRS 1 in DG mode. No time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
AHRS2 DG AHRS2 DG	Chime	Only active in dual-AHRS installation. Indicates AHRS 2 in DG mode. No time delay.
AHRS1	Chime	AW-109SP only. In single EFIS, dual AHRS and AHRS1 are selected, and AHRS1 is valid.
AHRS2	Chime	AW-109SP only. In single EFIS, dual AHRS and AHRS2 are selected, and AHRS2 is valid.
ADC1	Chime	AW-109SP only. In single EFIS, dual ADC and ADC1 are selected, and ADC1 is valid.
ADC2	Chime	AW-109SP only. In single EFIS, dual ADC and ADC2 are selected, and ADC2 is valid.
ADC INIT ADC INIT	Chime	ADC not at full accuracy during warm-up. No time delay.
ANP: 0.01 ANP: 15.0 ANP: 0.01 ANP: 15.0	Chime	GPS/SBAS Actual Navigation Performance based upon current GPS/SBAS HPL.
BARO MISCOMP BARO MISCOMP	Chime	Only active in dual-system (pilot and co-pilot) installation. Indicates mismatch of altimeter settings or altimeter modes between systems. 10-second time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
CHK BARO CHK BARO	Chime	Ascending through transition level: Altimeter not set to 29.92 inHg or 1013 mbar. Descending through transition level: Altimeter set to 29.92 inHg or 1013 mbar. Descent warning times out in 10 seconds. Disabled during QFE operation. 2-second time delay.
CREW CALL CREW CALL	Chime	Only active with EFIS control of an audio controller with pilot isolate function, and call notice is received from the controller.
DR 00:00 DR 01:23 DR 00:00 DR 01:23	Chime	GPS/SBAS in Dead Reckoning Mode with valid ADC and AHRS data. Timer shows time since loss of position to indicate quality of DR solution. No time delay. Inhibited during and for 10 seconds after unusual attitude mode.
FLTA INHBT FLTA INHBT	Chime	Shown when the FLTA function is automatically inhibited during normal operation. “NO TAWS” caution and “TAWS INHBT” advisory have priority over this message. No time delay.

Table 2-2: Warnings, Cautions, and Advisories

Display Flag	Aural Annunciation	Condition
FPM INHBT FPM INHBT	Chime	Flight Path Marker inhibit function activated through momentary discrete input. No time delay.
LNAV APPR LNAV APPR	Chime	GPS/SBAS in LNAV Approach Mode. No time delay.
LNV/VNV APPR LNV/VNV APPR	Chime	GPS/SBAS in LNAV/VNAV Approach Mode. No time delay.
LP APPR LP APPR	Chime	GPS/SBAS in LP Approach Mode. No time delay.
LPV APPR LPV APPR	Chime	GPS/SBAS in LPV Approach Mode. No time delay.
MORE-PRS MENU MORE-PRS MENU	None	Number of active messages exceeds 11. Guides pilot in accessing the EXPAND CAS menu. No time delay.
PLT1 PWR PLT2 PWR PLT3 PWR PLT4 PWR CPLT1 PWR CPLT2 PWR CPLT3 PWR CPLT4 PWR PLT1 PWR PLT2 PWR PLT3 PWR PLT4 PWR CPLT1 PWR CPLT2 PWR CPLT3 PWR CPLT4 PWR	Chime	Indicates one of the dual redundant power supplies within an IDU is not functioning correctly. 1-minute time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
PTK = L 1NM PTK = L 20NM PTK = R 1NM PTK = R 20NM PTK ENDING PTK = L 1NM PTK = L 20NM PTK = R 1NM PTK = R 20NM PTK ENDING	Chime	GPS/SBAS Parallel Offset path advisory. ## is nautical miles left (L) or right (R) of main path. No time delay.
RNP: 0.10A RNP: 15.0A RNP: 0.10A RNP: 15.0A	Chime	GPS/SBAS Automatic Required Navigation Performance as acquired from navigation database.
RNP: 0.10M RNP: 15.0M RNP: 0.10M RNP: 15.0M	Chime	GPS/SBAS Manual Required Navigation Performance as set by pilot.
SUSPEND 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.
SWISS GRID	Chime	When Swiss Grid is active. AW-109SP only.
TA ONLY TA ONLY	Chime	Only active with TCAS-II system. Indicates TCAS-II system is unable to display resolution advisories. No time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
TAS INHBT TAS INHBT	Chime	TAS aural inhibited through activation of TCAS/TAS Audio inhibit discrete input. No time delay.
TAWS GS CNX TAWS GS CNX	Chime	TAWS glideslope cancel (GPWS Mode 5) activated through use of discrete input. Enhanced HTAWS only. No time delay.
TAWS INHBT TAWS INHBT	Chime	TAWS inhibited through use of discrete input. No time delay.
TAWS LOW ALT TAWS LOW ALT	Chime	TAWS low altitude mode activated through use of discrete input. No time delay.
TCAS STBY TCAS STBY	Chime	Only active with TCAS-II system. Indicates system is: (1) in standby or (2) executing functional test in flight. No time delay.
TCAS TEST TCAS TEST	Chime	Only active with TCAS-II system. Indicates system is in functional test on ground. No time delay.
TERMINAL TERMINAL	Chime	GPS/SBAS in Terminal Mode. N/A for AW-109SP when in MOT mode. No time delay.
TRUE NORTH TRUE NORTH	Chime	True North Mode input discrete is asserted, and system is operating in True North Mode. No time delay.

Table 2-2: Warnings, Cautions, and Advisories		
Display Flag	**Aural Annunciation**	**Condition**
VECTORS VECTORS	Chime	GPS/SBAS in Vectors to Final Approach Mode prior to sequencing FAWP. No time delay.
VFR APPR VFR APPR	Chime	GPS/SBAS in VFR Approach Mode. No time delay.
VSI BARO	Chime	AW-109SP only. When label 365 (Inertial Vertical Speed) is not available and valid from the AHRS.
XFILL ARM XFILL ARM	Chime	Only active in dual-system (pilot and co-pilot) with good inter-system communications and crossfill not inhibited. Indicates systems are not synchronized, and synchronization function is available. No time delay.
XFILL INHBT XFILL INHBT	Chime	Only active in dual-system (pilot and co-pilot) with good inter-system communications. Indicates crossfill is manually inhibited through discrete input. No time delay.
--	Altitude Alert Tone	Tone given when within the greater of 500' or 50% of VSI from uncaptured selected or VNAV waypoint altitude. Inhibited in approach procedures. No time delay.
--	Chime	Sounds chime when countdown timer reaches 00:00:00. No time delay.

Volume of aural annunciations is adjusted according to severity:

WARNING	= Full volume set into aircraft limits
CAUTION	= 80% of volume set into aircraft limits
ADVISORY Other rotorcraft ADVISORY AW-109SP	= 60% of volume set into aircraft limits

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

Flags are visually prioritized so active warning flags are displayed above active caution flags, which are displayed above active advisory flags. Within categories, active flags are stacked in chronological order with the most recent annunciation appearing on top. Warning flags flash at 2Hz until acknowledged by pressing the audio mute switch. Caution flags flash at 1 Hz until acknowledged by pressing the audio mute switch.

NOTE:

AW-109SP warning and caution flags do not flash.

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

Table 2-3: Annunciations Priority
1) GPWS Mode 1 Warning
2) GPWS Mode 2 Warning
3) TAWS FLTA Warning
4) Obstruction Warning
5) TAWS FLTA Caution
6) Obstruction Caution
7) GPWS Mode 4-1
8) GPWS Mode 4-2
9) GPWS Mode 4-3
10) GPWS Mode 1 Caution
11) GPWS Mode 2 Caution

Table 2-3: Annunciations Priority
12) GPWS Mode 3
13) GPWS Mode 5 Warning
14) GPWS Mode 5 Caution
15) Check Gear
16) Traffic Warning (Resolution Advisory)
17) Traffic Caution (Traffic Advisory)
18) Low Fuel Warning
19) Low Fuel Caution
20) Fuel Split Caution
21) Fuel Totalizer Mismatch Caution
22) Check Range

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

2.6. Database and Software Updates

2.6.1. Navigation and Obstruction Databases

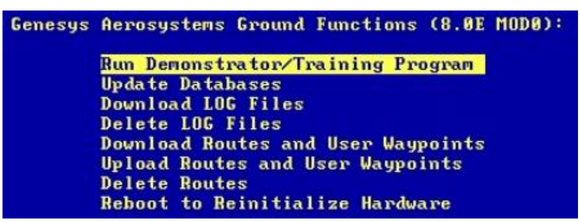

Figure 2-3: Ground Maintenance Page

The EFIS uses Jeppesen NavData® for the navigation database and Jeppesen data for the obstruction database, which are both secured directly through the Jeppesen Company. The EFIS is updated through the Ground Maintenance Function (GMF). To gain access to the GMF, prior to applying power, slide the slip indicator or non-slip blank door cover at the bottom-center of the IDU bezel upward to the first detent position to expose the USB port.

2.6.2. Update Requirements

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

Navigation Database - Every 28 days

Obstruction Database - Every 28 days

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

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

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

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

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

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

World - Containing major airports and navigation with the Americas.

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

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

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

CAUTION:

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

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

Once each IDU has been updated, power up the entire EFIS in normal flight mode and verify each IDU successfully updated with the latest database by noting the new NavData cycle expiration dates before acknowledging the Initialization screen (Figure 2-2). There is no expiration for the obstruction database.

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

The IDU provides an updateable navigation database containing at least the following location and path information, referenced to WGS-84, with a resolution of 0.01 minute (latitude/longitude) and 0.1° (for course information) or better at all of the following for the area(s) in which IFR operations are intended:

1) Airports.
2) VORs, DMEs (including DMEs collocated with localizers), collocated VOR/DMEs, VORTACs, and NDBs (including NDBs used as locator outer marker).
3) All named waypoints and intersections shown on enroute and terminal area charts.
4) All airways shown on enroute charts, including all waypoints, intersections, and associated RNP values (if applicable). Airways are retrievable as a group of waypoints (selecting the airway by name results in leading the appropriate waypoints and legs between the desired entry and exit points into the flight plan).
5) RNAV DPs and STARs, including all waypoints, intersections, and associated RNP values (if applicable). DPs and STARs are

retrievable as a procedure (selecting the procedure by name results in loading the appropriate waypoints and legs into the flight plan).

6) LNAV approach procedures in the area(s) in which IFR operation is intended consist of:

   a) Runway number and label (required for approach identification);

   b) Initial approach waypoint (IAWP);

   c) Intermediate approach waypoint(s) (IWP) (when applicable);

   d) Final approach waypoint (FAWP);

   e) Missed approach waypoint (MAWP);

   f) Additional missed approach waypoints (when applicable); and

   g) Missed approach holding waypoint (MAHWP).

   The complete sequence of waypoints and associated RNP values (if applicable), in the correct order for each approach, are retrievable as a procedure (selecting the procedure by name results in loading the appropriate waypoints and legs into the flight plan). Waypoints utilized as a final approach waypoint (FAWP) or missed approach waypoint (MAWP) in an LNAV approach procedure are uniquely identified as such (when appropriate) to provide proper approach mode operation.

7) LNAV/VNAV procedures in the area(s) where IFR operation is intended. LPV, LP, and/or LNAV/VNAV published procedures are available.

Select a procedure by name to load the appropriate waypoints and legs into the active flight plan. Waypoints used as a final approach waypoint (FAWP) and LTP/FTP/MAWP in an LNAV/VNAV procedure are uniquely identified as such to provide proper approach mode operation.

2.6.3. Terrain Database Update

The IDU-450 contains the entire World Terrain Database, which is updated on an as-needed basis and performed as required as described in a service bulletin.

2.7. Run Demonstrator/Training Program

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

2.7.1. Application Software Air Mode and Ground Mode

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

1) If Weight on Wheels/Weight on Ground discrete input is configured, Air or Ground Modes are determined solely from the discrete input position.

2) Otherwise, mode is determined as follows:

   a) If airspeed is valid and AGL altitude is valid, Ground Mode is set when indicated airspeed is less than 30 knots, and AGL altitude is less than 75 feet.

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

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

Section 3 Display Symbology

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List of Figures and Tables

3.1. Introduction

In an IFR installation, software of the primary IDU-450 is configured so only the PFD is displayed. On all other IDU-450 displays, software is configured so any screen display is shown at any time. On the AW-109SP, there is a PFD and MFD on each side of the cockpit. This section details the symbology used on the pilot and co-pilot Primary Flight Display (PFD) and Multi-Function Display (MFD) displays. The software of the pilot and co-pilot MFD may be configured to show **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, **HOVER**, **WX-RDR**, or **VIDEO** pages. When applicable, reference is made to either Tapes or Round Dials for Other Rotorcraft only (not applicable for AW-109SP rotorcraft).

3.2. PFD (PFI) Symbology

Figure 3-1: PFD

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

3.2.1. IDU-450 PFD Display Basic Mode

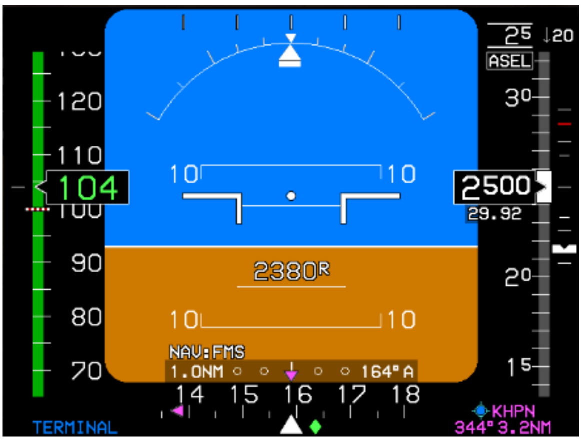


Figure 3-2: PFD in Basic Mode (Tapes)

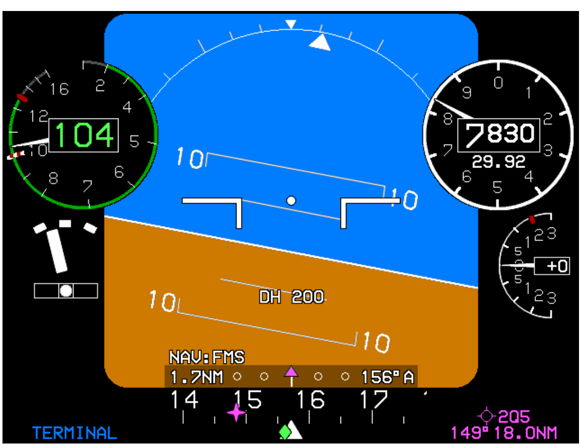


Figure 3-3: PFD in Basic Mode (Round Dials)

The following are no longer present when Basic mode is displayed:

1) Atmospheric perspective
2) Terrain rendering
3) Obstructions rendering
4) Flight Path Marker
5) Roll Pointer option
6) Bank Scale option
7) Airport runways

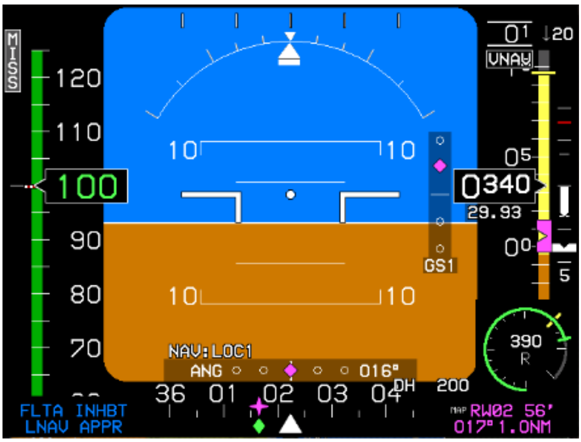


Figure 3-4: Basic Mode (Other Rotorcraft) (Tapes)

3.2.2. Basic Mode (AW-109SP)

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

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

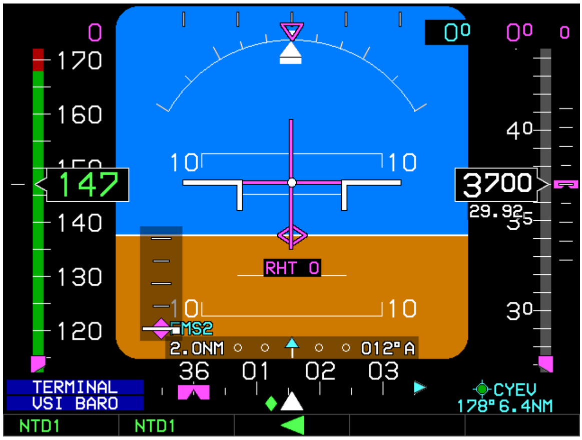
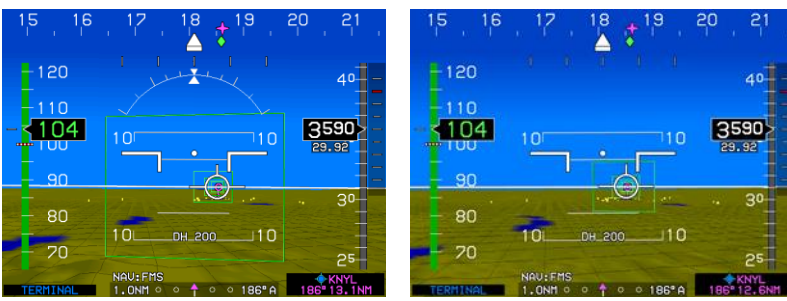


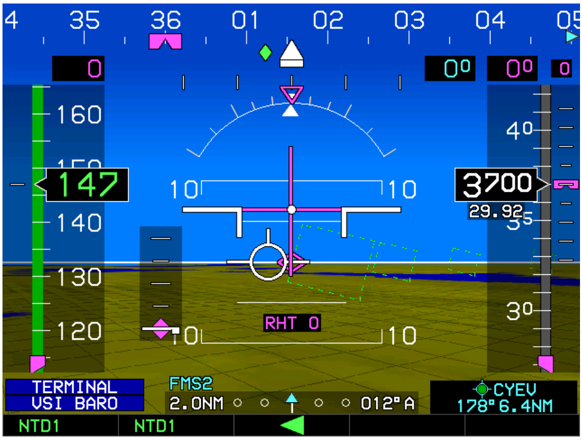
Figure 3-5: PFD in Basic Mode (AW-109SP)

3.2.3. Bank Scale Declutter IDU-450 PFD Display



With Bank Scale **Without Bank Scale**

Figure 3-6: PFD (Other Rotorcraft) (Tapes only)



Bank Scale always in view

Figure 3-7: PFD (AW-109SP)

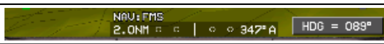
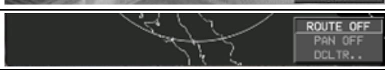
3.3. Menu Functions

Figure 3-8: Menu Functions

The top-level menu level corresponds to the permanent labeling of the IDU pushbuttons and is active any time no soft menu options appear on the screen. Soft menu function tiles appear next to the appropriate IDU button and the right encoder (❶) when appropriate.

On the PFD, scroll ❶ to activate the heading menu. On MFD pages with an adjustable display (e.g., ND, Strike, Traffic, Datalink, Hover, or Weather Radar) scroll ❶ to change the display scale (CW = increase scale, CCW = decrease scale). On the video page, scroll ❶ to change the zoom level (CW = increase zoom, CCW = decrease zoom).

With the exception of IDU #1, push ❶ to swap between the PFD and MFD, unless the IDU is in MFD-only mode. IDU #1 is always configured to the PFD page.

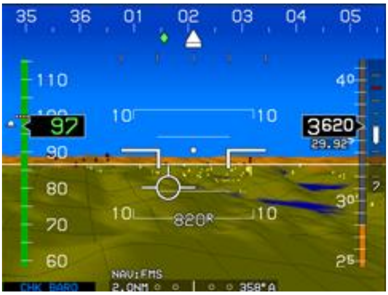
Table 3-1: Encoder Functions for All Pages	
	**PFD page**
	**MFD MAP page**
	**MFD Video page**
	**MFD Datalink page**

Selection lists too long to be presented in the available space indicate the location within the list. When the menu system is beyond the top-level, **EXIT (R1)** escapes to the top-level. When a menu level is deeper than the first level, **BACK (L1)** regresses one level through the menu system.

3.3.1. Selecting BARO

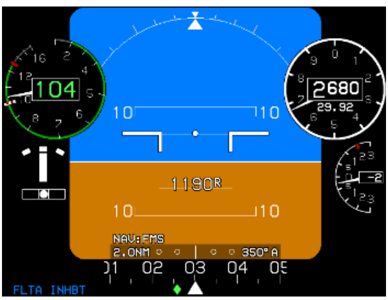
Press **BARO (R2)** to enter BARO mode and view the inches of mercury (inHg) or millibars (mbar) value in the lower right corner on any IDU configured for any available page. Scroll ❶ CW to increase or CCW to decrease the QNH. Push ❶ to enter the new value.

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



Other Rotorcraft (Tapes)

AW-109SP



Other Rotorcraft
(Round Dials)

Figure 3-9: Selecting BARO

Immediately below the altimeter setting, the mode is annunciated as QFE operations otherwise, no mode is annunciated.

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

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

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

Other Rotorcraft (Tapes) | **AW-109SP** | **Other Rotorcraft (Round Dials)**

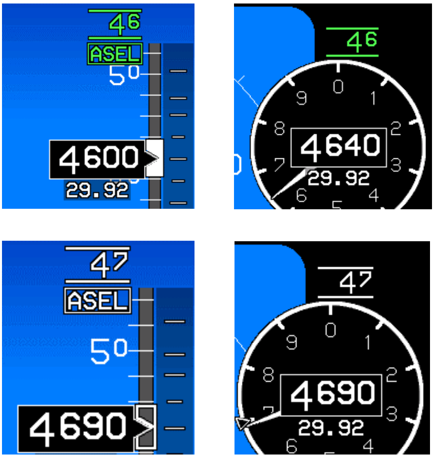
Figure 3-10: Altimeter Setting QNH

Other Rotorcraft (Tapes) | **AW-109SP** | **Other Rotorcraft (Round Dials)**

Figure 3-11: Altimeter QFE

3.3.2. Selected Altitude Sub-Mode (Target Altitude)

When in selected altitude sub-mode, the altitude scale has a pilot-settable target altitude bug geometrically interacting with the altitude box pointer. The target altitude bug setting is limited to -1000 feet at the low end, 20,000 feet at the high end, and is annunciated above the altitude scale as seen above with a resolution of 100 feet. For AW-109SP Remote Bugs Panel operation and setting of Altitude encoder for ALTA Datum, see Section 5 Menu Functions and Step-By-Step Procedures for Altitude Encoder (AW-109SP).



Tapes Round Dials

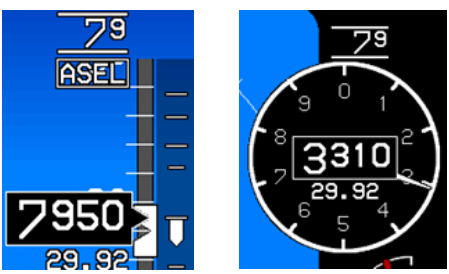
Other Rotorcraft

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

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

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

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



Tapes Round Dials

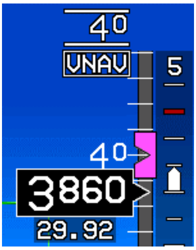
Other Rotorcraft

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

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

3.3.3. VNAV Sub-Mode

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



Tapes

Round Dials

Other Rotorcraft

When not vertically integrated with a fully-integrated digital autopilot, the VNAV altitude bug setting annunciation includes “VNAV” indicating the VNAV altitude sub-mode. Round Dial users must view the Active Waypoint Identifier, i.e.,

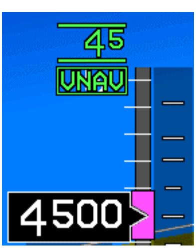
.

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

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

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

When vertically integrated with an autopilot:



Tapes

Round

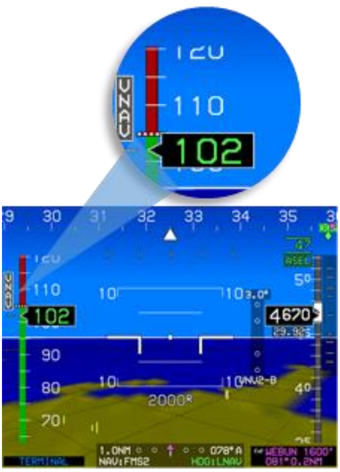
Other Rotorcraft

When in altitude hold mode, the VNAV altitude bug setting annunciation is green. The VNAV altitude bug is filled-magenta (Tapes only). During altitude hold capture, VNAV altitude bug setting annunciation is green and flashes, while the VNAV altitude bug is filled-magenta.

When in a climb or descent mode, the VNAV altitude bug setting annunciation is white, and the VNAV altitude bug is hollow-magenta (Tapes only).

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

3.3.4. Altitude Display (VNAV Tile)



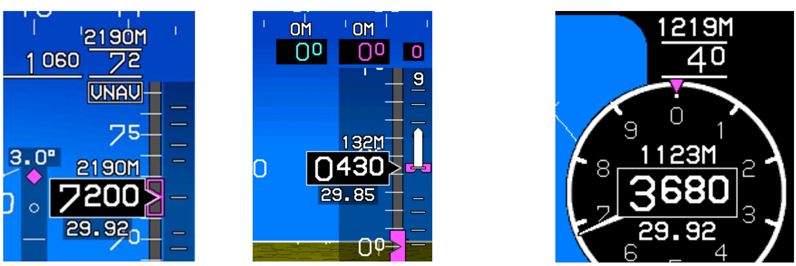
When enabled for performing VNAV with a manually selected altitude entered, **VNAV** appears for "one-touch" engagement of VNAV.

For AW-109SP Remote Bugs Panel operation, see RBP Appendix for VNAV Button (AW-109SP) to set altitude display for VNAV/LNAV operation.

Figure 3-16: Altitude Display (VNAV Tile)

3.3.5. Altitude Display (Metric Units)

Pilot-selectable altitude values are in metric units with a resolution of 10 meters as depicted.



Other Rotorcraft (Tapes) **AW-109SP** **Other Rotorcraft (Round Dials)**

Figure 3-17: Altitude Display (Metric Units)

3.4. PFD Symbology

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

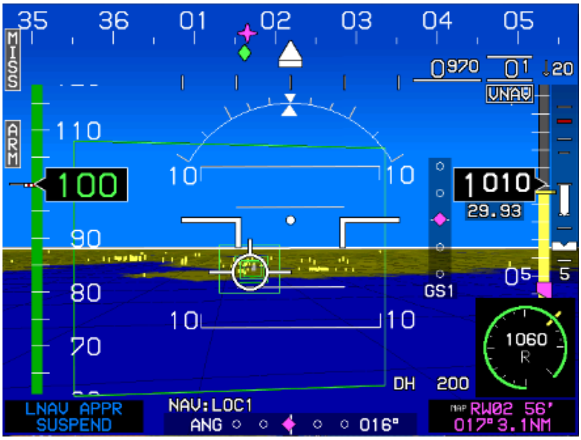


Figure 3-18: PFD Symbology - Other Rotorcraft (Tapes)

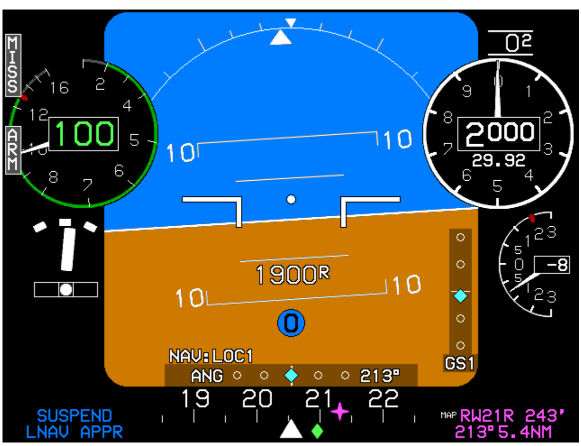


Figure 3-19: PFD Symbology - Other Rotorcraft (Round Dials)

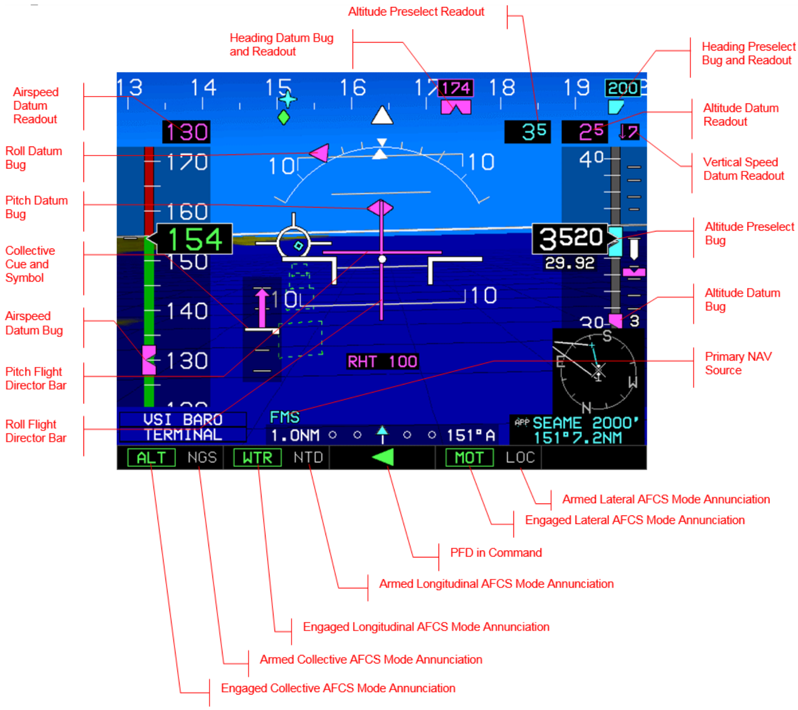


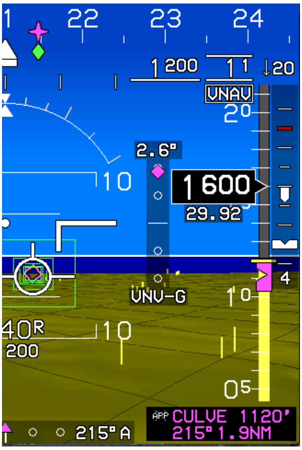
Figure 3-20: PFD Symbology (AW 109SP)

3.4.1. Minimum Altitude

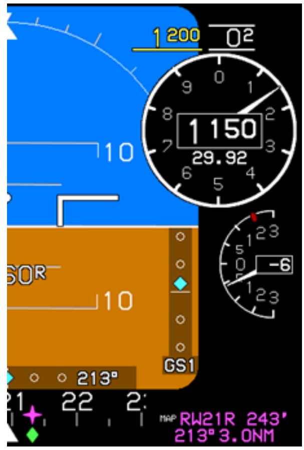
For the Tapes PFD, when a minimum altitude is selected (in 10-foot increments), a bug in the form of a bold amber (yellow) bar is displayed in the appropriate position on the altitude tape and below in amber (yellow). The minimum altitude setting is indicated above the altitude tape with a line drawn below. In Figure 3-20, 1200' MSL is set. Minimum and target altitude/VNAV altitude bugs may be used simultaneously. For Round Dials PFD, minimum altitude is set as stated above but turns yellow and flashes when the aircraft descends below the minimum altitude setting.

Audible Annunciation

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



Other Rotorcraft
(Tapes)

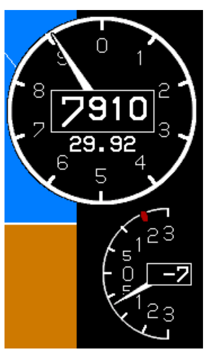


Other Rotorcraft
(Round Dials)

Figure 3-21: Minimum Altitude

3.4.2. Vertical Speed Indicator

Tapes



Round Dials

Other Rotorcraft

AW-109SP

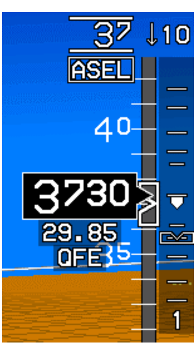
Figure 3-22: VSI

A vertical speed indicator (VSI) is located to the right of the altitude box. The VSI is depicted in a "worm" format and provides analog and digital representation of VSI in feet per minute. The VSI worm grows in proportion to the square root of the vertical speed so a change near 0 feet per minute displaces the worm to a much greater degree than an equivalent change at a larger feet-per-minute value. Readouts of vertical speed rounded to the nearest 100 feet per minute appear above the VSI scale (for climbs) or below the VSI scale (for descents).

Table 3-2: Scale Graduations and Display

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

The AW-109SP VSI includes a Vertical Speed Bug Datum bug geometrically interacting with the VSI pointer annunciated above the VSI scale with a resolution of 100 feet per minute. This value is magenta with an arrow of the same color pointing in the direction of the Vertical Speed Datum. This bug is filled-magenta at all times. For enhanced night visibility, the background of the Vertical Speed Datum Bug value annunciation is blacked-out.



The pilot-selectable VSI bug setting (100’ FPM resolution) in this example is set to 1000 FPM descent rate.

The vertical speed bug is 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.

Figure 3-23: VSI Bug

When vertically integrated with an autopilot, the VSI bug setting annunciation is green with the speed bug filled-white when in VSI climb or descent mode. Otherwise, the VSI bug setting is white, and VSI bug is hollow-white.

Figure 3-24: VSI Bug (Vertically Integrated)

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

3.4.3. Vertical Speed Indicator (Round Dials)

A vertical speed indicator (VSI) is located below the altitude display. The scale of the VSI limits is as described for the tapes vertical speed indicator.

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

Figure 3-25: Vertical Speed Indicator (Round Dials)

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

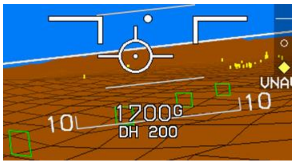
3.4.4. Normal AGL Indication

AGL altitude is displayed in two formats, at the bottom-center of the display above the Course Deviation Indicator (Normal) and as the (Analog) AGL Indicator. These are mutually exclusive of each other and driven by the AGL altitude source used for TAWS but not displayed when the source is invalid. Source indication appears to designate the source for either format as follows:

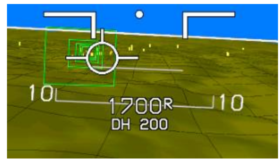
R = Radar altitude.

G = GPS/SBAS geodetic height less database ground elevation.

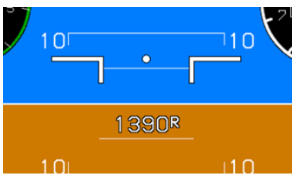
B = Barometric altitude less database ground elevation.



(SVS Basic) AGL Based on GPS Altitude (Tapes)



(SVS TAWS) AGL Based on Radar Altimeter (Tapes)



Normal AGL (Round Dials)

Figure 3-26: Normal AGL Indication

AGL indication designed behavior.

Table 3-3: AGL Indication

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

AGL altitude is not displayed in either format when it is greater than the radar altimeter maximum valid altitude but not displayed when it is invalid. Additionally, the AGL indication includes a display of the currently set decision height.

This is accompanied by "Decision Height" aural annunciation, and the decision height display and readout turn amber (yellow) and flash. (N/A AW-109SP)

3.4.5. Analog AGL Indication (Tapes only)

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

Figure 3-27: Analog AGL Indication

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

Table 3-4: Analog AGL Indicator

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

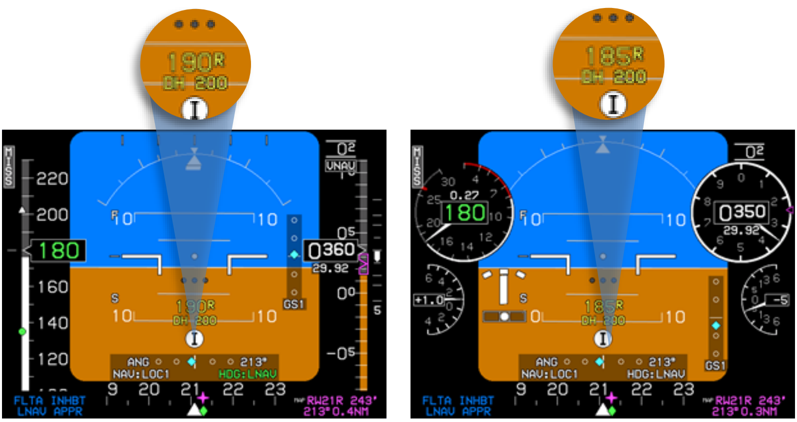
Table 3-5: Analog AGL Indicator Markings

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

Table 3-5: Analog AGL Indicator Markings

	Major Tick Marks	Minor Tick Marks
90’		✓
100’	✓	
200’		✓
300’		✓
400’		✓
500’	✓	
1000’	✓	

3.4.6. Decision Height



Basic Mode (Tapes) **Round Dials**

Figure 3-28: Decision Height

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

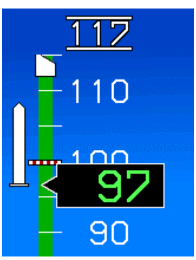
This is accompanied by a “Decision Height” aural annunciation, and decision height readout turns amber (yellow) and flashes. (N/A AW-109SP)

The Radar Height Readout is displayed on the PFD AGL altitude indication beneath the DH readout. The readout is magenta text "RHT" followed by magenta numerical text indicating the radar Height Bug. The AFCS communicates the Radar height to the EFIS.

Figure 3-29: AW-109SP Decision Height and Radar Height Readout

3.4.7. Airspeed Display (Tapes)

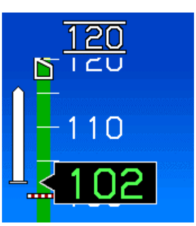
Airspeed is digitally displayed in same color as airspeed scale in knots, miles per hour, or kilometers per hour with interactive pointer. The airspeed scale is commensurate with the certification category of the aircraft.



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

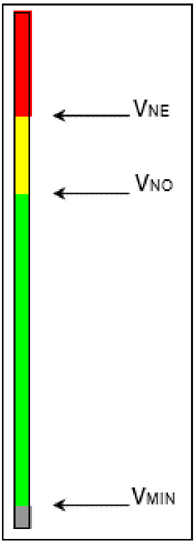
The airspeed scale range has at least 40-75 measurement units. During an ADC failure, a red "X" is displayed in place of the airspeed scale.

Figure 3-30: Airspeed Display



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

Figure 3-31: Airspeed Trend



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

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

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

Figure 3-32: Airspeed Scale FAR Part 27/29

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

Figure 3-33: Airspeed Scale Bug

The airspeed scale has a pilot-settable airspeed bug that is filled-white at all times and geometrically interacts with the airspeed box pointer, which is white. The airspeed bug is annunciated above the airspeed scale with a resolution of one knot indicated airspeed used only as a visual reference and is mutually exclusive with the vertical speed bug.

When the airspeed bug setting differs from aircraft airspeed to the extent the airspeed bug is off-scale, the airspeed bug appears to be “parked” in the direction of the difference with half of the airspeed bug visible as seen in Figure 3-33.

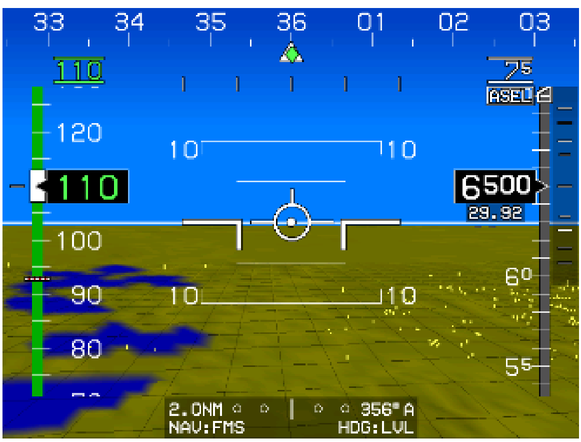
Table 3-6: Airspeed Bug Limits

Low end	**High end**
VMIN	Red-line ($\mathbf{V_{NE}}$)

Table 3-7: Airspeed Bug Setting Annunciation and Bug Colors

	Vertically Integrated Autopilot	
	Without	**Without**
Airspeed bug setting annunciation color	White at all times	Green when in airspeed climb or descent mode otherwise white
Airspeed bug	Filled-white at all times	Filled-white when in airspeed climb or descent mode otherwise hollow-white

3.4.8. Airspeed Display (With EFIS-Coupled)



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

Figure 3-34: Airspeed Display (with EFIS-Coupled) (Tapes)

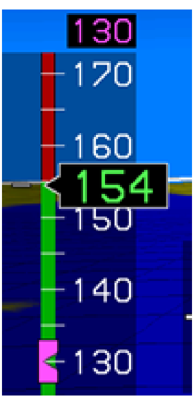
3.4.9. Airspeed Display (Round Dials)

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

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

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

3.4.10. AW-109SP Airspeed Display



The airspeed scale includes an Airspeed Datum Bug, which geometrically interacts with the airspeed box pointer and is magenta-filled.

When limited at the edge of the airspeed scale, the bug is cropped. The Airspeed Datum readout is annunciated in magenta above the airspeed scale with a resolution of 1 KIAS.

Figure 3-36: Airspeed Display (AW-109SP)

When either engine is failed, a red and white barber pole is displayed at $\mathbf{V_{NE}}$ on the airspeed scale. Between $\mathbf{V_{MIN}}$ and 0 knots, the background color of the airspeed scale is amber (yellow), but the text of the Airspeed Readout remains gray. In approach mode, groundspeed is displayed immediately below the airspeed box with a gray-shaded background. For night visibility, the Airspeed Scale background is gray-shaded, and the Airspeed Datum Readout background is blacked-out.

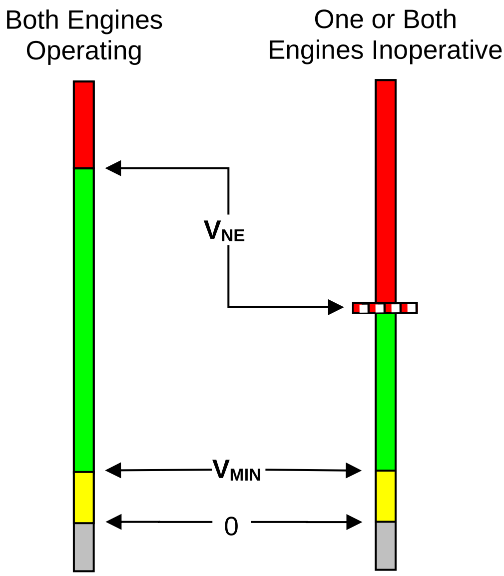


Figure 3-37: Airspeed Scale (AW-109SP)

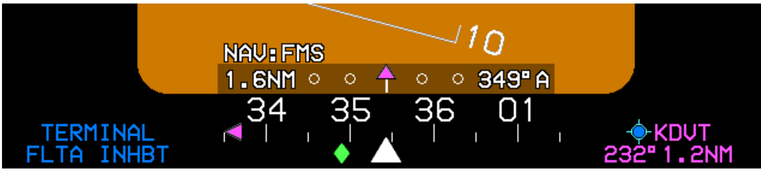
3.4.11. Dynamically Calculated V_{NE}

V_{NE} has two different subcategories, which are **V_{NE}** with retractable landing gear, and **V_{NE}** with fix extended landing gear. **V_{NE}** is dynamically determined based on outside air temperature, altitude, engine status, and landing gear status. (See AW-109SP Rotorcraft flight manual for **V_{NE}** calculation and corrections based outside air temperature, altitude, engine status, and landing gear status.)

3.4.12. 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, at an aircraft roll angle of zero, they approximately conform to the 3-D PFD background. The heading scale includes a triangular white heading pointer aligned with the longitudinal axis of the aircraft with a slip indicator.

Tapes



Basic Mode and Round Dials

Figure 3-38: Heading Display

An integral slip indicator is provided and may replace the mechanical slip indicator mounted in the bezel. The slip indicator is a rectangle just below the heading pointer that moves left and right to indicate the lateral acceleration sensed by the AHRS in the same manner as the ball in a mechanical slip indicator. The integral slip indicator is responsive to lateral (Y-axis) G-force (the slip indicator is the white rectangular part of the heading pointer) and is damped, so it approximately matches a conventional glass vial indicator.

When the AHRS is in DG mode, the DG symbol appears as shown here.

Figure 3-39: DG Indicated when AHRS in DG Mode

Figure 3-40: Slip/Skid Indicator (Tapes only)

The heading scale has a green, diamond-shaped track pointer aligned with the aircraft's track across the earth. When the aircraft's track is displaced from aircraft heading beyond the boundaries of the PFD screen, the track pointer is drawn at the limit of the heading scale in the direction of the displacement, and the aircraft track value is displayed in a solid green box above the track pointer as seen in Figure 3-41. The track pointer is not displayed when indicated airspeed is in the noise range (when indicated airspeed or groundspeed is less than 20 KIAS).

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

Figure 3-41: Displaced Heading Bug (Tapes)

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

3.4.13. Heading Display (AW-109SP)

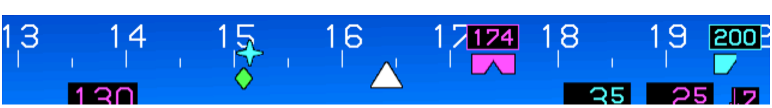


Figure 3-42: Heading Display (AW-109SP)

The heading scale includes a Heading Datum Bug and Heading Preselect Bug geometrically interacting with the heading pointer. The Heading Datum Bug is filled-magenta, and the Heading Preselect Bug is filled-cyan. When commanded by the AFCS or a heading bug is limited at the edge of the heading scale, a digital readout is displayed above the bug. When the two bugs overlap, the Heading Datum Bug is on top of the Heading Preselect Bug. When either heading bug is limited at the edge of the heading scale, the bug is cropped. If both bugs are limited at the edge of the heading scale in the same direction, the Heading Preselect Bug is offset inward so both bugs are visible. When an active waypoint exists, the color of the star-shaped waypoint pointer or the triangular arrow indicating the direction of an off scale waypoint is determined using Table 3-11.

3.4.14. Pitch Scale

Figure 3-43: Pitch Scale

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

The pitch scale and double width horizon line, which rotates in conjunction with the background according to the aircraft's roll angle, have increments every 5° with major increments and pitch scale labels every 10°. Increments are equally spaced to approximately conform to the 3-D PFD background. Pointer bars at the ends of each major increment indicate the direction to the horizon and automatically declutter to present the fewest possible increments needed to unambiguously display pitch attitude. The pitch scale terminates with a zenith symbol (small white circle) at +90° and a nadir symbol (small white circle with "+") at -90°.

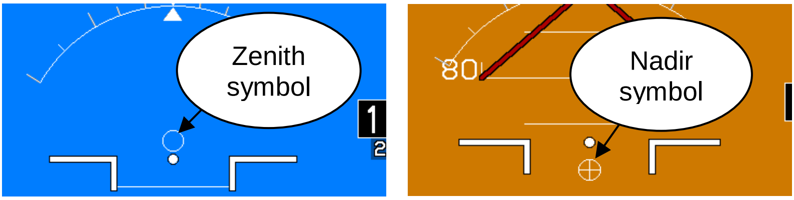
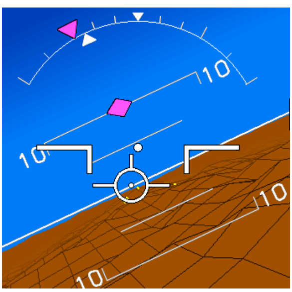


Figure 3-44: Pitch Scale Zenith and Nadir Symbols

The PFD has Large Aircraft Symbol Reference Marks fixed in the center of the display. Rotation of the background, pitch scale, and background oriented display elements occur relative to the location of the Large Aircraft Symbol Reference Marks.

3.4.15. Pitch and Roll Scale (AW-109SP)



The Roll Datum Bug is a magenta equilateral triangle moving along the roll scale to indicate the AFCS commanded roll datum. When the AFCS communicates roll datum to the EFIS, the Roll Datum Bug is filled-magenta.

Figure 3-45: Pitch and Roll Scale (AW-109SP)

The Pitch Datum Bug is a magenta diamond, which moves along the Pitch Scale to indicate the AFCS commanded pitch datum. When the AFCS communicates pitch datum value to the EFIS, the Pitch Datum Bug is filled-magenta; otherwise, it is hollow-magenta.

3.4.16. Turn Rate Indicator (Tapes only)

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

Figure 3-46: Turn Rate Indicator

3.4.17. Unusual Attitude Mode

Unusual Attitude Mode is enabled when the pitch attitude exceeds +30° or -30° or bank angle exceeds 50°. 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) aid in unusual attitude recovery and are a normal part of the pitch scale and are not necessarily tied to unusual attitude mode.

Tapes

Round Dials

Figure 3-47: Unusual Attitude Mode

NOTE:

The recovery chevrons are a normal part of the pitch scale but are not necessarily tied to unusual attitude mode.

The following features are disabled in unusual attitude mode:

1) Terrain and obstruction rendering
2) CDI
3) VDI
4) Flight Path Marker
5) Highway in the Sky boxes
6) Atmospheric perspective
7) Analog and digital AGL indication
8) Active Waypoint symbology
9) Mini Map
10) Traffic thumbnail
11) If in Basic Mode, PFD reverts to Normal Mode
12) If in Zoom mode FOV, PFD reverts to normal FOV
13) Runways

3.4.18. PFD Background

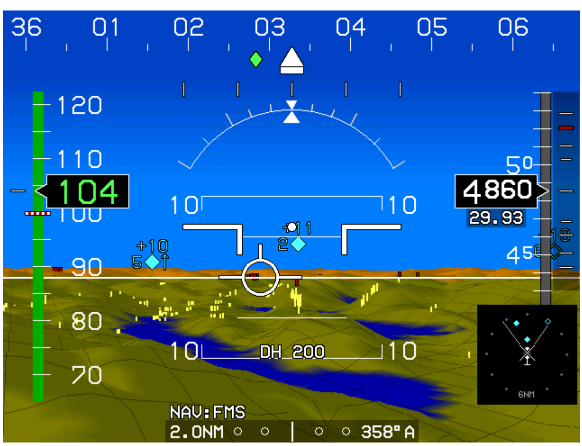


Figure 3-48: Rotorcraft PFD Terrain and Obstructions (Tapes)

The PFD has a 3-D background generated from terrain elevation and obstruction elevation data stored in electronic memory. The "actual horizon" displayed on the PFD is based upon the higher of terrain within 90NM or a horizon calculated using a visible horizon equation (e.g., horizon [NM] = 1.17 x sq. root alt in feet). Thus, the relative elevation of terrain and obstructions with respect to aircraft altitude and performance is observed by reference to the primary flight information pitch ladder and flight path marker.

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

Terrain and obstruction rendering uses hidden surface removal techniques, while terrain/sky rendering uses atmospheric perspective techniques. Terrain with obstruction rendering is collectively pilot-selectable to declutter the display (*independent declutter of obstructions is not possible*). Terrain and obstruction rendering is disabled in Basic Mode, Unusual Attitude Mode, and during any reversionary mode. In Unusual Attitude Mode, the blue-brown boundary line of the background decouples from the pitch scale at high pitch angles so a sliver of the blue-brown boundary line always remains visible to give guidance to the horizon.

The terrain ahead of the aircraft is shown conformally with the artificial horizon in the correct scale and perspective for the aircraft's current position and altitude. Worldwide terrain coverage is provided in each IDU and is shown with a resolution as shown in Table 3-8.

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

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

NOTE:

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

Table 3-8: LAT-LON Resolution Boundaries

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

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

Table 3-9: Terrain and Obstruction Rendering Levels

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

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.

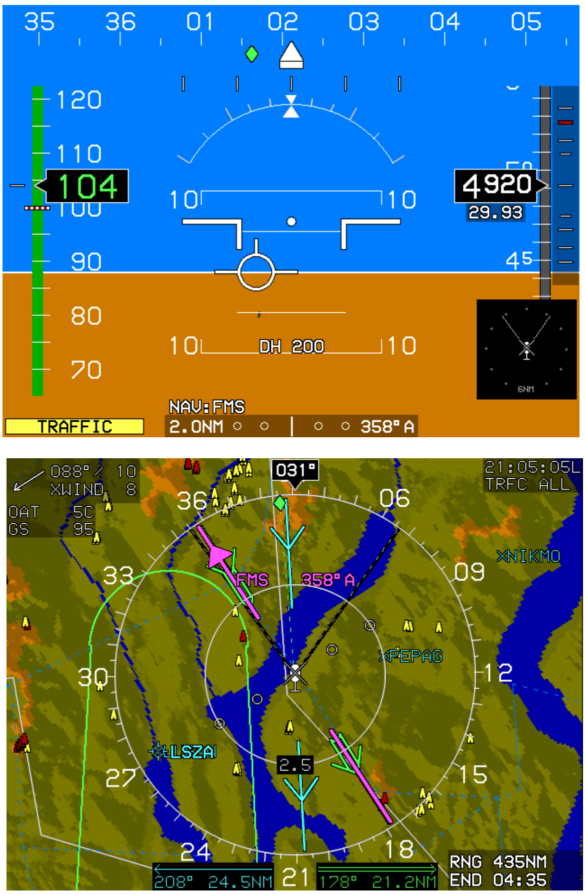


Figure 3-49: PFD with Terrain Deselected on PFD (Tapes only) and Selected on MFD

When terrain and obstruction rendering is deselected or disabled, the PFD background is a conventional blue over brown attitude display presentation without atmospheric perspective. Additionally, terrain may be deselected on the PFD and retained on the ND MAP display as seen in Figure 3-49.

Towers, antennas, and other obstructions such as buildings and manmade structures are shown on the PFD display as vertical amber (yellow) lines. Obstructions are conformal in location and size and only shown in conjunction with terrain regardless of altitude. Obstructions representing a collision hazard are annunciated aurally and with a caution or warning flag. Obstructions causing TAWS alarm are depicted as a flashing amber and red triangle. All vertical amber (yellow) lines in the Figure 3-50 are obstructions.

Audible Annunciation

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

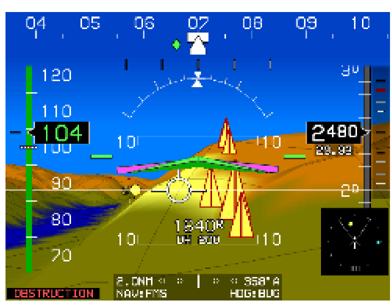
WARNING:

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

NOTE:

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

Obstructions without Hazardous Condition



Obstructions Creating an OBSTRUCTION Warning

Figure 3-50: PFD with Obstructions (Tapes only)

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

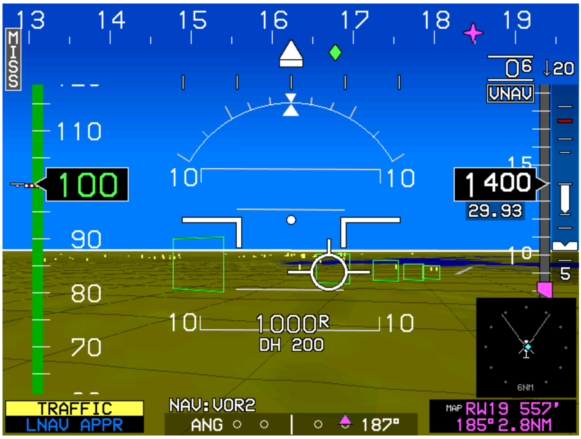
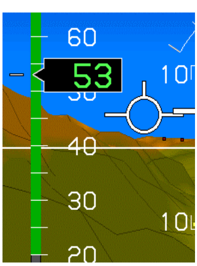
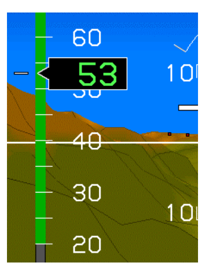


Figure 3-51: Flight Path Marker (Tapes only)

The flight path marker appears at a location on the background to coincide with the aircraft's actual flight path as projected upon the outside world and is referenced to the Large Aircraft Symbol Reference Marks. The Reference Marks are centered on the display and laterally displaced parallel to the horizon with respect to the center of the display to account for the difference between aircraft track and heading and are vertically displaced perpendicular to the horizon to account for aircraft climb or descent angle. Because the flight path marker is used in conjunction with a 3-D background, the flight path marker utility normally associated with a HUD is achieved.



Flight Path Marker nearing Airspeed tape due to strong crosswind



Flight Path Marker removed due to excessive crosswinds from the right

Figure 3-52: Flight Path Marker Views (Tapes only)

When the location of the flight path marker is displaced to the extent it would interfere with heading, altitude, or airspeed indications, it is removed from the display as seen in Figure 3-52 with increasing crosswind from the right side.

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.

Figure 3-53: Flight Path Marker Absent (Unusual Attitude Mode) (Tapes only)

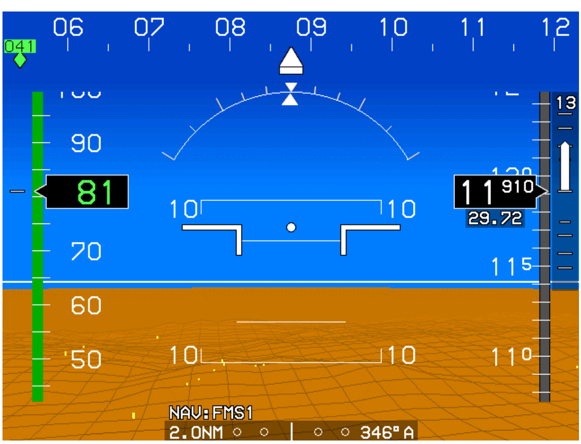


Figure 3-54: PFD with Flight Path Marker Removed (Tapes only)

In Unusual Attitude Mode, the flight path marker disappears to allow the pilot to concentrate on the Large Aircraft Symbol Reference Marks for unusual attitude recovery. In reversionary mode 1 (GPS failure), the flight path marker changes to a light gray color after one minute to indicate degraded performance (Figure 3-55).

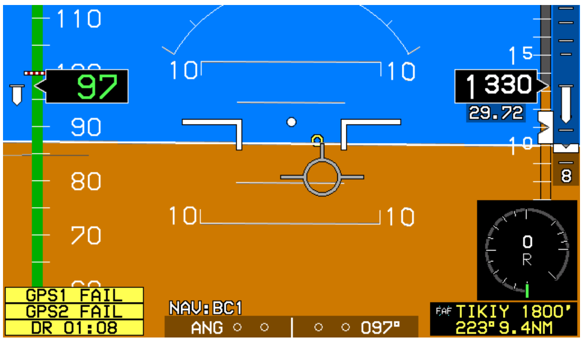
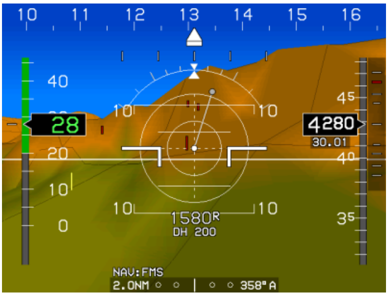


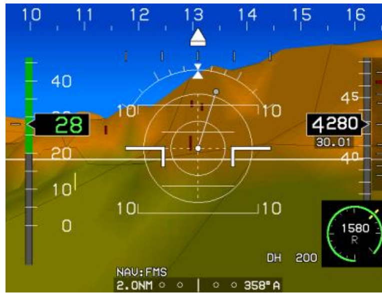
Figure 3-55: PFD with GPS Failure after 1 Minute (Tapes only)

3.5. Hover Vector (Tapes only)

Flight path marker is removed at low speed, <30 knots groundspeed, and replaced with hover vector symbology. The hover vector indicates direction and groundspeed of drift at low groundspeeds (when lower than 30 IAS) consisting of Large Aircraft Symbol Reference Marks, an inner concentric ring indicating ten knots groundspeed, an outer concentric ring indicating 20 knots groundspeed, and a vertical and horizontal dashed line passing through the center extending to the outer ring. The white dot of the Large Aircraft Symbol Reference Marks indicates 0 knots groundspeed and is the center for the concentric rings. A gray dot equal in size to the white dot and connected to the white dot by a white line floats over the concentric ring area to indicate direction and magnitude of drift in a gods-eye view. Deviation of the dot in a straight up direction (12 o'clock position) indicates forward flight while straight down (6 o'clock position) indicates rearward flight. Deviation of the dot laterally indicates lateral drift in that direction. The movement of the dot is constrained to less than five knots per second to prevent jumpiness. The example above shows drift, forward and slightly to the right (1 o'clock position) at 20 knots groundspeed. (See § 3.26.4 for full Hover Vector symbology with Hover page selected on MFD.)



AGL Indicator (Normal)



AGL Indicator (Analog)

AW-109SP (Normal)

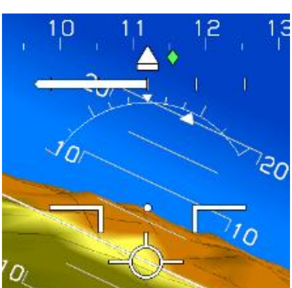
AW-109SP (Analog)

Figure 3-56: PFD Hover Vector Symbology (Tapes only)

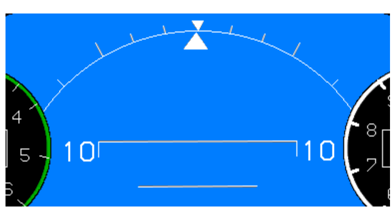
NOTE:

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

3.6. Bank Angle Scale (Tapes)



Tapes



Round Dials

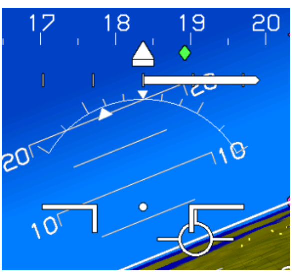
Figure 3-57: Bank Angle

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

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

When decluttering is not selected, the bank angle scale and sky pointer appear full time with level, 10°, 20°, 30°, 45°, and 60° marks on left and right sides. The bank angle scale and roll pointer are centered upon the Large Aircraft Symbol Reference Marks (Basic Mode or Unusual Attitude Mode). In Round Dial configuration, the bank scale cannot be decluttered.

3.6.1. Turn Indication (Tapes only)



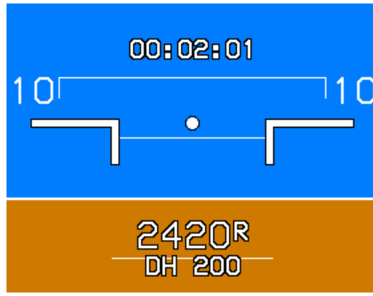
Rate of turn is available as an option in the PFD Declutter menu to show a worm in the direction of turn with full scale deflection indicating a standard rate of turn and half standard rate indicated at the mid-scale marking.

Figure 3-58: Turn Indicator

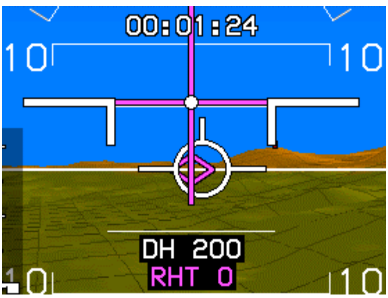
3.7. Timer Indication

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

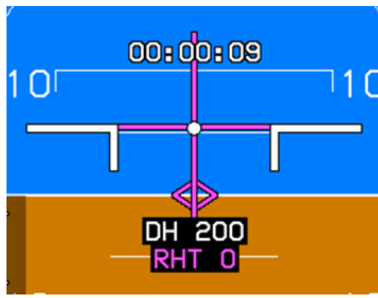
Other Rotorcraft



Other Rotorcraft Basic Mode (or Round Dials)



AW-109SP

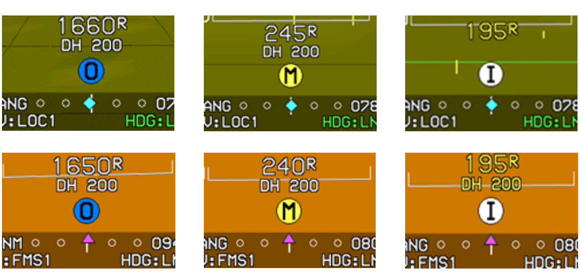


AW-109SP Basic Mode

Figure 3-59: Timer

3.8. Marker Beacon Symbology

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



Tapes

Basic Mode and Round Dials

Figure 3-60: Marker Beacons

3.9. Flight Director Symbology (Tapes, Basic, Round Dials)

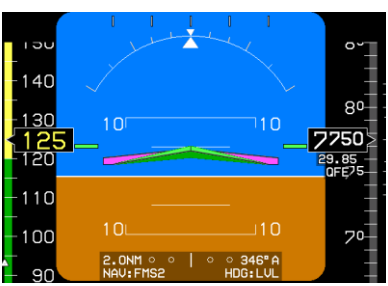
The Flight Director Symbology is pilot-selectable through controls on the IDU or integrated autopilot/flight director equipment. When selected, Flight Director Symbology and valid steering commands are received from the Flight Director with one of the following symbols shown in the Normal Mode.

The PFD has a waterline symbol fixed in the center of the display. Rotation of the background, pitch scale, and background oriented display elements occur relative to the location of the waterline symbol or Large Aircraft Reference Marks.

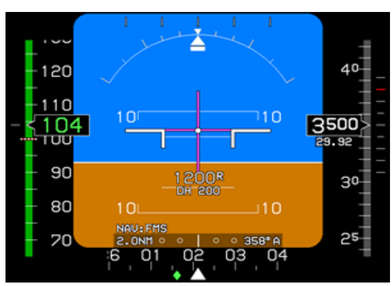
FD1 Single Cue (Tapes)

FD2 Dual Cue (Tapes)

Figure 3-61: Rotorcraft Flight Director (Tapes)



FDI Single Cue (Basic Mode)



FD2 Dual Cue (Basic Mode)

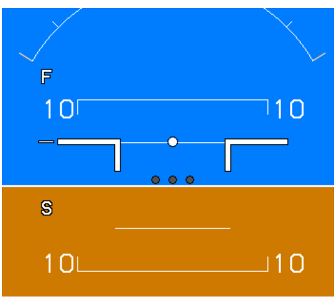
Figure 3-62: Rotorcraft Flight Director (Basic Mode)

FDI Single Cue (Round Dials)

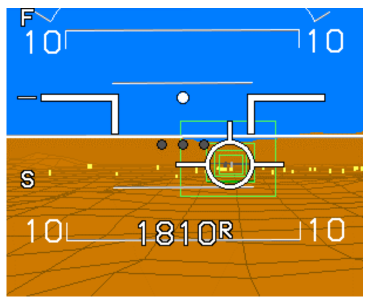
FD2 Dual Cue (Round Dials)

Figure 3-63: Rotorcraft Flight Director (Round Dials)

3.10. Landing Gear Indication



Basic Mode (Tapes)



Normal Mode (Tapes)

Round Dials

Figure 3-64: Landing Gear Indication

If configured, the PFD displays landing gear position as small "tires" below the Flight Path Marker Large Aircraft Symbol Reference Marks (rotorcraft and Basic Mode). The landing gear position display is driven by discrete inputs configured in the aircraft limits as landing gear discretes.

3.11. Course Deviation Indicator

Tapes

Round Dials

Figure 3-65: Course Deviation Indicator

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

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

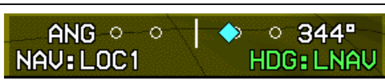
2) Automatic RNP: These are based upon RNP values, which are coded in the navigation database. The EFIS looks at the leg coding on all legs other than those on the Final Approach Segment. On the Final Approach Segment, the EFIS looks at the "Level of Service" record for those approaches, which have RNP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

3) Default TSO-C146C Operation: As specified as per Table 3-10 for enroute, terminal, and various approach modes according to the "Level of Service" record.

Table 3-10: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
Full Scale Deflection	Flash
When Slaved to GPS/SBAS	Scale is appropriate FSD value for mode of flight: **Enroute**: ±2NM **From Enroute to Terminal**: Change from ±2 NM FSD to ±1 NM FSD over distance of 1 NM; start transition when entering terminal mode. **From Terminal to Enroute**: Change from ±1 NM FSD to ±2 NM FSD over distance of 1 NM; start transition when entering enroute mode. **From Terminal to Approach**: If VTF, switch immediately. Otherwise, change from ±1 NM FSD to approach FSD over distance of 2 NM; start transition at 2 NM from FAWP. **From Approach to Terminal**: Change to ±1 NM. **From Departure to Terminal**: If initial leg is aligned with runway, change from ±0.3 NM FSD to ±1 NM FSD at the turn initiation point of the first fix in the departure procedure.
When Slaved to GPS/SBAS (with GPS Loss of Navigation)	Amber (Yellow)
Normal conditions	Magenta

Table 3-10: CDI Behavior and Color

CDI Pointer and Condition	Color or Behavior
In sources other than FMS	Angular scale annunciation
Navigation source is Localizer (Course error exceeds 105°)	Reverse sensing
When lateral deviations are in a failed state	Red "X" displayed over CDI
EFIS not coupled with autopilot	
	Selected NAV source FMS2
	Selected NAV source VOR1
	Selected NAV source VOR2
EFIS coupled system with autopilot	
	Holding the wings level*
	Tracking HDG BUG**
	LNAV in ARM mode**
	LNAV captured**

Notes: *No positive autopilot feedback

**Positive autopilot feedback

NOTE:

When outside the approach region of operation and neither a manually entered nor automatic RNP value exists, system operation defaults to GPS/SBAS operation as specified in RTCA/DO-229D.

3.12. Course Deviation Indicator (AW-109SP)

The Course Deviation Indicator displays the course deviation for the selected Primary NAV Source. The Primary NAV Source drives the indicated course deviation and is annunciated just above the CDI scale. Annunciation is either **FMS**, **FMS1**, **FMS2**, **VOR1**, **LOC1**, **BC1**, **VOR2**, **LOC2**, or **BC2** (“BC” is annunciated instead of “LOC” when course error exceeds 105°). For VOR, the bearing and DME are annunciated next to the primary NAV source above the CDI. For LOC or BC, the DME is annunciated next to the primary NAV source above the CDI. If a DME channel is in hold mode, the associated distance readout is displayed in amber (yellow), and the letter “H” is shown to the right of the distance readout. The Course Deviation Indicator is displayed when a MOT flight pattern is displayed.

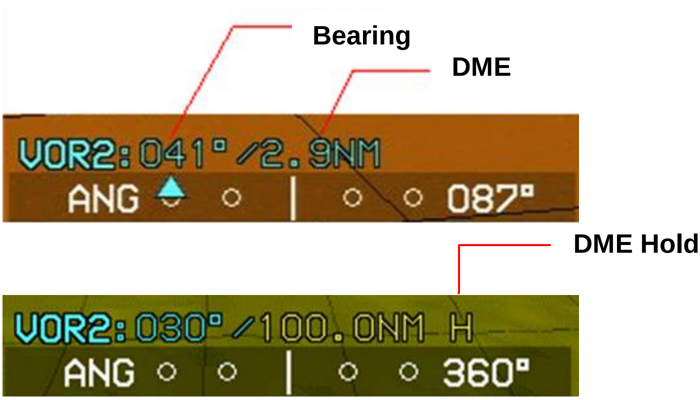


Figure 3-66: Course Deviation Indicator (AW-109SP)

Table 3-11: AW-109SP Lateral Navigation Color Logic

Type of Indicator	Color	Notes
Primary source FMS1 Or FMS2	Amber (Yellow)	During Loss of Navigation Caution
Side in Command and Side Not in Command	Magenta	If FMS1 or FMS2 and either the AFCS engaged, lateral Nav Mode is NAV, and the EFIS is in LNAV mode, or the AFCS engaged lateral Nav Mode is NLOC.

Table 3-11: AW-109SP Lateral Navigation Color Logic		
Type of Indicator	**Color**	**Notes**
Primary source is not FMS (VLOC1 or VLOC2)	Magenta	AFCS engaged lateral navigation mode is VOR, LOC, TCN, VAPP, or BC
	Cyan	All other cases

3.12.1. OBS Setting of CDI

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

1) NAV: **FMS1**
2) NAV: **FMS2**
3) NAV: **VOR1**
4) NAV: **LOC1**
5) NAV: **BC1** (annunciated instead of LOC1 when course error exceeds 105°)
6) NAV: **VOR2**
7) NAV: **LOC2**
8) NAV: **BC2** (annunciated instead of LOC2 when course error exceeds 105°)

3.12.2. Heading/Roll-Steering Sub-Mode

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

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

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

In an installation without an autopilot or with a fully-integrated autopilot (e.g., HeliSAS-E), the heading/roll-steering sub-mode annunciation is not meaningful and should be decluttered from the CDI display. Therefore, the shaded background of the CDI only falls behind the CDI scale. An abbreviated navigation source annunciation (without “NAV:”) appears above the top left corner of the CDI scale. The heading/roll-steering sub-mode annunciation does not appear, as it is not required with autopilot mode annunciations or when an installation does not include an autopilot.

Without Autopilot **With HeliSAS-E**

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

3.13.1. Vertical Deviation Indicator

The PFD has a vertical deviation indicator on the right side to display vertical deviation for the currently selected vertical navigation source for displaying descent profile. When the selected vertical navigation source is FMS, the vertical deviation indicator conforms to the vertical deviation display requirements of the GPS/SBAS requirements. The vertical deviation indicator only appears when the source of vertical navigation is valid. When the source of vertical navigation is FMS (either LPV or VNAV modes), the source is valid if on VNAV descent segments when approaching the Top of Descent point to provide descent anticipation as long as the following are true:

1) The aircraft is within 2NM or twice the full scale deflection for the mode of flight (whichever is greater) of the lateral navigation route; AND

2) The aircraft is in TO operation relative to the active VNAV waypoint (i.e., taking into account VNAV offsets); AND

3) If on the final approach segment, the aircraft is within a 35° lateral wedge of the azimuth reference point (the GARP or MAWPT + 10,000 ft.).

Table 3-12: Vertical Deviation Indicator Behavior

Source (Below the VDI)	**Behavior/Condition**	**Pointer Color**
FMS	Conforms to the VDI display	Magenta
Glideslope	Source must be valid when a valid glideslope is received.	Magenta
LPV or VNAV mode	Source is valid if: On VNAV descent segments when approaching the Top of Descent point so as to provide descent anticipation as long as the following are true: 1) On VNAV descent segments; OR 2) If the vertical deviations on VNAV level segments option is enabled, on VNAV level segments; OR 3) If the vertical deviations on VNAV level segments option is disabled, when approaching the Top of Descent point to provide descent anticipation; Providing: 1) The aircraft is within 2NM or twice the full scale deflection for the mode of flight (whichever is greater) of the lateral navigation route; AND 2) The aircraft is in TO operation relative to the active VNAV waypoint (i.e., taking into account VNAV offsets); AND	Magenta

Table 3-12: Vertical Deviation Indicator Behavior

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

Vertical deviation indicator disappears in Unusual Attitude Mode.

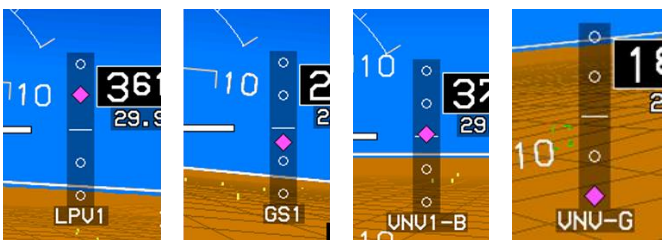


Figure 3-68: Vertical Deviation Indicator

1) **LPV Mode and LPV1 or LPV2**: When descending on the final approach segment in LPV mode. GPS Altitude utilized to generate VDI, pilot may follow guidance to LPV minima regardless of temperature.

2) **LNAV Mode and VNAV1-G or VNAV2-G**: When descending on the final approach segment in LP, LNAV/VNAV, and LNAV or RNP modes when using GPS VNAV. GPS Altitude utilized to generate VDI, pilot may follow guidance to LNAV minima regardless of temperature.

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

4) **GS1 or GS2**: Glideslope receiver #1 or #2 as indicated. Pilot follows guidance to published Barometric DH.

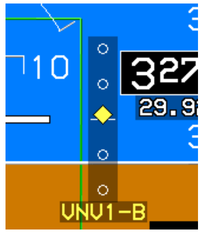
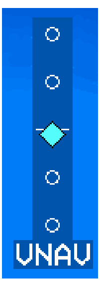


Figure 3-69: Vertical Deviation Indicator Color during GPS/SBAS LON or VLON

3.13.2. Vertical Deviation Indicator (AW-109SP)



Color of the Vertical Deviation Indicator is determined using Table 3-13. The VDI is not displayed when a MOT flight pattern is being displayed.

Figure 3-70: Vertical Deviation Indicator Color (AW-109SP)

Table 3-13: AW-109SP Vertical Deviation Color Logic

Type of Indicator	Color	Notes
Primary source FMS1 or FMS2	Amber (Yellow)	During loss of navigation caution
Side in Command and Side Not in Command	Magenta	1) If FMS1 or FMS2 and either the AFCS engaged vertical Nav Mode is VNAV and the EFIS is in VNAV Submode tracking the VNAV descent control law; or

Table 3-13: AW-109SP Vertical Deviation Color Logic

Type of Indicator	Color	Notes
		2) AFCS engaged vertical navigation mode is NGS; or 3) AFCS engaged vertical navigation mode is NGA
	Cyan	In all other cases from above
Vertical Deviation Indicator	Magenta	Color for the side not in command is magenta if the primary navigation source of the side not in command is same as the primary navigation source of the side in command and the AFCS engaged vertical navigation mode is GS.
	Cyan	All other cases

3.13.3. Vertical Deviation Indicator (EFIS Coupled)

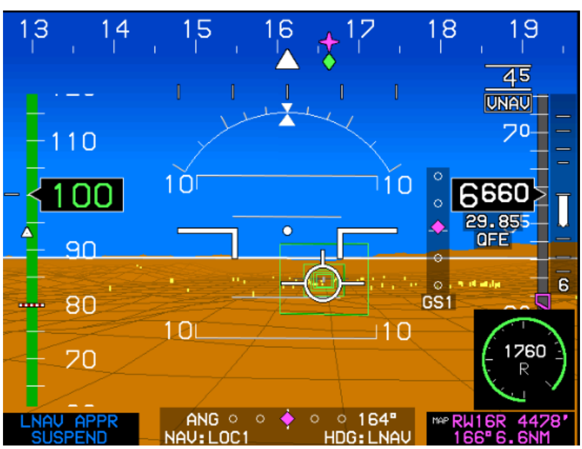
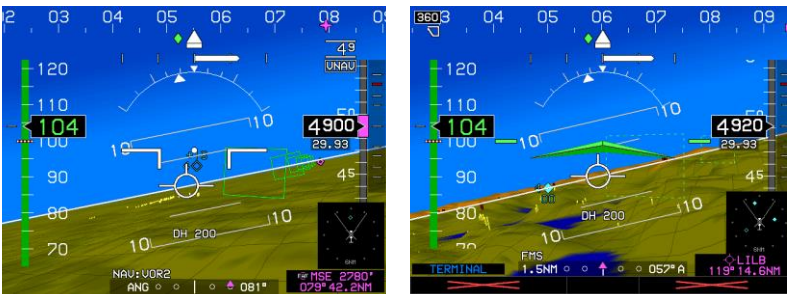


Figure 3-71: EFIS Coupled Vertically with Glideslope Mode Engaged

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 is green indicating the autopilot is vertically coupled to the selected vertical navigation source. Otherwise, the selected vertical navigation source is white.

3.13.4. Highway in the Sky/Skyway (Tapes)



Coupled **Uncoupled**

Figure 3-72: Highway in the Sky

3.13.5. Highway in the Sky (AW-109SP)

The Highway in the Sky boxes are dashed if the autopilot is not coupled to the displayed flight plan (either FMS or MOT). Coupling is indicated using the same logic as lateral navigation.

Figure 3-73: Highway in the Sky (AW-109SP)

3.13.6. Active Waypoint and Waypoint Identifier

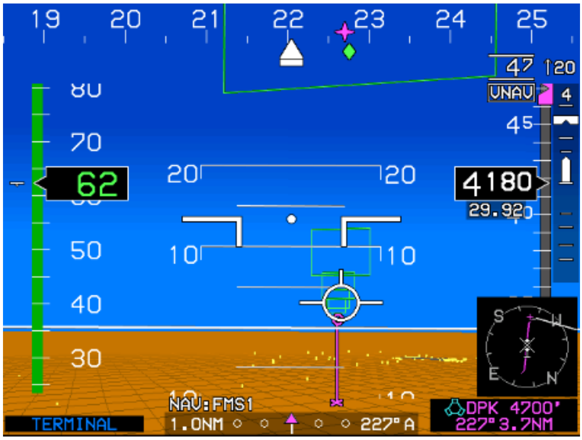
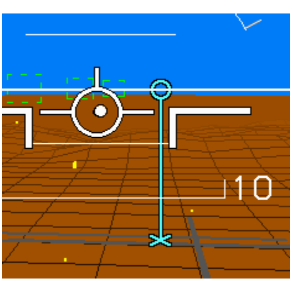


Figure 3-74: Active Waypoint

The active waypoint symbol is displayed as a magenta "tethered balloon" consisting of an "X" depicted at the ground location of the active waypoint, a hoop or "tethered balloon" (fly-over waypoints) or "tethered diamond" (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 (e.g., terminal and enroute fixes). The active waypoint symbol is drawn using the hidden surface removal techniques of the terrain and obstruction rendering so an active waypoint behind terrain appears to be so. The active waypoint symbol disappears in Unusual Attitude Mode but turns amber (yellow) in the event of GPS Loss of Navigation caution.



Color of the active waypoint symbol is determined using the Lateral Navigation Color Logic on Table 3-11.

Figure 3-75: Active Waypoint (AW-109SP)

The identifier of the waypoint along with the bearing and distance to the waypoint is displayed in the lower right corner of the PFD in magenta. If a target altitude is not set and the active waypoint has a VNAV altitude associated as the example above, the identifier includes a display of the VNAV altitude.

NOTE:

Only the active waypoint is shown on the PFD display. Subsequent waypoints in a route are displayed sequentially as the current active waypoint is passed.

With terrain turned off, the active waypoint is always visible regardless of distance.

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

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

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

3.13.7. Mini Map (Other Rotorcraft) (Tapes only)

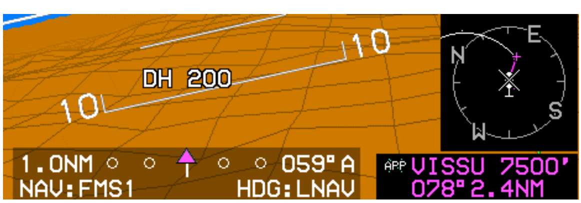


Figure 3-76: Mini Map

3.13.8. Mini Map and Active Waypoint Information Block (AW-109SP)

The color of the active leg of the navigation route and the active waypoint on the mini-map is determined using Table 3-11.

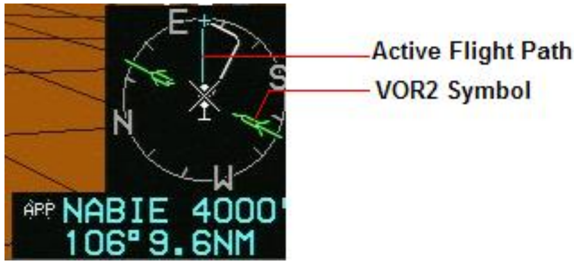
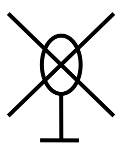
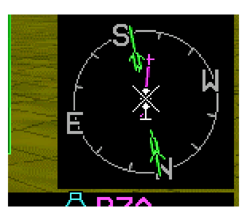


Figure 3-77: Mini Map and Active Waypoint Information Block (AW-109SP)

Table 3-14: Mini-Map Behavior (When not Decluttered)		
VOR Pointer, Active Leg, Ownship Symbol	**Color**	**Condition**
VOR 1	Cyan	When Valid
VOR 2	Green	When Valid
Active Leg (GPS/SBAS normal)	Magenta	
Active Leg (GPS/SBAS LON condition)	Amber (Yellow)	
Ownship symbol Rotorcraft 	White	
Mutually exclusive with the Analog AGL Indicator		
Mini-Map disappears in Unusual Attitude Mode		
Mutually exclusive with Traffic Thumbnail		

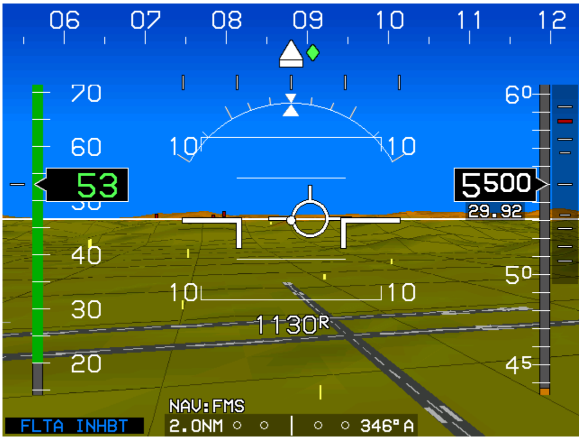
Cyan VOR #1



Green VOR #2

Figure 3-78: Mini Map VOR Symbology

3.13.9. Runways (Tapes only)



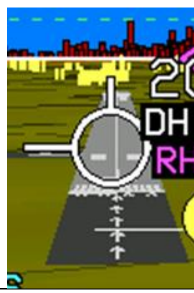
Runways (Other Rotorcraft)

Runways (AW-109SP)

Figure 3-79: Runways

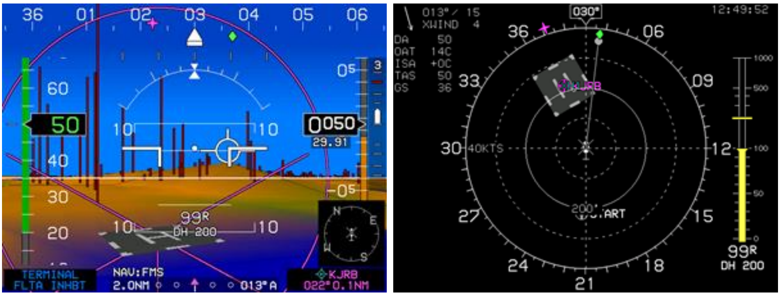
The PFD displays airport runways in a 3-D manner. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, the runways for the airport associated with the procedure are also displayed. In addition, the runways associated with the three nearest airports (as computed by the TAWS algorithms) are displayed. The runways are displayed using the hidden surface removal techniques of the terrain and obstruction rendering, so runways behind terrain appear to be so. Runways are 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, is shown in light gray. When the depiction of a runway is wide enough, runway markings, including aiming point markings, centerline, designation, and displaced threshold arrows, are shown as follows.

Table 3-15: Runway Drawing Criteria

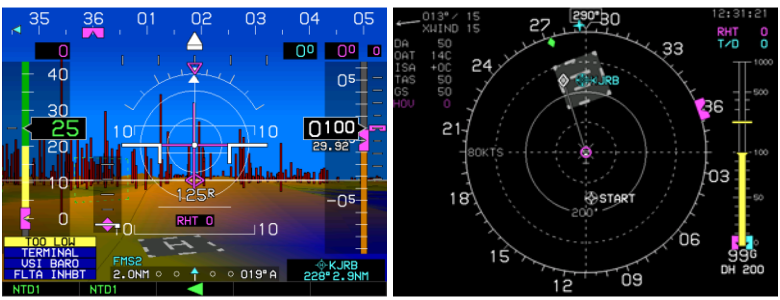
Feature	**Color**	**Notes**
Runway markings, aiming point markings, centerline, designation, and displaced threshold arrows	Dark gray 	According to characteristics from navigation database, e.g., including position, orientation, length, and width.
Runway markings	Medium gray 	
Landing portion of the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

3.13.10. Heliports

Heliports appear as distinguishable 150’ X150’ helipads with applicable markings as shown below.



Heliport (Other Rotorcraft)



Heliport (AW-109SP)

Figure 3-80: Helipads

3.13.11. AFCS Annunciations (AW-109SP)

Figure 3-81: AFCS Annunciations (AW-109SP)

The Collective, Longitudinal (pitch), and Lateral (roll) Engaged Annunciations are shown, in that order, with a black background at the bottom of the display. The current PFD symbology is adjusted to make room at the bottom of the display for these annunciations. To the right of each, the Collective, Lateral, and Longitudinal Armed Annunciations are displayed as shown in Figure 3-20.

When commanded by the AFCS, each engaged annunciation is displayed within an unfilled box. The box is either flashing green or amber (yellow). A green box has a 1Hz flashing 60% duty cycle for five seconds after AFCS request then off. An amber (yellow) box has a 1Hz flashing 60% duty cycle for five seconds after AFCS request then steady on as long as the request is maintained by AFCS.

When commanded by the AFCS, excessive deviation is indicated with a flashing amber (yellow) chevron displayed on either side of the annunciation box. The amber (yellow) chevron has a 1Hz flashing 60% duty cycle (0.6 seconds on and 0.4 seconds off).

3.13.12. PFD in Command Arrow (AW-109SP)

The PFD in Command arrow is a filled-green triangle in the middle of the autopilot annunciation bar pointing to the PFD in command of the AFCS.

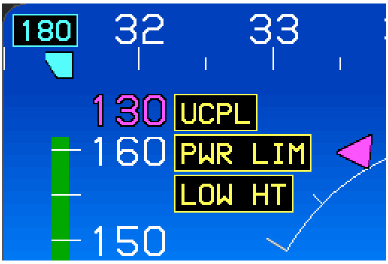
3.13.13. FMS LNAV and FMS VNAV Submode Annunciations (AW-109SP)

FMS LNAV and FMS VNAV Submode Annunciations are in the right-most portion of the autopilot annunciation bar. The Submode Annunciations are magenta. If the LNAV Submode is armed, the LNAV Submode annunciation is white.

Table 3-16: (AW-109SP) FMS LNAV and FMS VNAV Submode Annunciations

LNAV Annunciation	**Meaning**
----	LNAV Submode Failure Warning
HDG	Heading Submode Engaged
LNAV in white color	Heading Submode Engaged and LNAV Submode Armed
LNAV	LNAV Submode Engaged
VNAV Annunciation	**Meaning**
---	VNAV Submode Failure Warning
ALTA	Altitude Acquire Submode Engaged
VNAV	VNAV Submode Engaged

3.13.14. AFCS Caution Alert Messages (AW-109SP)



Order of precedence for AFCS caution alert messages:

1) UCPL
2) PWR
3) PIM
4) LOW HT

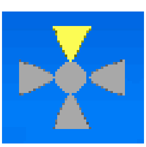
Figure 3-82: AFCS Caution Alert Messages (AW-109SP)

3.13.15. Link Fail Message (AW-109SP)

If no AFCS labels are present on either AFCS channel for one second, the EFIS displays a “LINK FAIL” Alert.

Figure 3-83: Link Fail Message (AW-109SP)

3.13.16. Cyclic Cue (AW-109SP)

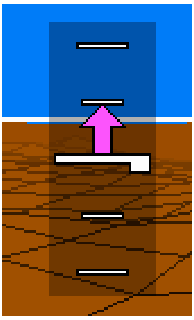


If commanded and controlled by the AFCS, the Cyclic Cue is displayed in the upper left of the PFD. The center circle is either gray or green as commanded by the AFCS. The outer triangles are either gray or amber (yellow) as commanded by the AFCS.

Figure 3-84: Cyclic Cue (AW-109SP)

3.13.17. Collective Cue and Symbol (AW-109SP)

The Collective Cue and Symbol indicate collective position and collective steering. The Collective scale consists of five white tick marks over a shaded background. The distance between tick marks represents a 25% change in value. The Collective Symbol is white. The Collective Symbol input has a range of 0% (bottom of the scale) to 100% (top of the scale).



The Collective Cue input has a range of -100% to +100%. The Collective Cue originates from the Collective Symbol and points upward to the extent of the value for positive values or points downward to the extent of the value for negative values. Maximum Collective Cue deflection is limited by the range of the scale. At Collective Cue values between -1 and +1 (i.e., no change in collective position being commanded), double arrows are displayed, one above the Collective Symbol and one below.

Figure 3-85: Collective Cue and Symbol (AW-109SP)

3.13.18. Horizon Synchronization (AW-109SP)

Figure 3-86: Horizon Synchronization (AW-109SP)

Horizon Synchronization functionality allows re-centering of the horizon during Cat A departures. When activated, it introduces an offset to pitch angle and is available for activation when all of the following conditions are met:

1) Cat A is enabled (airspeed<60KIAS);

2) Pitch attitude is valid;

3) No Pitch or Roll Miscompare Alert exists;

4) Pitch is in the range of +/- 11°; and

5) EFIS is not in unusual attitude mode.

When Horizon Synchronization is activated (engaged), it remains activated when pitch is greater than +/- 11° and less than or equal to +/- 30°. Horizon Synchronization is deactivated when any of the following is true:

1) Pitch attitude information is invalid;

2) Pitch and Roll miscompare Alert exists;

3) Pitch is greater than +/- 30°;

4) EFIS is in unusual attitude mode.

When Horizon Synchronization is activated, the horizon line is re-centered and two amber (yellow) reference marks are displayed at the actual horizon position. If Horizon Synchronization is manually or automatically deactivated, Horizon Synchronization mode is deactivated and the PFD and/or MFD displays return to normal.

3.14. MFD Screen requirements (AW-109SP)

3.14.1. ND Screen

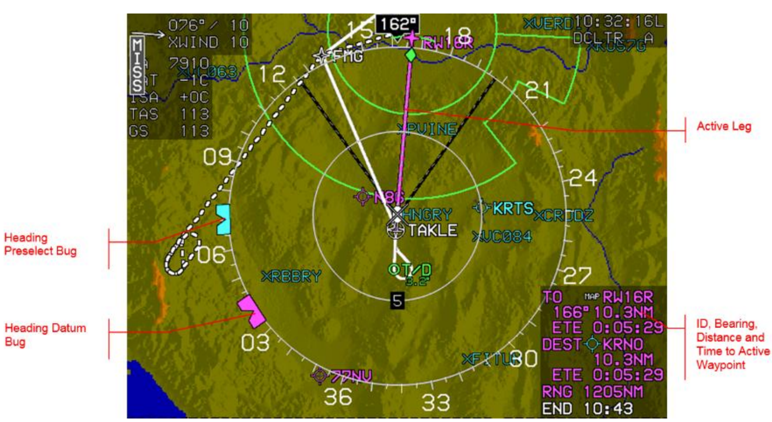


Figure 3-87: ND Screen (AW-109SP)

3.14.2. Compass Rose Symbols (AW-109SP)

The Compass Rose has a Heading Datum Bug and a Heading Preselect Bug shaped to geometrically interact with the present heading pointer symbol. The Heading Datum Bug is filled-magenta, and the Heading Preselect Bug is filled-cyan. When the two bugs overlap, the Heading Datum Bug is drawn on top of the Heading Preselect Bug.

3.14.3. HSI Overlay (AW-109SP)

The HSI Overlay also includes a NAV Preview display and when selected, the HSI overlay displays a NAV Preview Pointer indicating the NAV Preview selected course, deviation, and TO/FROM in a standard HSI format. The NAV Preview Pointer is a dashed cyan line to differentiate it from the Primary NAV Pointer. When the AFCS armed mode indicates BC, LOC, VAPP, TCN, or VOR, the NAV Preview pointer flashes with a 1Hz 60% duty cycle. This indicates the AFCS is about to switch from NAV mode to the armed mode and, upon switching, the armed mode uses the NAV Preview source as its Primary NAV source. The NAV Preview Pointer TO/FROM indicator is a solid white triangle. There is no deviation scale associated with the NAV Preview Pointer to avoid confusion with the Primary NAV Pointer deviation scale. NAV Preview source indication and OBS setting are displayed in the top center portion of the HSI overlay and are the same color as the NAV Preview Pointer.

3.14.4. Active Leg of Active Flight Plan Path/Active Waypoint/Manual Course (AW-109SP)

The color of the active leg in the flight plan path, active waypoint, and manual course line are determined using Table 3-11.

NOTE:

When a MOT flight pattern is displayed, the active leg includes all legs between the “From” and “To” waypoints.

3.14.5. Identifier, Bearing, Distance and Time to Active Waypoint (AW-109SP)

Color of the identifier, bearing, distance, and time to the active waypoint is determined using Table 3-11.

Figure 3-88: Identifier, Bearing, Distance and Time to Active Waypoint (AW-109SP)

NOTE:

When a MOT flight pattern is displayed, values are derived from the AFCS.

3.14.6. Swiss Grid (AW-109SP)

The Swiss Grid is a geographic coordinate system common in Switzerland and uses the geodetic datum CH1903. If the pilot selects Swiss Grid Mode, all displayed location parameters are converted from WGS 84 latitude, longitude, and MSL altitude to Swiss Grid X, Y, and Z for display.

CAUTION:

Swiss Grid should not be used outside of Switzerland.

Figure 3-89: Swiss Grid (AW-109SP)

When in Swiss Grid Mode, NavData information boxes display Swiss Grid Coordinates X, Y, and Z parameters instead of latitude and longitude. The display of elevation in feet MSL at the top of the NavData information box is retained regardless of mode.

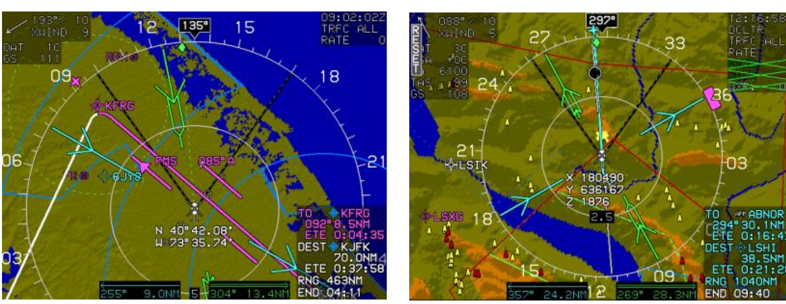
3.15. Analog Navigation Display Symbology

Navigation Display is presented in a variety of formats, including:

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

3.15.1. Basic Moving Map

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

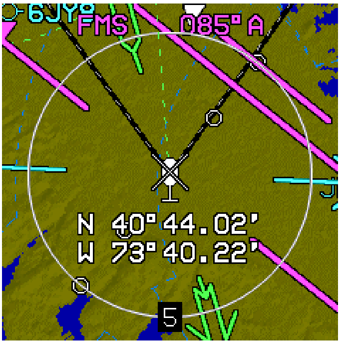


Other Rotorcraft **AW-109SP**

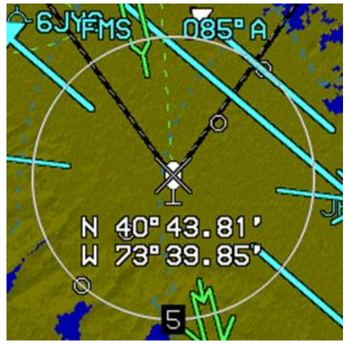
Figure 3-90: Basic Moving Map

NOTE:

When selected, latitude/longitude is displayed below the ownship symbol.



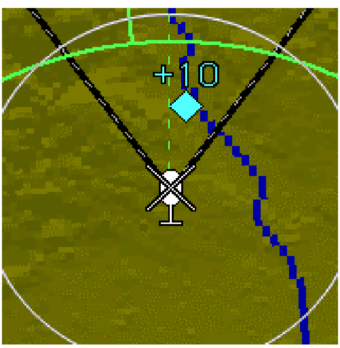
Other Rotorcraft



AW-109SP

Figure 3-91: Latitude/Longitude Display

3.15.2. Ownship Symbology



Rotorcraft

Pan Mode

Figure 3-92: Ownship Symbology

3.15.3. Compass Rose/ND Boundary Circle Symbol

Figure 3-93: Compass Rose/ND Boundary Circle Symbol

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

3.15.4. Moving Map with Instrument Approach

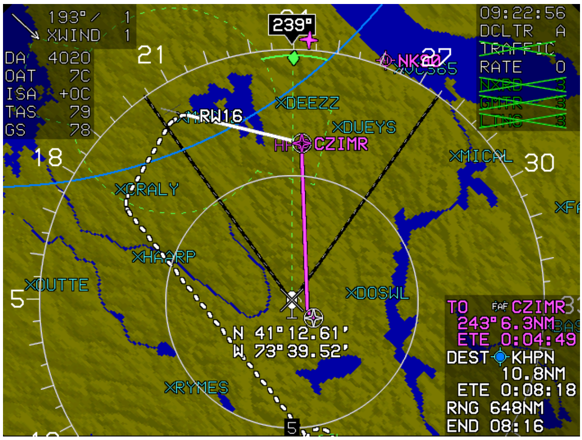


Figure 3-94: Moving Map with Instrument Approach

3.15.5. North-Up Arc Mode

Figure 3-95: North-Up Arc Mode

3.15.6. North-Up Centered Mode

Figure 3-96: North-Up Centered Mode

3.15.7. Heading-Up Centered Mode

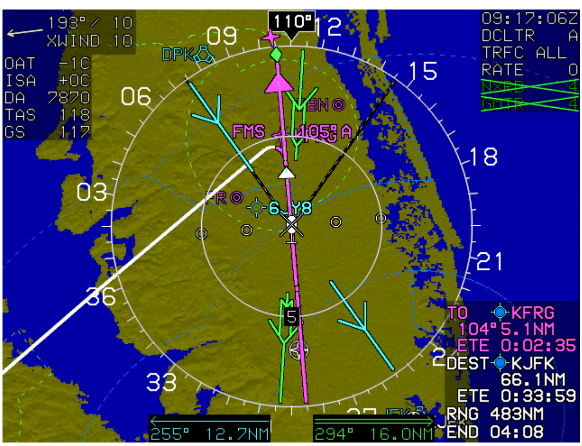


Figure 3-97: Heading-Up Centered Mode

3.15.8. Air Data and Groundspeed

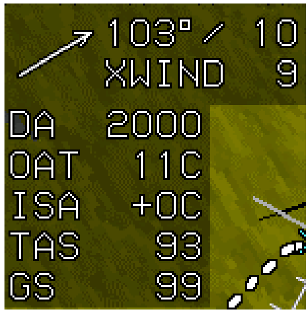


Figure 3-98: ND Air Data and Groundspeed

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

1) **Wind**: Information consists of the following readouts:

   a) Direction in degrees;

   b) Speed in knots;

   c) Crosswind component in knots; and

   d) Graphical wind vector arrow oriented to correspond to the ND orientation.

NOTE:

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

If referenced to magnetic North, direction readout uses the degree (°) symbol. Otherwise, a stylized True North (^{T}) symbol is used.

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

3) **International Standard Atmosphere (ISA)**: Difference between ISA temperature and current outside air temperature is displayed digitally in Degrees C or F (Negative values = less than Standard OAT). Decluttered if the “Show ISA Temperature Flag” is disabled in EFIS limits.

4) **Density Altitude**: Digitally in feet. Decluttered if “Show Density altitude Flag” is disabled in EFIS limits.

5) **True Airspeed**: Digitally in knots. Decluttered if “True Airspeed Flag” is disabled in EFIS limits.

6) **Groundspeed**: Digitally in knots.

3.16. Conventional HSI/PTR Format

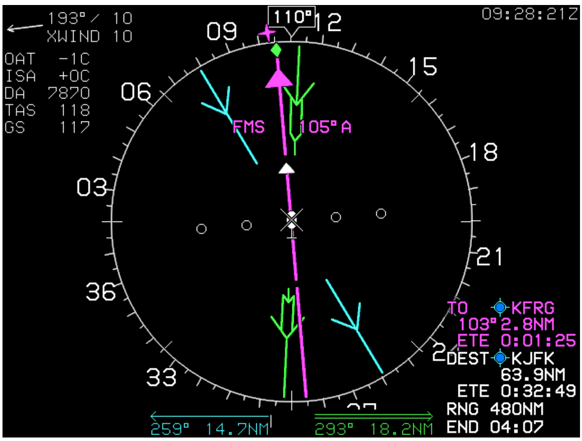


Figure 3-99: Conventional HSI/PTR Format

When the HSI screen is selected, the same ownship symbology is used as described for the ND, and the compass rose is always aligned with Magnetic North. When the HSI NAV source fails, a red “X” is displayed in place of the HSI deviations.

As seen in Figure 3-100, a green diamond-shaped track pointer appears on the compass rose and is aligned with the aircraft’s track across the earth at groundspeeds greater than 30 Kts.

Conventional symbology is displayed on the HSI, including a selected course needle, lateral deviation indicator, and “TO-FROM” indicator. When slaved to GPS/SBAS and a GPS Loss of Navigation condition exists, the HSI pointer becomes amber (yellow); otherwise, it remains magenta.

When selected, the VOR1, VOR2, and ADF navigation are displayed as seen in Figure 3-100 with the magenta single line FMS1 showing a Course of 266°, a cyan single line VOR1 needle showing 078° and 6.4 DME to the station and a green double line VOR2 needle showing a bearing of 112° and 26.8 DME to the station. The ADF is tuned to a NDB with a bearing of 219° to the station. When the signal is invalid, the associated pointer is not shown.

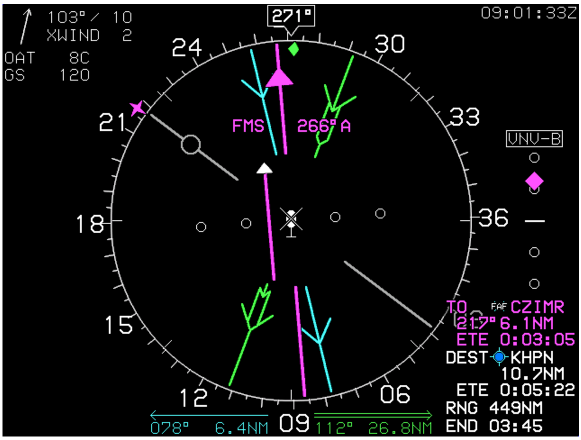


Figure 3-100: Conventional HSI/PTR Format: HSI with VDI and Glideslope

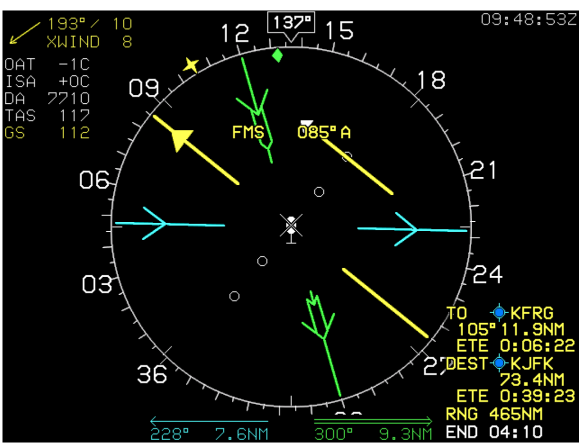


Figure 3-101: Conventional HSI/PTR Format with Loss of Navigation Condition

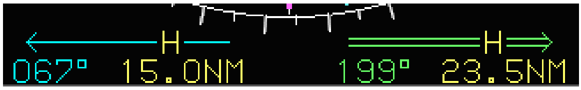
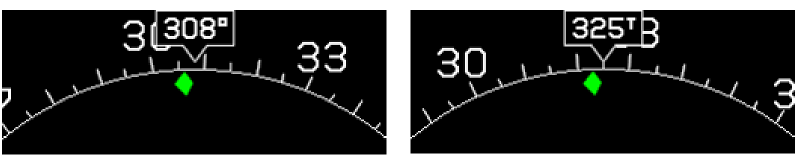


Figure 3-102: ND (HSI with DME on Hold)

When VOR1 and VOR2 pointers are selected for display, a bearing and distance display at the bottom of the ND appear. If bearing or distance is not valid, the respective field is filled with dashes. If a DME channel is in hold mode, the associated distance readout is displayed in amber (yellow) rather than blue or green, and the letter "H" is shown above the distance readout as seen in Figure 3-102.

The ownship symbol (Figure 3-92) is centered and points straight up on the HSI. The HSI has a compass rose aligned with either magnetic North or True North depending upon the status of the True North discrete input (if enabled upon installation). When the HSI NAV source fails (FMS, VOR1, or VOR2), a red "X" is displayed in place of the HSI deviations.

3.16.1. Compass Rose Symbols



Normal Mode **True North Mode**

Figure 3-103: Compass Rose

When selected, a digital heading readout and pointer aligned with the longitudinal axis of the ownship symbol appear on the compass rose boundary circle. If referenced to magnetic North, the heading readout uses the degree (°) symbol. Otherwise, a stylized True North (^{T}) symbol is used. A green diamond-shaped track pointer aligned with the aircraft's track across the earth appears on the compass rose when groundspeed is less than 30 knots. The pilot-settable heading bug geometrically interacts with the heading pointer on the compass rose. A magenta, star-shaped waypoint pointer is displayed on the heading scale at a point corresponding with the active waypoint but turns amber (yellow) in the event of GPS Loss of Navigation caution.

NOTE:

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

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

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

1) **Zulu or LCL Time**: As specified in § 3.16.9.
2) **Timer**: As specified in § 3.16.9.
3) **HSI Source**: When the HSI is slaved to GPS/SBAS, HSI source is white, but turns amber (yellow) if there is a GPS Loss of Navigation.
4) **OBS**: Setting associated with the HSI source is shown. When HSI source is FMS, FMS OBS setting matches the OBS setting shown on the PFD FMS CDI. The FMS OBS setting is labeled “A” for automatic or “M” for manual. The OBS setting is white, but when the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition it turns amber (yellow).
5) **CDI Scale**: Shown and matches the CDI scale shown on the PFI course deviation. The CDI scale is white as in Figure 3-104 and Figure 3-105. When HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition, CDI scale is amber (yellow).

Figure 3-104: HSI CDI Scale (Tapes)

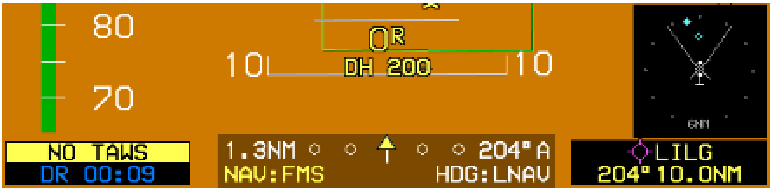
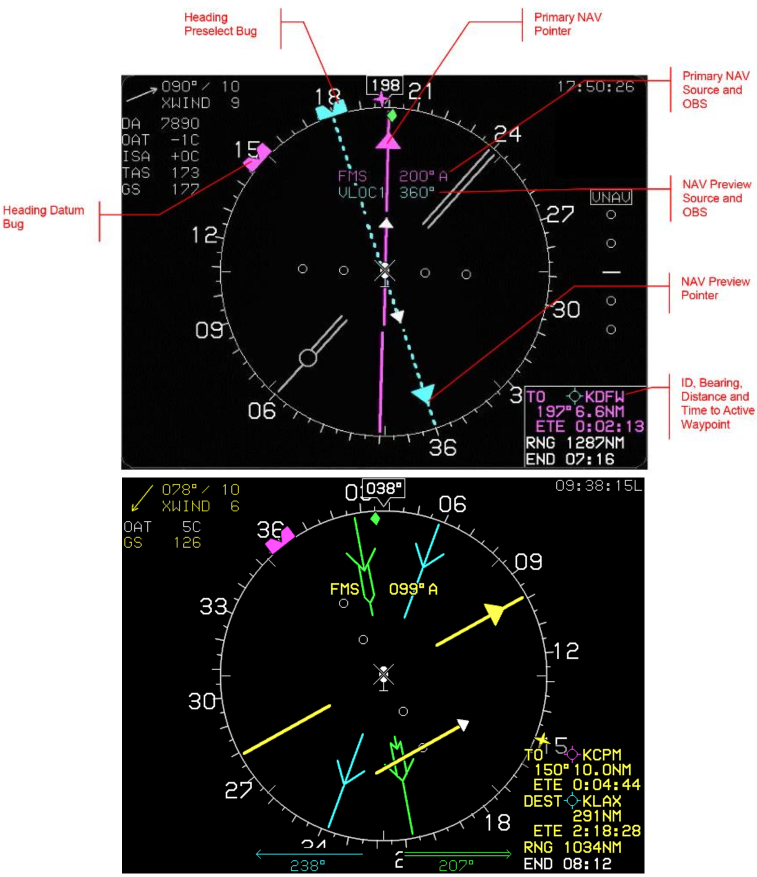


Figure 3-105: HSI CDI Scale (with LON Condition)

3.16.2. HSI Screen (AW-109SP)



With GPS LON

Figure 3-106: HSI Screen (AW-109SP)

3.16.3. Compass Rose Symbols (AW-109SP)

The Compass Rose has a Heading Datum Bug and Heading Preselect Bug, which geometrically interact with the present heading pointer symbol. The Heading Datum Bug is filled-magenta, and the Heading Preselect Bug is filled-cyan. When the two bugs overlap, the Heading Datum Bug is on top of the Heading Preselect Bug. The AFCS communicates Heading Preselect and Datum Bug values to the EFIS. The color of the star-shaped active waypoint pointer is determined using Table 3-11.

3.16.4. Vertical Deviation Indicator (AW-109SP)

Vertical Deviation Indicator color is determined using Table 3-13.

3.16.5. Primary NAV Pointer (AW-109SP)

The Primary NAV Pointer is drawn as a solid line of the color determined using Table 3-11. Navigation source indication and OBS setting are displayed in the top center portion of the HSI and are the same color as the Primary NAV Pointer.

3.16.6. NAV Preview Pointer (AW-109SP)

When a NAV Preview is selected, the HSI page displays a NAV Preview Pointer indicating the NAV Preview selected course, deviation, and TO/FROM in a standard HSI format. The NAV Preview Pointer is a dashed cyan line to differentiate it from the Primary NAV Pointer. When the AFCS armed mode indicates BC, LOC, VAPP, TCN, or VOR, the NAV Preview pointer flashes with a 1Hz 60% duty cycle indicating the AFCS is about to switch from NAV mode to the armed mode. Upon switching, the armed mode uses the NAV Preview source as its Primary NAV source. The NAV Preview Pointer TO/FROM indicator is a solid white triangle. There is not a deviation scale associated with the NAV Preview Pointer to avoid confusion with the Primary NAV Pointer deviation scale. NAV Preview source indication and OBS setting are displayed in the top center portion of the HSI and are the same color as the NAV Preview Pointer.

3.16.7. Identifier, Bearing, Distance and Time to Active Waypoint (AW-109SP)

As specified in § 0.

3.16.8. Fuel Totalizer/Waypoint Bearing and Distance Functions

Figure 3-107: Fuel Totalizer/Waypoint Bearing and Distance Functions

Table 3-17: 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 are shown. Waypoint information is magenta but turns amber (yellow) in the event of a GPS Loss of Navigation caution.	ETA or ETE Degree (°) symbol or True North (^{T}) symbol
DEST Waypoint	If there is an active flight plan, waypoint type, identifier, range, and estimated time enroute/ estimated time of arrival for the last waypoint ("DEST" waypoint) of the active flight plan are shown. Range and time to the destination waypoint are based upon the flight plan route, if the active waypoint is not the last	ETA or ETE Degree (°) symbol or True North (^{T}) symbol

Table 3-17: Fuel Totalizer/Waypoint Bearing and Distance Functions

Function	Conditions	Type Symbols Options
	waypoint; otherwise, range and time to the destination waypoint are based upon a direct geodetic path. DEST Waypoint information is white but turns amber (yellow) in the event of a GPS Loss of Navigation caution.	
Range	Aircraft range based upon instantaneous fuel flow, fuel remaining, and groundspeed are shown immediately below the "DEST" waypoint information for easy comparison.	
Endurance	Aircraft endurance based upon instantaneous fuel flow and fuel remaining is shown.	

3.16.9. Clock/Options

Figure 3-108: Clock/Options

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

Table 3-18: Clock/Options		
Feature	**Options**	**Notes**
Zulu Time or Local Offset	Zulu or Local	**hh:mm:ss** format and synchronized with the GPS/SBAS constellation.
Timer	**COUNT UP** **COUNT DN..** **FLT TIME**	Countdown or count-up timer displayed when selected and matches timer shown on PFD.
Declutter Mode	**DCLTR A** **DCLTR M**	= Automatic declutter mode = Manual declutter mode
Terrain Status	Enabled or Disabled	19:51:13L TRFC ALL Terrain status is indicated by the absence or presence of terrain.

3.17. Navigation Log

With Fuel Enabled

Without Fuel Enabled

Figure 3-109: Navigation Log

3.17.1. Clock and Groundspeed

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

1) **Zulu or LCL Time**: As specified in § 3.16.9.

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

3.17.2. Fuel Remaining and Fuel Flow Data

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

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

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

3.17.3. Waypoint Identifier Column

The identifier for each waypoint of the active flight plan is displayed in the left-most column of the NAV Log. The active waypoint is indicated with an asterisk and shown in magenta (cyan for AW-109SP) but turns amber (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 for the pilot to easily distinguish the waypoint type

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

1) **FAF** = Waypoint is a Final Approach Fix

2) **MAP** = Waypoint is a Missed Approach Point

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

4) **APP** = Waypoint is part of an Instrument Approach Procedure, but is not a Final Approach Fix, Missed Approach Point, or part of the Missed Approach segment.

5) **VFR** = Waypoint is part of a VFR Approach.

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

7) **DP** = Waypoint is part of a Departure Procedure.

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

3.17.4. VNAV and VNAV Offset Column

The VNAV altitude and associated VNAV Offset (in NM) are displayed immediately to the right of the Waypoint Identifier column. In the case of an approach with a Final Approach Segment data block, the VNAV Offset readout associated with the Missed

Approach Point is “GPI” to designate distance to the Glidepath Intercept Point. VNAV altitudes and offsets from the navigation database or manually entered are shown in white. VNAV altitudes and offsets computed automatically are shown in gray. VNAV and VNAV Offset column elements align with Waypoint Identifier column elements to indicate the VNAV information applies to the associated waypoint.

NOTE:

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

3.17.5. Path Column

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

1) Geodetic path between waypoints is displayed with the “Direct-To” symbol,  **(R4)**, followed by the initial geodetic course for the leg.

2) Discontinuities (i.e., a leg where FMS is unable to compute a valid path) are shown with the legend -DISCONT-.

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

4) Holding patterns are shown with a pictorial representation of a holding pattern (either left or right turns) as well as the inbound course for the holding pattern.

5) Arcs are shown with a pictorial representation of an arc (either left or right turns) as well as the entry and exit radials for the arc.

6) An altitude termination leg is shown by the initial geodetic course for the leg followed by the altitude at which the leg terminates.

The Path column elements are offset from Waypoint Identifier column elements to indicate the path information applies to the leg between waypoints.

3.17.6. Distance Column

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

3.17.7. Estimated Time Enroute Column

ETE between waypoints is displayed immediately to the right of the Distance column and is calculated taking into account the associated distance between waypoints and current groundspeed. ETE column elements are offset from Waypoint Identifier column elements to indicate ETE information applies to the leg between waypoints.

3.17.8. Estimated Time of Arrival Column

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

3.17.9. Fuel Remaining Column

Fuel remaining at the active waypoint and all subsequent waypoints is displayed immediately to the right of the ETA column. Fuel remaining at the active waypoint is calculated taking into account the associated time remaining on the active leg, current fuel flow, and current fuel quantity. Fuel remaining at subsequent waypoints is calculated taking into account the cumulative ETEs, current fuel flow, and current fuel quantity. Fuel Remaining column elements align with Waypoint Identifier column elements to indicate the fuel remaining information applies to the associated waypoint.

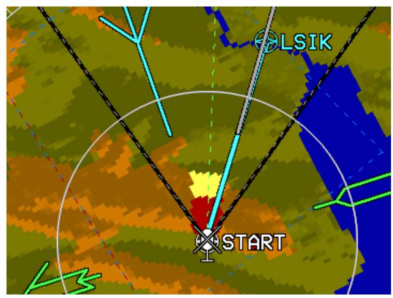
NOTE:

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

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

3.18. Start Point

Other Rotorcraft



AW-109SP

Figure 3-110: Start Point

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

3.19. Altitude Capture Predictor/Top of Descent

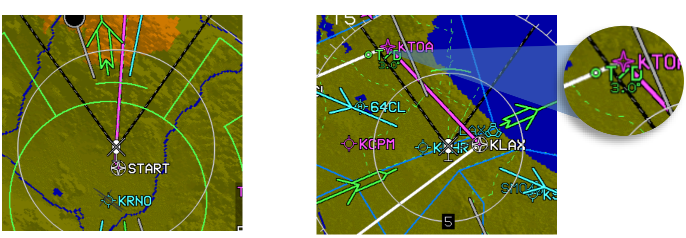
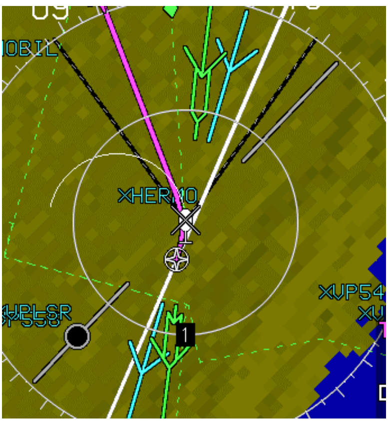


Figure 3-111: Top of Descent or Top-of-Climb

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

3.19.1. Projected Path



When the aircraft is in a bank angle, a projected path emanates from the ownship symbol. This curving path is based upon the aircraft bank angle and groundspeed as it projects one minute into the future up to a maximum of 180° of turn. The projected path or “noodle” assists in course interception and making small adjustments to bank angle for proper roll out.

Figure 3-112: Projected Path

3.20. Active Flight Plan Path/Manual Course/Runways

When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path is shown on the ND in 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). The fly-over waypoint symbol is distinct from fly-by waypoints and consists of the waypoint symbol within a circle. When there is a parallel offset, the active flight plan path depicts the parallel offset path, and the original flight plan path is shown with haloed gray dashed lines. Top of descent symbols with an indication of glidepath angle are shown where VNAV descents are predicted to commence.

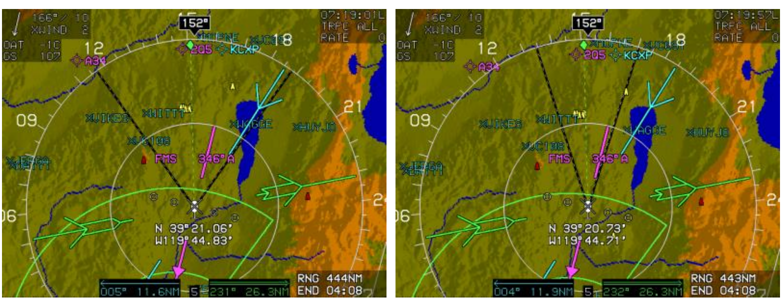
When there is an active waypoint and the GPS/SBAS OBS setting is manual, the manual course through the waypoint is shown as a pointer centered on the waypoint. The pointer matches the lateral navigation guidance given on the PFD (GPS/SBAS CDI in manual OBS mode, skyway boxes, and mini-map).

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

The ND displays airport runways in correct relationship and scale to the ownship symbol. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, the runways for the airport associated with the procedure are displayed. In addition, the runways associated with the three nearest airports (as computed by the TAWS algorithms) are displayed.

3.21. FOV Indication

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



Normal Field of View **Narrow Field of View**

Figure 3-113: Field of View

3.22. 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. Scroll ❶ to set the overall map scale to .5, 1, 2.5, 5, 10, 25, 50, 100, or 200NM.

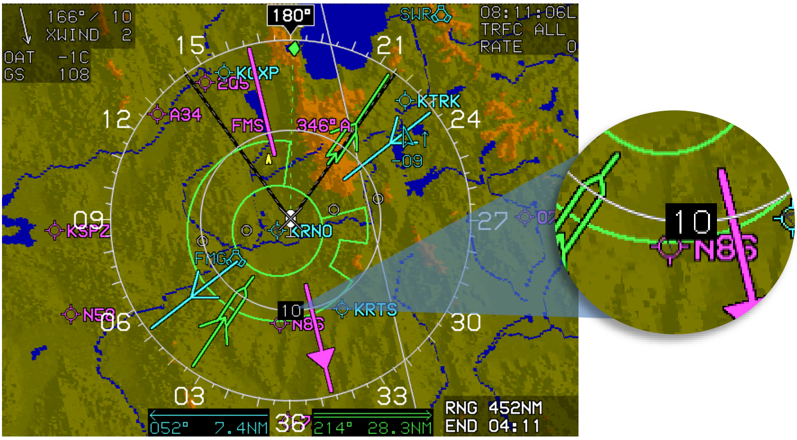
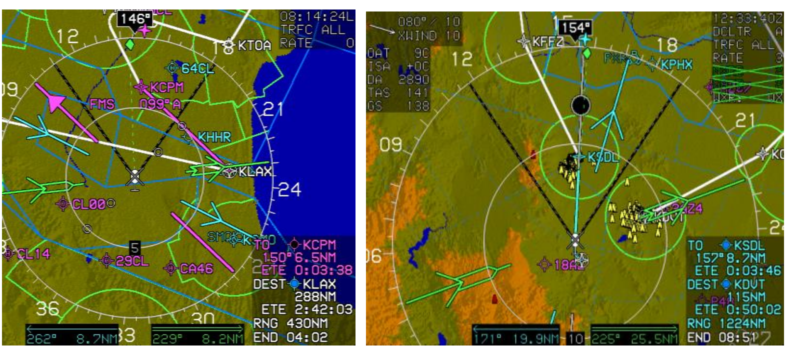


Figure 3-114: Range

3.23. Navigation Data



Other Rotorcraft AW-109SP

Figure 3-115: Navigation Data and Airspace Depiction

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

The ND has manual and automatic decluttering of navigation data. There are six levels of automatic declutter based upon the number of navigation data symbols drawn in the current ND format and range. Decluttering is as follows:

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

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

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

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

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

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

Table 3-19: Airspace Depiction

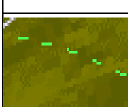
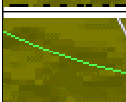
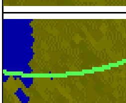
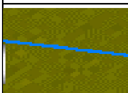
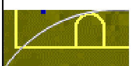
Type of ARINC 424 Airspace		Vertical Limits
	Single pixel, dashed lines	More than ±500’
	Single pixel solid lines	Within 500’
	Double pixel solid lines	Within airspace vertical limits

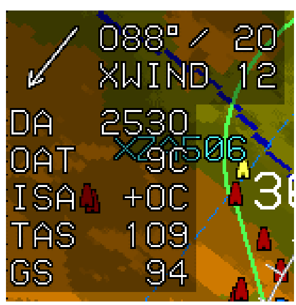
Table 3-19: Airspace Depiction

Type of ARINC 424 Airspace	Color of Airspace
 Class C, Control Area, TRSAs, Class D	Green
 Class B, TCAs (Where applicable)	Blue
 Caution Areas, Danger Areas, MOAs, Training Areas, Warning Areas, Unknown Areas	Amber (Yellow)
 Prohibited Areas, Restricted Areas, Temporary Flight Restricted Areas (When equipped with Datalink)	Red

3.23.1. Air Data and Groundspeed

As specified in § 3.15.8.

True North Mode



Normal Mode

Figure 3-116: Air Data and Groundspeed

3.23.2. Analog Navigation Symbology

When selected, the ND displays analog (VOR1 and VOR2) navigation symbology, when valid. When the VOR1 and/or VOR2 pointers are selected for display, bearing and distance for the selected VOR pointers appear at the bottom of the ND view (cyan for VOR1; green for VOR2). If the DME channel is in hold mode, the associated distance readout is amber (yellow), and the letter "H" is shown above the distance readout. The size of the HSI depends on Arc or Center modes to ensure a full HSI is always displayed.

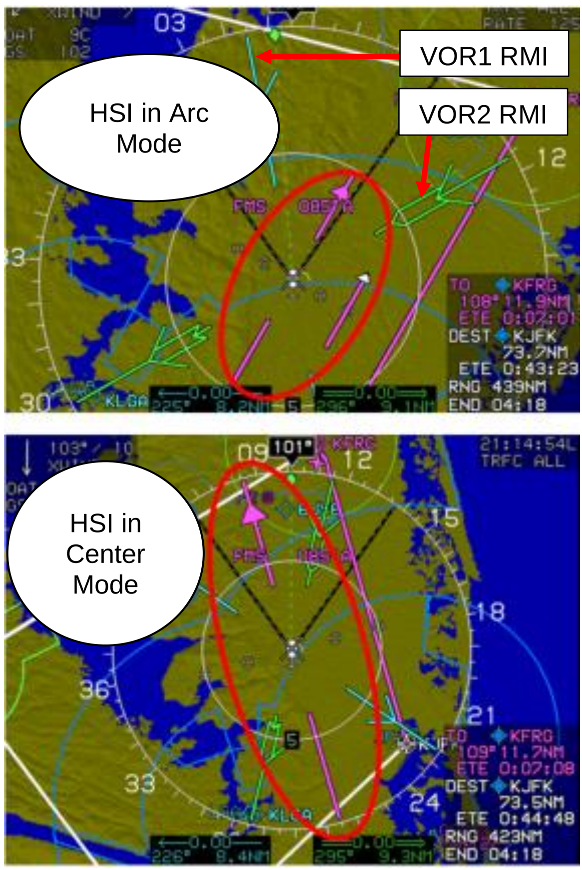


Figure 3-117: Analog Navigation Symbology

Other Rotorcraft

AW-109SP

Figure 3-118: Analog Navigation Symbology

3.23.3. Borders

Without State Borders drawn (Other Rotorcraft)

With State Borders drawn (Other Rotorcraft)

Without State Borders drawn (AW-109SP)

With State Borders drawn (AW-109SP)

Figure 3-119: Borders

If national and United States state borders are selected, they are drawn at all map scales. The borders are white if the ND background includes terrain.

3.23.4. Terrain/Obstructions

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

Table 3-20: Terrain Display on Navigation Display Color Relationship to Aircraft Altitude

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

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

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

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

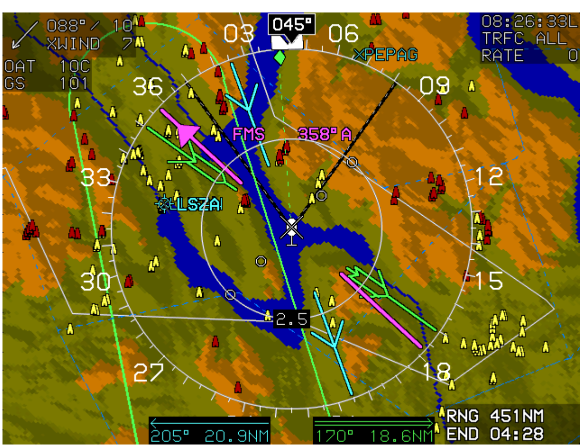


Figure 3-120: Terrain/Obstructions

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

Table 3-21: Obstructions		
Lateral Distance Away	8.5 NM or greater	Not depicted on the ND
	8.5 NM or less	As described below
Vertical Criteria	More than 2000' below aircraft	Not depicted on the ND
	Within 2000' but more than 500' below aircraft	Depicted in amber
	Within 500' but below aircraft	Depicted in light red
	At or above aircraft altitude	Depicted in deep red.

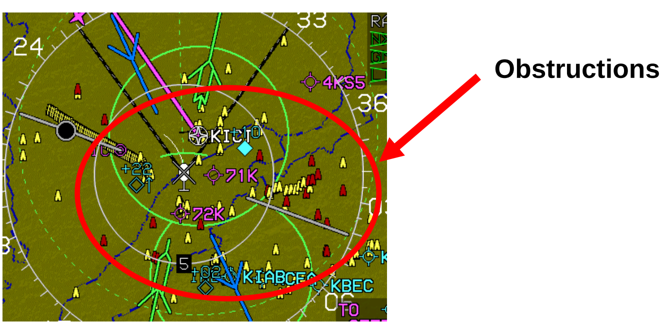


Figure 3-121: Obstructions

Terrain and obstruction rendering is pilot-selectable 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.

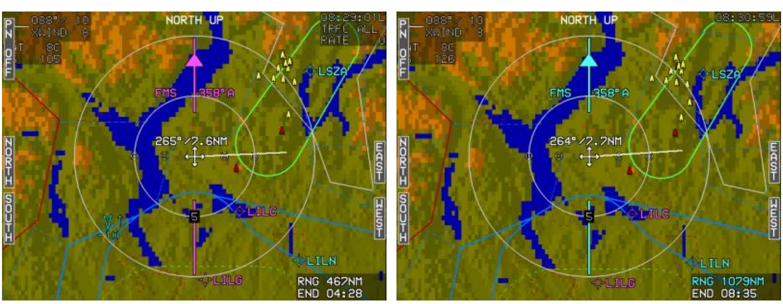
NOTE:

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

3.24. Pan Mode

The ND screen has a pan mode for the pilot to change the location of the center of the screen away from current location and 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.

Figure 3-122 shows the line with bearing and distance from the map center to the aircraft's current position in white When the aircraft is more than 0.5 NM away. If referenced to magnetic North, the bearing uses the degree (°) symbol. Otherwise, a stylized True North (^{T}) symbol is used. When panning, the nearest displayed airport, VOR, NDB, or fix within the inner range ring is highlighted with a flashing circle. 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 as before pan mode was enabled.

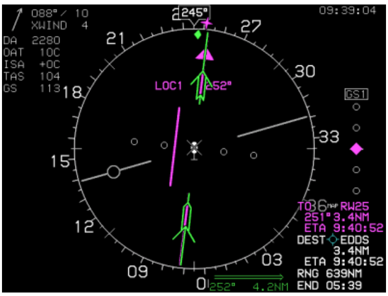


Other Rotorcraft **AW-109SP**

Figure 3-122: Pan Mode

3.25. HSI Screen

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



Normal Magenta Pointer Color

GPS Loss of Navigation Condition Amber (Yellow) Pointer Color

Figure 3-123: HSI Pointer Color

3.25.1. HSI Screen VDI

A vertical deviation indicator appears, as seen above, 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 displayed on the top of the VDI to avoid clutter with waypoint information below:

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

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

3) GS1: Glideslope #1

4) GS2: Glideslope #2

3.25.2. Analog Navigation Symbology

The HSI has the capability when selected, to display analog (VOR1 [cyan] and VOR2 [green]) navigation symbology with an RMI pointer format overlaid upon the HSI. When the signal is invalid, the associated pointer is not shown. When the signal is valid for VOR1 and VOR2, a bearing and distance display for the selected VOR pointers appears at the bottom of the display as in Figure 3-124.

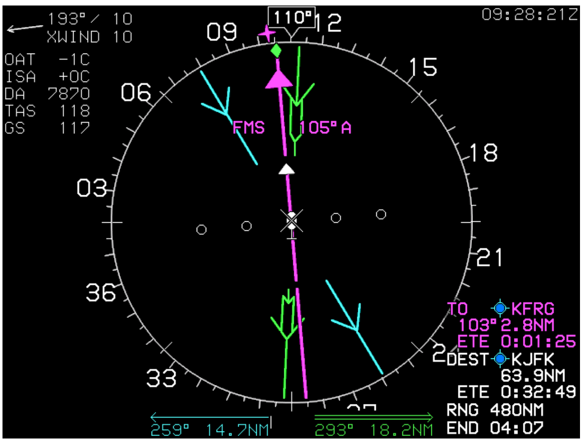


Figure 3-124: Analog Navigation Display VOR1 and VOR2

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

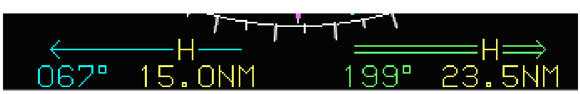


Figure 3-125: HSI Bearing Distance Readout with DME in HOLD

Valid Marker Beacon discretes are displayed as indicators on the PFD and ND HSI display as seen in Figure 3-126 with appropriate coloring markings. Only during a built-in-test may more than one marker beacon be active. The display of marker beacons is disabled when the NAV source is FMS.

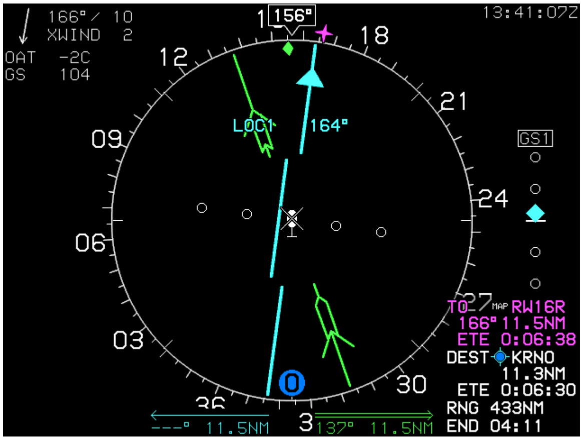
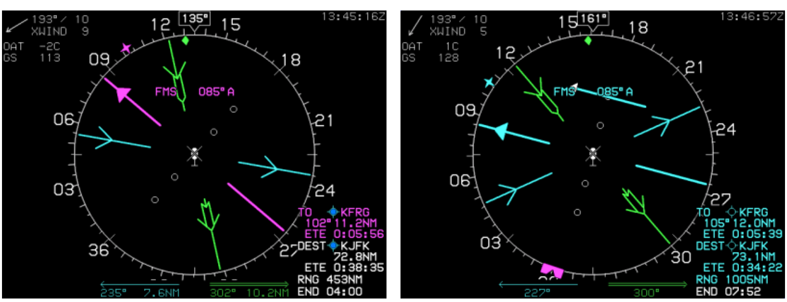


Figure 3-126: HSI with Marker Beacon Displayed

3.25.3. HSI with Marker Beacon Displayed Air Data and Groundspeed

Air data and groundspeed are displayed as specified in § 3.15.8.



Other Rotorcraft **AW-109SP**

Figure 3-127: HSI Display Air Data and Groundspeed

3.25.4. Clock/Options

Time based on Zulu **Time based on Local Offset**

Figure 3-128: HSI Clock

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

1) **Zulu or LCL Time**: As specified in § 3.16.9.

2) **Timer**: As specified in § 3.16.9.

3) **HSI Source**: Is white but amber (yellow) when the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation.

4) **OBS**: Setting associated with the HSI source is shown. When the HSI source is FMS, the FMS OBS setting matches the OBS setting shown on the PFD FMS CDI. The FMS OBS setting is labeled with an "A" for automatic or "M" for manual. OBS setting is white but is amber (yellow) when the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition.

5) **CDI Scale**: Current CDI scale is shown and matches the CDI scale shown on the PFD course deviation. The CDI scale is white but is amber (yellow) when the HSI is slaved to GPS/SBAS and there is a GPS Loss of Navigation condition.

3.25.5. Fuel Totalizer/Waypoint Bearing and Distance Functions

Fuel totalizer, waypoint bearing, and waypoint distance are displayed in the lower right corner of the HSI as specified in § 3.16.8.

Figure 3-129: HSI Fuel Totalizer/Waypoint Bearing

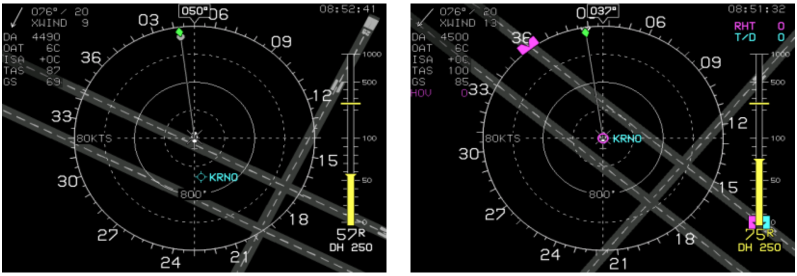
3.26. Hover Screen

The hover screen has the following elements.

3.26.1. Ownship Symbol

Hover screen ownship symbology is as in Figure 3-92.

3.26.2. Hover Screen Orientation



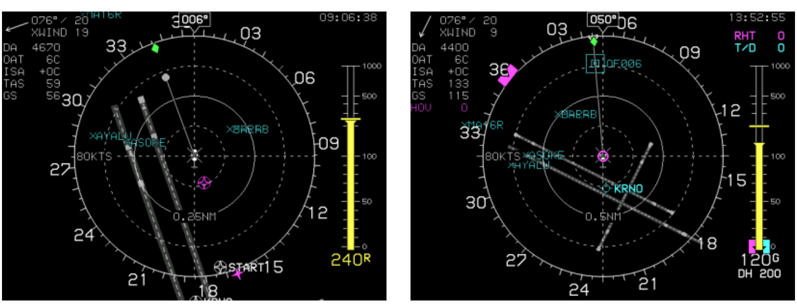
Other Rotorcraft AW-109SP

Figure 3-130: ND (Hover Vector Screen)

3.26.3. Hover Screen Range

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

3.26.4. Hover Vector



Other Rotorcraft (AW-109SP)

Figure 3-131: Hover Vector Symbology

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

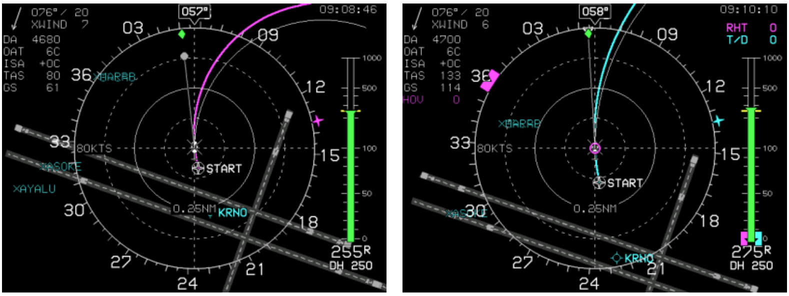
The ownship symbol indicates 0 knots groundspeed and a dot connected to the ownship symbol by a gray line floating over the hover screen to indicate flight direction and groundspeed. Deviation of the dot in a straight up direction (12 o'clock position) indicates forward flight while straight down (6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

3.26.5. Compass Rose Symbols

Figure 3-132: ND (Hover Vector Compass Rose)

A digital magnetic heading readout and pointer aligned with the longitudinal axis of the ownship symbol appears on the compass rose boundary circle. A green diamond-shaped track pointer aligned with the aircraft's track across the earth appears on the compass rose when groundspeed is greater than or equal to 30 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the compass rose. A magenta, star-shaped waypoint pointer is displayed on the heading scale at a point corresponding with the active waypoint, which turns amber (yellow) in the event of GPS Loss of Navigation caution.

3.26.6. Active Flight Plan Path/Manual Course



Hover Vector Screen **Hover Vector Screen (AW-109SP)**

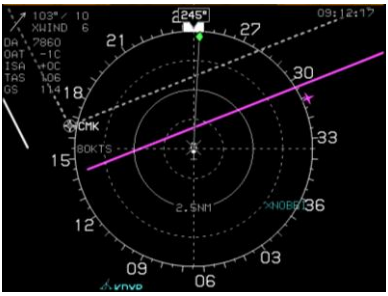
Figure 3-133: ND (Hover Vector Active Flight Plan Path/Manual Course)

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

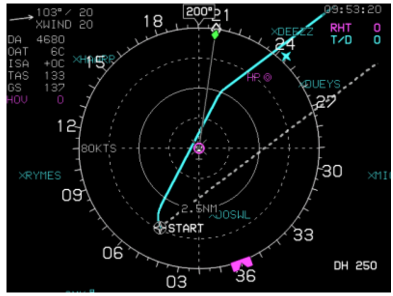
When there is a parallel offset, the active flight plan path depicts the parallel offset path, and the original flight plan path is shown with haloed gray lines.

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

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



Hover Vector Parallel Track



Hover Vector Parallel Track (AW-109SP)

Figure 3-134: ND (Hover Vector Active Flight Plan Path/Parallel Course)

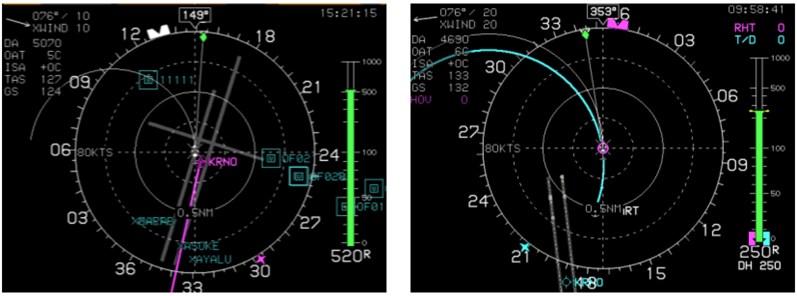
3.26.7. Navigation Data

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

The hover screen displays airport runways in correct relationship and scale to the ownship symbol. Immediately upon a system startup on the ground, the runways for the nearest airport are displayed. Upon activation of a DP, VFR approach, IFR approach, or STAR procedure, the runways for the airport associated with the procedure are displayed. In addition, the runways associated with the three nearest airports are also displayed. Runways are shown in dark gray according to characteristics contained in the navigation database, including position, orientation, length, and width. The landing portion of the selected runway, taking into account displaced threshold data, are shown in light gray.

3.26.8. Projected Path

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



Other Rotorcraft **AW-109SP**

Figure 3-135: ND (Hover Vector Projected Path)

3.26.9. Air Data and Groundspeed

Displayed as specified in § 3.15.8.

3.26.10. Clock and Timer

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

1) **Zulu or LCL Time**: As specified in § 3.16.9.

2) **Timer**: As specified in § 3.16.9.

3.26.11. AGL Indication

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

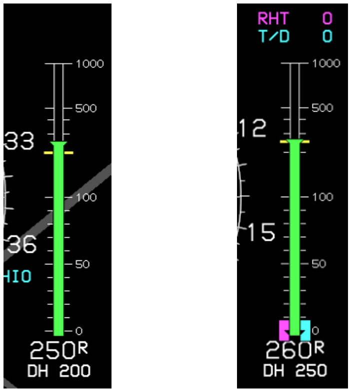
R = radar altitude.

G = GPS/SBAS geodetic height less database ground elevation.

B = barometric altitude less database ground elevation.

The digital readout of AGL altitude is not displayed when it is greater than the radar altimeter maximum valid altitude nor when it is invalid. The digital readout of AGL altitude is not displayed when its source is barometric and indicated airspeed is in the noise range (less than

20 KIAS) due to rotor wash effects. When AGL altitude source is radar altitude, the digital readout of AGL indication is smoothed to avoid jumpiness (as specified in Table 3-3).



Other Rotorcraft **AW-109SP**

Figure 3-136: ND (Hover Vector AGL Indication)

<table>
<tr><th colspan="3">Table 3-22: Analog AGL Indication Designed Parameters</th></tr>
<tr><th>Range of Altitude</th><th>Markings</th><th>Notes</th></tr>
<tr><td>0-1000’</td><td>Green-filled column</td><td>Thermometer fashioned style. Top of the column has a widened area for better registration against the scale accordingly, so the widened area disappears at AGL altitudes greater than 1,000 feet (i.e., maximum analog indication).</td></tr>
<tr><td colspan="3">Scaling</td></tr>
<tr><td>0 to 100’</td><td>Linear</td><td rowspan="2">0’ AGL is at the bottom, 50’ AGL is at 25% of height, 100’ AGL is at 50% of height, 200’ AGL is at 67% of height, 500’ AGL is at 83% of height, and 1,000’ AGL is at full height</td></tr>
<tr><td>100’-1,000’</td><td>Logarithmic</td></tr>
<tr><td colspan="3">Major Tick Marks</td></tr>
<tr><td colspan="3">0’, 50’, 100’, 500’, and 1,000’</td></tr>
</table>

Table 3-22: Analog AGL Indication Designed Parameters		
Range of Altitude	**Markings**	**Notes**
Minor Tick Marks		
10’, 20’, 30’, 40’, 60’, 70’, 80’, 90’, 200’, 300’, and 400’		
The color-filled column is not displayed when AGL altitude is invalid. Analog indication of AGL altitude (including the scale) is not displayed, when its source is barometric and indicated airspeed is in the noise range (less than 20 KIAS) due to rotor wash effects.		

3.26.12. Decision Height Indication

AGL indication may include a display of the set decision height altitude as specified in § 3.4.6.

3.26.13. Hover Screen (AW-109SP)

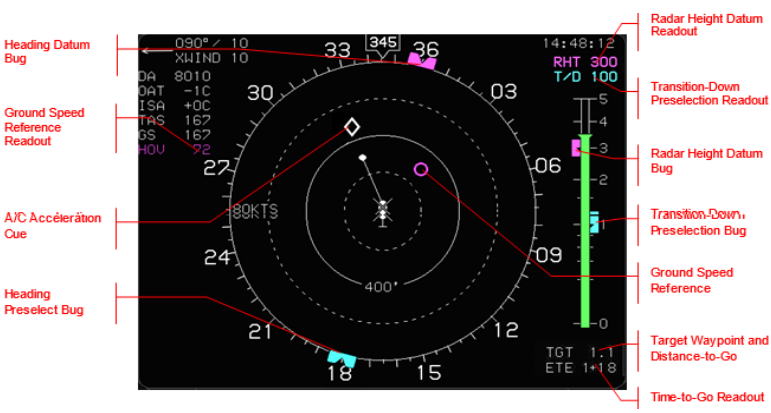


Figure 3-137: Hover Screen (AW-109SP)

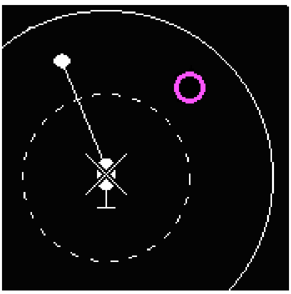
3.26.14. Compass Rose Symbols (AW-109SP)

The Compass Rose has a Heading Datum Bug and Heading Preselect Bug geometrically interacting with the present heading pointer symbol. The Heading Datum Bug is filled-magenta, and the Heading Preselect Bug is filled-cyan. When the two bugs overlap, the Heading Datum Bug is drawn on top of the Heading Preselect

Bug. The AFCS communicates the Heading Preselect and Datum Bug values to the EFIS. The color of the star-shaped active waypoint pointer is determined using Table 3-11.

3.27. Hover Vector (AW-109SP)

3.27.1. Groundspeed Reference (AW-109SP)

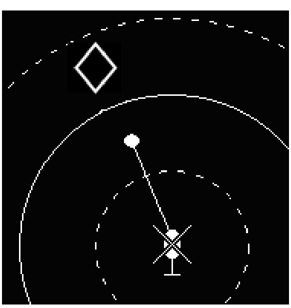


Groundspeed Reference is an unfilled circle originating from the ownship symbol scaled according to the current groundspeed scale of the Hover Page. The Groundspeed Reference value is derived from the longitudinal and lateral components from the AFCS.

Figure 3-138: Groundspeed Reference (AW-109SP)

The Groundspeed Reference symbol is limited and cropped at the outer circle of the HSI. The color discrete determines whether the Groundspeed Reference Bug is displayed in magenta or cyan.

3.27.2. A/C Acceleration Cue (AW-109SP)



The A/C Acceleration Cue is an unfilled white diamond indicating the normalized Lateral and Longitudinal Acceleration. This symbol originates from the end of the hover vector and is independent of the current scale of the Hover Page.

The input range is -1 to 1 and full scale (1) corresponds to the number of pixels from the center to the outer ring of the display. The A/C Acceleration Cue is limited and cropped at the outer circle of the HSI. The A/C Acceleration is derived from the longitudinal and lateral components supplied by the AFCS.

Figure 3-139: A/C Acceleration Cue (AW-109SP)

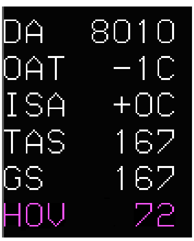
3.27.3. Active Flight Plan Path (AW-109SP)

Active leg color in the flight plan path is determined with Table 3-11.

NOTE:

When a MOT flight pattern is displayed, the active leg includes all legs between the “From” and “To” waypoint.

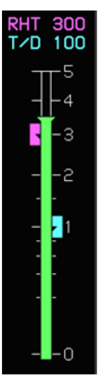
3.27.4. Air Data and Groundspeed (AW-109SP)



The Groundspeed Datum Readout is displayed in magenta or cyan as “HOV” with the groundspeed datum numerical value. The Groundspeed Datum value is computed from the longitudinal and lateral components by the AFCS. The color discrete is determine whether the Groundspeed Readout is displayed in magenta or cyan based on AFCS data.

Figure 3-140: Air Data and Groundspeed (AW-109SP)

3.27.5. AGL Indication



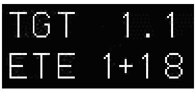
The Radar Height Bug is a magenta-filled bug with a notch geometrically interacting with the AGL indication. The Radar Height Readout is magenta text “RHT” followed by magenta numerical text indicating the value of the Radar Height Bug, placed above the AGL scale.

Figure 3-141: Radar Height Bug and Readout (AW-109SP)

3.27.6. Transition-Down Pre-Selection Bug and Readout (AW-109SP)

The Transition-Down Pre-selection Bug is a cyan-filled bug with a notch geometrically interacting with the AGL indication. The Transition-Down Pre-selection Readout is cyan text “T/D” followed by cyan numerical text indicating the value of the Transition-Down Pre-selection Bug placed above the AGL scale.

3.27.7. Identifier, Distance, and Time to MOT Waypoint (AW-109SP)



The MOT waypoint ID and distance to MOT waypoint is displayed in the lower right of the display in white text. Time to MOT waypoint is displayed below the ID and distance formatted as white letters “ETE” and minutes + seconds.

Figure 3-142: Identifier, Distance, and Time to MOT Waypoint (AW-109SP)

3.27.8. Nav Log Screen (AW-109SP)

Color of the active waypoint as specified in Table 3-11.

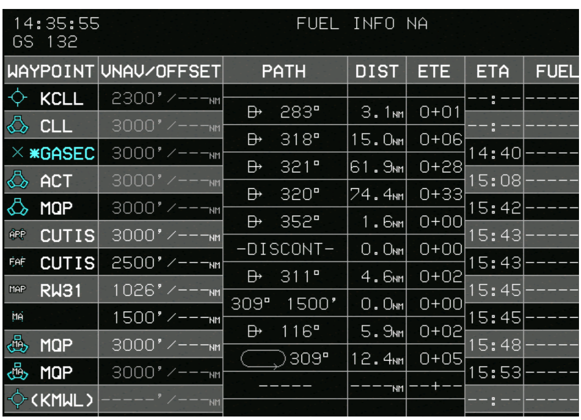


Figure 3-143: NAV LOG (AW-109SP)

3.28. PFD and MFD Screen Requirements/Hover Vector (AW-109SP)

The groundspeed value used for hover vector indication on both MFD and PFD screens is derived from across and along heading velocity. If data from AFCS is not available or invalid, GPS groundspeed and track are used for hover vector indication.

Section 4 Reversionary Modes

Table of Contents

List of Figures and Tables

4.1. Reversionary Modes

The equipment has eight reversionary modes as follows:

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

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

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

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

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

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

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

Mode 7: GPS, ADC, and AHRS failed.

To use this section, review the following table and notes to determine what feature or function is affected by one or more of the three sensors failed conditions. Examples follow with the IDU-450 displays in various configurations with a table breaking down the affected functions.

Not all possible IDU-450 display configurations and format combinations are represented here. All eight modes of System Operation are represented for description purposes.

4.2. System Operation in Reversionary Modes

Table 4-1: Reversionary Mode Status (PFD)

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

Table 4-2: Reversionary Mode Status (ND)

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

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

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

Table 4-3: Reversionary Mode Status (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 (e.g., heading is failed or true airspeed cannot be calculated), function is disabled.

Note 2: Only radar altitude presented when available.

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

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

Note 5: Waterline symbol expanded to large attitude bars. Rotorcraft versions (Part 27 or Part 29 airspeed scale), use full-time large attitude bars and do not show the waterline symbol.

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

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

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

Note 10: Presents 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: Rotorcraft versions (Part 27 or Part 29 airspeed scale), use full-time large attitude bars and do not show the waterline symbol.

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

Note 24: Assuming valid fuel flow information, both range and endurance are presented using inertial dead-reckoning based on last known wind information. If the pilot is unable to dead-reckon due to loss of heading or true airspeed cannot be calculated, endurance only information is presented.

Note 25: Inhibited in accordance with the conditions specified in TAWS Automatic Inhibit Function. (Abnormal Operation)

4.2.1. 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 are disabled.

4.2.2. Heading Failure Mode

In addition, the equipment has a heading failure mode. With heading failed, the PFD heading scale and MFD compass rose aligns with track (if available) or is removed and replaced with a Red-X. In this failure mode, the PFD heading scale includes the nomenclature “GPS TRK” around the track marker to clearly delineate the failure mode.

4.2.3. 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-450 is as follows:

When an MFD (IDU #2, 3, or 4) becomes the “transmit-enabled” IDU, the MFD automatically switches to the PFD screen. Push ❶ to change the MFD to other screens after the automatic switch.

4.2.4. GPS Failure

GPS degrades or fails as a result of loss of satellite information, or GPS equipment failure. When the integrity is provided by SBAS, the IDU provides a LOI (Loss of Integrity) monitoring caution within two 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 causes the EFIS to lose GPS updating of aircraft position, groundspeed, and ground track, and the ability to calculate the wind information.

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

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

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

   a) The absence of power;

b) Equipment malfunction or failure;

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

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

e) HPL > HAL on the final approach segment. Genesys Aerosystems EFIS does not transition to DR Navigation at this stage. A GPS Navigation solution is still presented; and

f) Where HPL > HAL on the final approach segment, this position may still be satisfactory for GPS Navigation. For example, an HPL of 0.31NM exists which means as soon as a transition to TERMINAL mode occurs, all alerts would disappear. This is significantly important during a wind change, if the system had been in a DR mode.

NOTE:

At any time, view HFOM on the FAULTS page to see the system-reported accuracy.

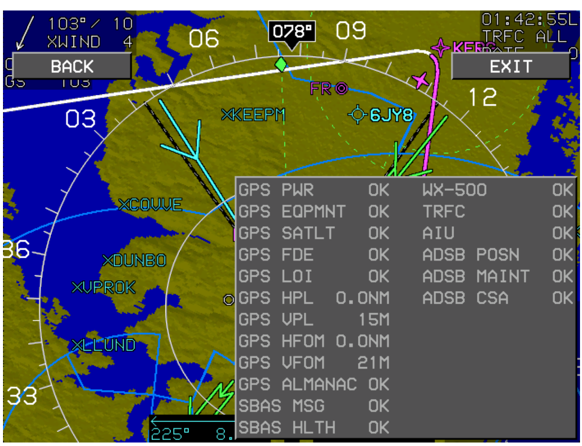


Figure 4-1: FAULTS Page on MFD

1) **DR** (Dead Reckoning)

   a) If a GPS position cannot be calculated, a dead reckoning solution is provided with a timer, DR 01:23. This solution is calculated from heading and TAS derived from the AHRS and ADC.

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

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

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

   a) The absence of power;

   b) Equipment malfunction or failure;

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

   d) There are an insufficient number of SBAS HEALTY satellites;

   e) The horizontal protection level exceeds the alert limit as follows for LNAV/VNAV approaches:

      i) Prior to sequencing the FAWP- HAL should be 0.3 NM with no limit on VAL

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

When in LNAV mode, the fault detection function detects positioning failures within 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-450 PFD and MFD are affected as follows.

4.3. PFD (Tapes) Failure Mode 0

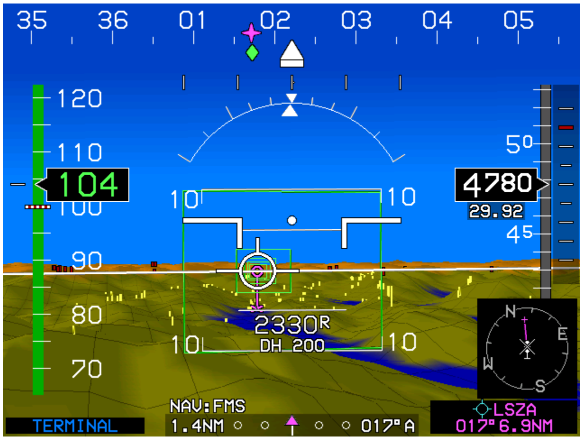


Figure 4-2: PFD (Tapes) Failure Mode 0
GPS, ADC, and AHRS Normal

4.3.1. PFD (Round Dials) Failure Mode 0

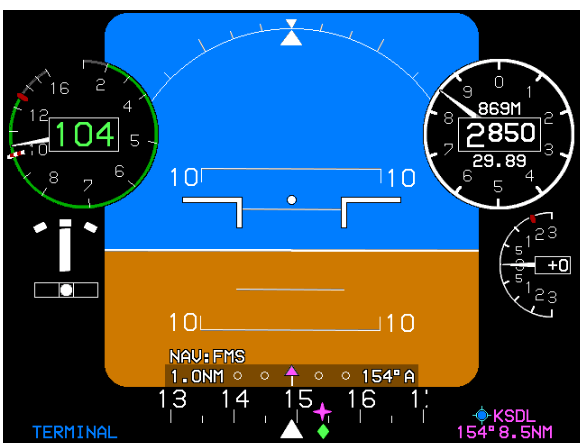


Figure 4-3: PFD (Round Dials) Failure Mode 0
GPS, ADC, and AHRS Normal

4.3.2. MFD Failure Mode 0 (Normal Mode)

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

4.4. PFD (Tapes) Failure Mode 1

Figure 4-5: PFD (Tapes) Failure Mode 1
GPS/SBAS Failed; ADC and AHRS Normal

4.4.1. PFD (Round Dials) Failure Mode 1

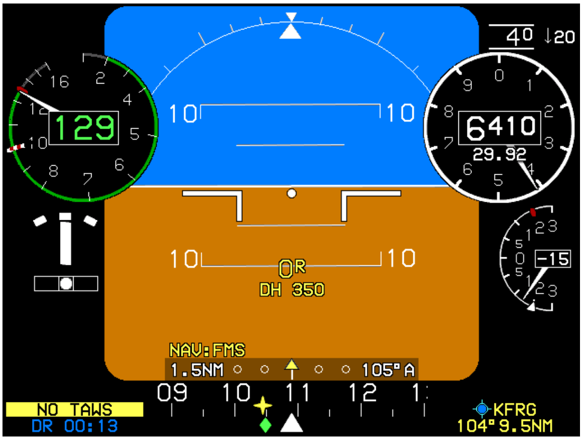


Figure 4-6: PFD (Round Dials) Failure Mode 1
GPS/SBAS Failed; ADC and AHRS Normal

4.4.2. MFD Failure Mode 1

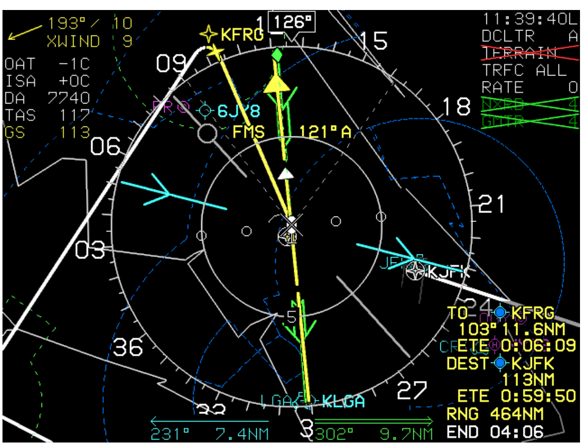


Figure 4-7: MFD Failure Mode 1
GPS/SBAS Failed; ADC and AHRS Normal

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

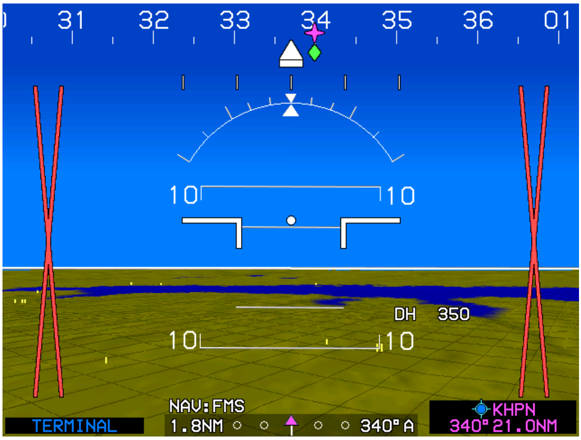


Figure 4-8: PFD (Tapes) Failure Mode 2 (Normal Mode)
ADC Failed; GPS/SBAS and AHRS Normal

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

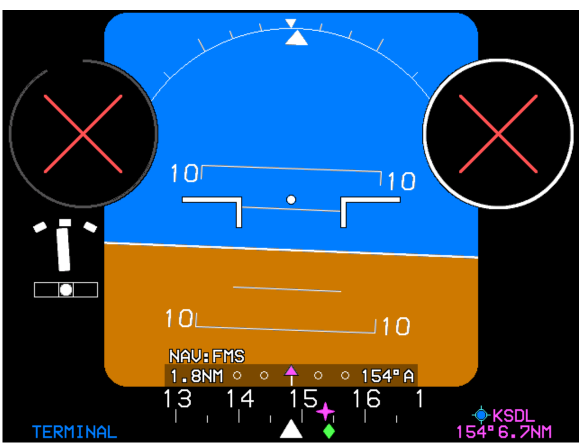


Figure 4-9: PFD (Round Dials) Failure Mode 2 (Normal Mode)
ADC Failed; GPS/SBAS and AHRS Normal

4.5.2. MFD Failure Mode 2

Figure 4-10: MFD Failure Mode 2
ADC Failed; GPS/SBAS and AHRS Normal

4.6. PFD (Tapes) Failure Mode 3

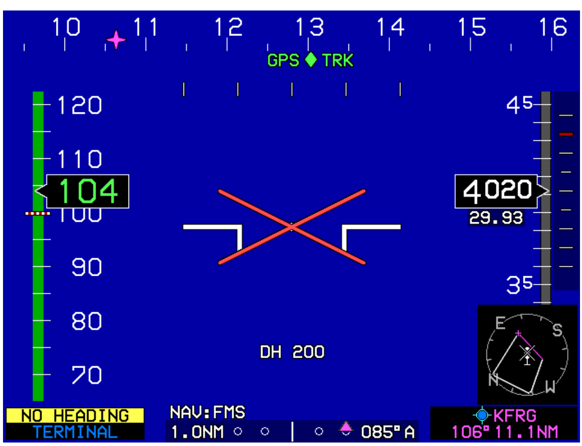


Figure 4-11: PFD (Tapes) Failure Mode 3
AHRS Failed; GPS/SBAS and ADC Normal

4.6.1. PFD (Round Dials) Failure Mode 3

Figure 4-12: PFD (Round Dials) Failure Mode 3
AHRS Failed; GPS/SBAS and ADC Normal

4.6.2. MFD Failure Mode 3

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

4.7. PFD (Tapes) Failure Mode 4

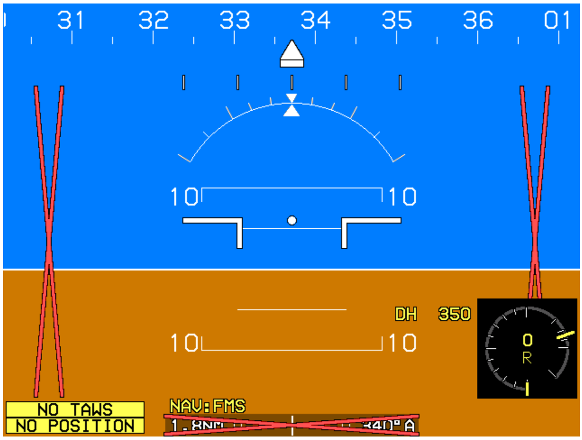


Figure 4-14: PFD (Tapes) Failure Mode 4
GPS/SBAS and ADC Failed; AHRS Normal

4.7.1. PFD (Round Dials) Failure Mode 4

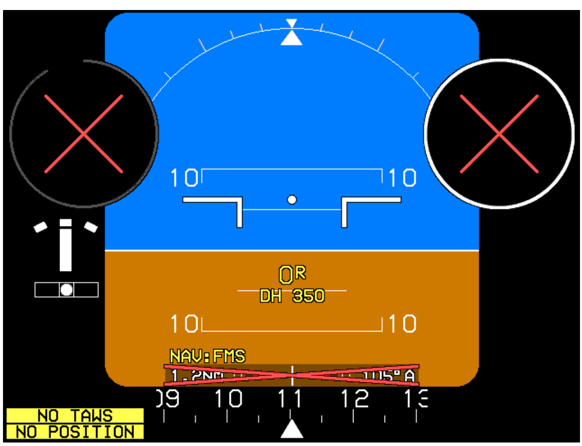


Figure 4-15: PFD (Round Dials) Failure Mode 4
GPS/SBAS and ADC Failed; AHRS Normal

4.7.2. MFD Failure Mode 4

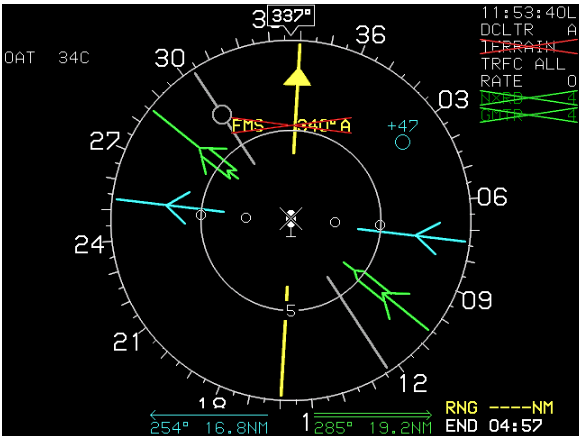


Figure 4-16: MFD Failure Mode 4
GPS/SBAS and ADC Failed; AHRS Normal

4.8. PFD (Tapes) Failure Mode 5

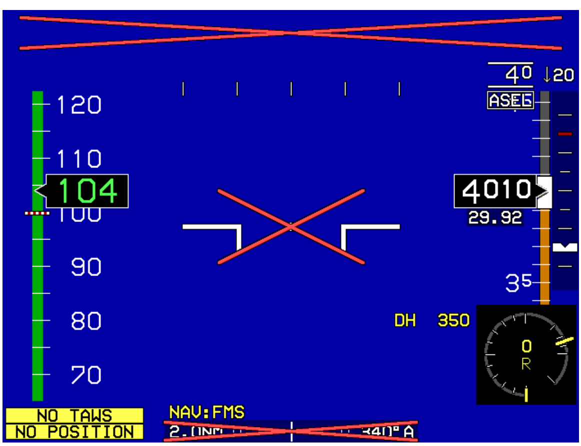


Figure 4-17: PFD (Tapes) Failure Mode 5
GPS/SBAS and AHRS Failed; ADC Normal

4.8.1. PFD (Round Dials) Failure Mode 5

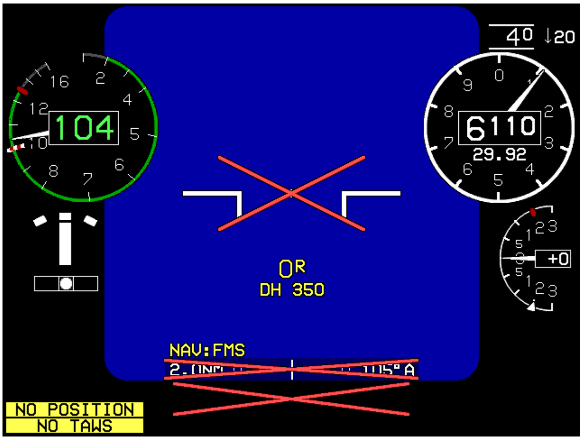


Figure 4-18: PFD (Round Dials) Failure Mode 5
GPS/SBAS and AHRS Failed; ADC Normal

4.8.2. MFD Failure Mode 5

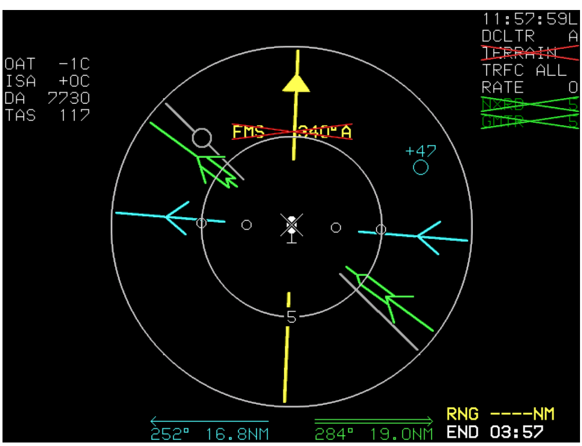


Figure 4-19: MFD Failure Mode 5
GPS/SBAS and AHRS Failed; ADC Normal

4.9. PFD (Tapes) Failure Mode 6

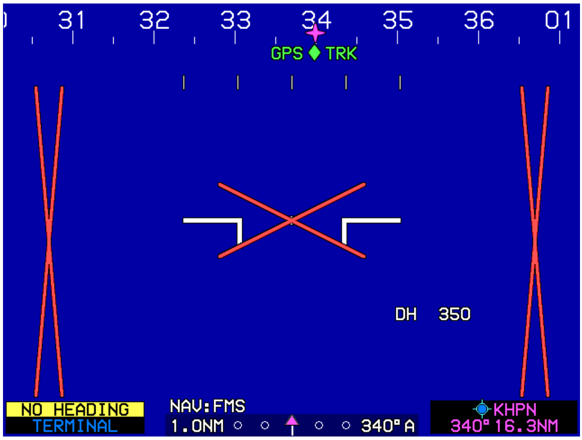


Figure 4-20: PFD (Tapes) Failure Mode 6
ADC and AHRS Failed; GPS/SBAS Normal

4.9.1. PFD (Round Dials) Failure Mode 6

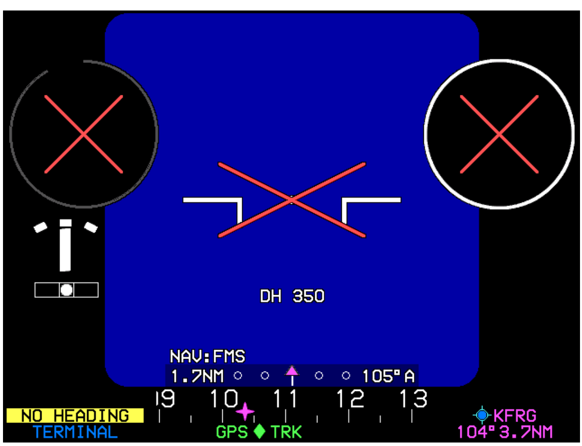


Figure 4-21: PFD (Round Dials) Failure Mode 6
ADC and AHRS Failed; GPS/SBAS Normal

4.9.2. MFD Failure Mode 6

Figure 4-22: MFD Failure Mode 6
ADC and AHRS Failed; GPS/SBAS Normal

4.10. PFD (Tapes) Failure Mode 7

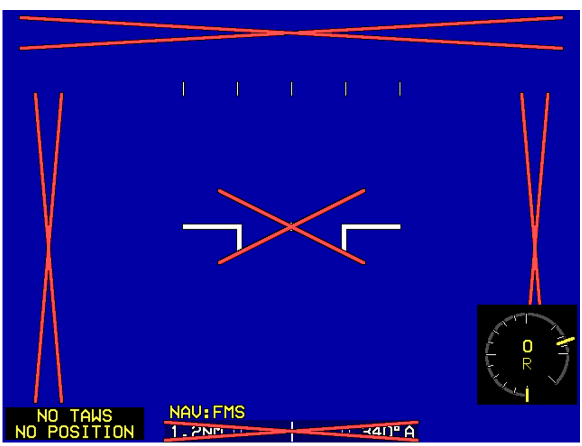


Figure 4-23: PFD (Tapes) Failure Mode 7
GPS/SBAS, ADC, and AHRS Failed

4.10.1. PFD (Round Dials) Failure Mode 7

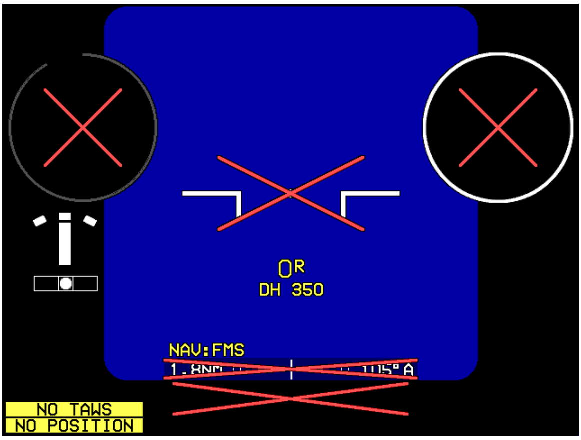


Figure 4-24: PFD (Round Dials) Failure Mode 7
GPS/SBAS, ADC, and AHRS Failed

4.10.2. MFD Failure Mode 7

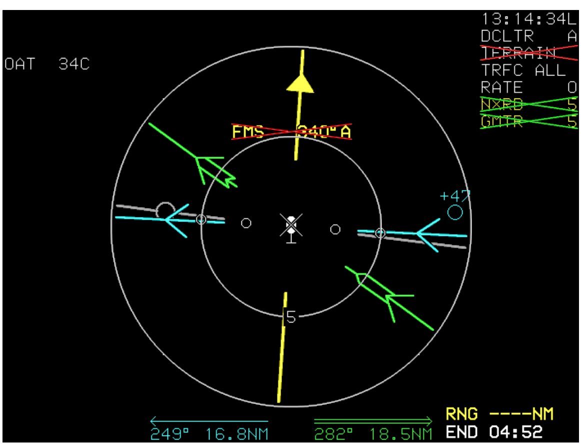


Figure 4-25: MFD Failure Mode 7
GPS/SBAS, ADC, and AHRS Failed

Section 5 Menu Functions and Step-By-Step Procedures

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List of Figures and Tables

5.1. Menu Functions

Navigate IDU menu functions by using the eight peripheral buttons and lower right (❶) rotary encoder. The rotary encoder in the lower left corner of the IDU-450 is only used for adjusting screen and button brightness and cannot be used for menu functions.

❶

Figure 5-1: IDU-450 Input Controls

5.2. Menu Synchronization

System settings changed by the menu system are synchronized between multiple IDUs in MFD-MFD mode. All parameters for rotorcraft are included. Each appendix for Datalink, Strikes, RBP, Traffic, Video, and Weather Radar contains specific limitations for menu synchronization for that feature.

Table 5-1: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Fuel Totalizer Quantity	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
AHRS 1 and 2 mode and slewing values	
VNAV Climb Angle	
Countdown Timer Start Time	
Countdown Timer Default Value	
Remote Tune Frequencies	
VNAV Descent Angle	
Decision Height Setting	Used when “Dual Decision Height Flag” is false. (In the configuration settings).
Emergency and Minimum Fuel Settings	N/A for AW-109SP
Heading Bug	
Minimum Altitude Bug Value	
VLOC OBS Settings	
Roll Trim parameter	
Airspeed Bug Setting	N/A for AW-109SP
Target Altitude Bug Setting	
Timer Starting Signal	
Traffic Filter Setting	
VSI Bug Setting	
True North mode	
UTC Offset	
Crosslink Synchronization Status	
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot 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	

Table 5-1: Menu Synchronization

Menu Parameter	Notes
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Decision Height Setting	Used when “Dual Decision Height Flag” is true. (In the configuration settings).
Navigation Source	
PFD Basic Mode	
PFD Zoom Mode	
PFD Analog AGL	
PFD Full-time Bank Scale Flag	
PFD Flight Director 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 weather radar.
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 pilot maximum MFD operating flexibility.	
MFD Selected Page	Parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Datalink Page Settings	
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.
MFD Hover Page Scale	
MFD Map and HSI Page Pointer Settings	
MFD Map Function Declutter Settings	

Table 5-1: Menu Synchronization	
Menu Parameter	**Notes**
MFD Show ETA Flag	
MFD Map NavData Symbol Declutter Settings	

5.3. Menu Function Types

There are two types of menu functions on the IDU-450, top-level menu functions corresponding to the labeled pushbutton, and soft menu functions indicated by menu tiles, which appear on screen. Soft menu function tiles appear next to the appropriate IDU button or in the lower right corner when use of the encoder is appropriate. Soft menu functions take precedence over IDU pushbutton functions.

Soft menu functions may include an indication of further menu levels with a two-dot trailer. When the menu system is beyond the top-level, **EXIT (R1)** provides one-touch escape to the top-level. When a soft menu level is deeper than the first level, **BACK (L1)** regresses through the menu system by one level.

5.4. Top-Level Menu

On the IDU-450, the top-level menu corresponds to the permanent label of the IDU pushbuttons and is active anytime no soft menu options appear on the screen.

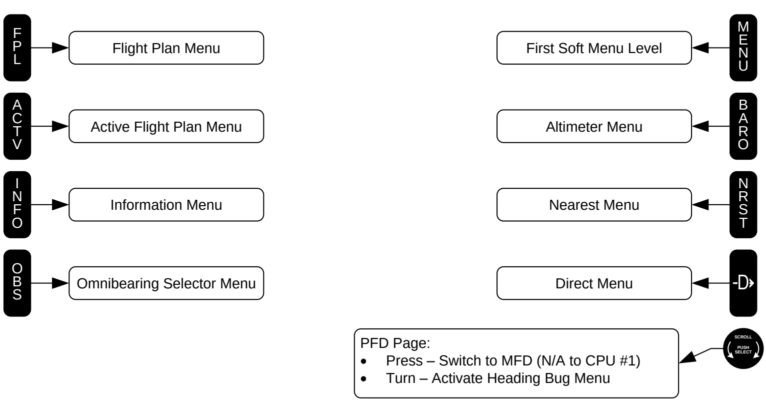


Figure 5-2: PFD Top-Level Menu

5.4.1. Top-Level Menu Option Descriptions

1) **FPL (L1)**: Flight plan menu
2) **ACTV (L2)**: Active flight plan menu
3) **INFO (L3)**: Information menu
4) **OBS (L4)**: Omnibearing selector menu
5) **MENU (R1)**: First-level associated with the current display page and times out after 10 seconds if there are no subsequent pilot actions.
6) **BARO (R2)**: Altimeter menu option
7) **NRST (R3)**: Nearest menu option
8)  **(R4)**: Direct menu option

5.4.2. Top-Level Menu Soft Menu Tiles (AW-109SP)

Once Horizon Synchronization is armed, vertical **HS ON (L2)** appears on the “transmit enabled” IDU. Press **HS ON (L2)** to engage Horizon Synchronization mode and apply the appropriate offset to displayed pitch attitude. Once engaged in Horizon Synchronization mode, **HS OFF (L2)** appears on the “transmit enabled” IDU. Press **HS OFF (L2)** to cancel Horizon Synchronization mode. Horizon Synchronization mode is also cancelled when the availability logic is no longer met. In most cases, Horizon Synchronization is cancelled by accelerating through the Cat. A range (60KIAS) rather than by pressing **HS OFF (L2)**.

5.4.3. #1 Encoder (➊)

1) On a PFD, scroll to activate the heading menu.
2) On MFD pages with an adjustable display scale (e.g., ND, Strike, Traffic, Datalink, Hover, or Weather Radar), scroll to change the display scale (CW = increase, CCW = decrease).
3) On the Video page, scroll to change the zoom level (CW = increase, CCW = decrease).
4) With the exception of IDU #1, push to swap between the PFD and MFD. IDU #1 is always fixed to the PFD page.

5.4.4. Top-Level Menu Automatic Pop-up Function Descriptions

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

Table 5-2: Top-Level Menu Automatic Function Descriptions Precedence, Tile Legend, and Action	
FPL (L1)	1) When a terrain popup occurs during a TAWS FLTA alert, **RESET** appears. (Enhanced HTAWS only) 2) When showing ND Page with Pan Mode enabled, **PN OFF** appears. Press to disable Pan Mode. **RESET** has precedence over **PN OFF**. 3) When display is “transmit enabled”, **LNAV** appears. When there is an active flight plan, heading bug sub-mode is active, and the system is integrated with an analog autopilot. Press to deactivate heading bug sub-mode and resume guidance to the active flight plan path. **RESET** and **PN OFF** have precedence over **LNAV**. LNAV does not appear on the AW-109SP; pilot must use the RBP LNAV button. 4) When display is “transmit enabled”, **MISS** appears upon transitioning the Final Approach Fix. Press to activate the missed approach procedure. **RESET**, **PN OFF,** and **LNAV** have precedence over **MISS**. 5) When display is “transmit enabled”, **CONT** appears when in a holding pattern with further active flight plan legs after the holding pattern. Press to re-enable automatic waypoint sequencing to allow normal sequencing to the leg after the holding pattern. **RESET**, **PN OFF**, **LNAV**, and **MISS** have precedence over **CONT**.
ACTV (L2)	1) When showing ND Page with: (a) Pan Mode enabled; (b) information for the nearest highlighted waypoint is shown; and (c) airport

Table 5-2: Top-Level Menu Automatic Function Descriptions Precedence, Tile Legend, and Action	
	weather information present in the information block; **WX** appears to allow the display of textual METAR and TAF data for the airport. **UP** has precedence over **WX**. 2) When display is "transmit enabled", **VNAV** appears when VNAV guidance is valid, the selected altitude sub-mode is active, and the system is integrated with an analog autopilot or HeliSAS-E. Press to deactivate selected altitude sub-mode and resume guidance to the VNAV path. **UP** and **WX** have precedence over **VNAV**. VNAV does not appear on the AW-109SP; pilot must use the RBP VNAV button. 3) When display is "transmit enabled", **ARM** appears when on the Final Approach Segment (between the Final Approach Fix and Missed Approach Point). Press to arm Missed Approach Procedure to automatically activate upon sequencing the Missed Approach Point. **UP**, **WX**, and **VNAV** have precedence over **ARM**. (See #2 for AW-109SP)
INFO (L3)	When showing ND Page with Pan Mode enabled, **NORTH** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.
OBS (L4)	When showing ND Page with Pan Mode enabled, **SOUTH** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.
BARO (R2)	When showing ND Page with Pan Mode enabled, **INFO** or **HIDE** appears. Press to toggle the display of information for the nearest highlighted waypoint.
NRST (R3)	When showing ND Page with Pan Mode enabled, **EAST** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.
 **(Direct-To)** **(R4)**	When showing ND Page with Pan Mode enabled, **WEST** appears. Press to shift the center of the Pan Mode ND Page in the specified direction.

5.5. First Page (PFD)

On the IDU-450, IDU #1 is fixed to the PFD page, and other IDUs may show the PFD page as a backup function. IDU-450 PFD page first-level options are as follows.

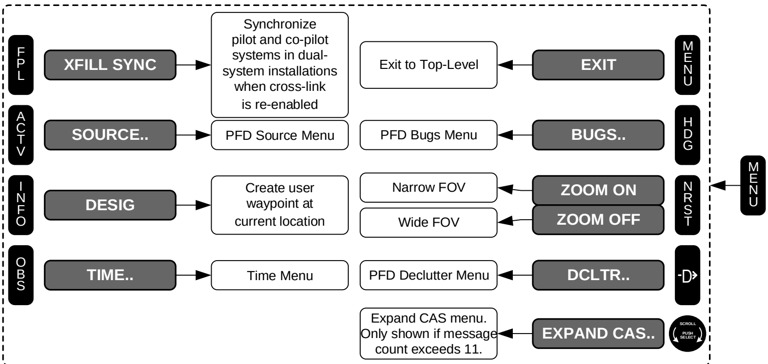


Figure 5-3: First Page PFD

5.5.1. PFD Page First-Level Option Descriptions

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

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

Crossfill (1)	Flight Plan	Indication (Pilot and Co-pilot)	Action to Synchronize Flight Plans		Result
			Pilot	Co-pilot	
Enabled (Cond.1)	Synchro-nized	None	None	None	No action required. Pilot and co-pilot sides already synchronized.
Enabled (Cond.2)		XFILL ARM	**MENU (R1)**	None	Pilot's flight plan is sent to co-pilot side and both

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

Crossfill [1]	**Flight Plan**	**Indication (Pilot and Co-pilot)**	**Action to Synchronize Flight Plans**		**Result**
			Pilot	**Co-pilot**	
	Not Synchro-nized [2]		**XFILL SYNC (L1)**		sides are synchronized going forward. XFILL ARM is removed from both sides.
			None	**MENU (R1)** **XFILL SYNC(L1)**	Co-pilot's flight plan is sent to pilot side and both sides are synchronized going forward. XFILL ARM is removed from both sides.
Inhibited (Cond.3)	Not Synchro-nized	XFILL INHBT	Enable crossfill [1] (proceed to Cond. 2)		XFILL INHBT removed. XFILL ARM displayed on both sides.

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

(2) Pilot and co-pilot flight plans can become unsynchronized under the following conditions:

- Crossfill is inhibited, and pilot and co-pilot flight plans are separately changed before crossfill is re-enabled.
- Either the pilot or co-pilot side is restarted with an active flight plan on the other side and crossfill enabled.

2) **Source (ACTV) (L2)**: Activates PFD source selection menu option.

3) **DESIG (INFO) (L3)**: Creates a user waypoint at the current aircraft location. In addition, if pressed with an ND page operating in panning mode, creates a user waypoint at the phantom panning location. User waypoint is automatically named “OF###”, where ‘###’ is the next available over-fly user waypoint number.

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

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

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

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

5.5.2. PFD Screen First Soft Menu Level

When Horizon Synchronization is available and the IDU is “transmit enabled,” **HRZ SYNC (L2)** appears in the PFD screen first soft menu level. **HRZ SYNC** takes precedence over the PFD Source menu. Press **HRZ SYNC (L2)** to arm Horizon Synchronization mode. It is anticipated the pilot takes this action on a Cat. A departure prior to lifting the helicopter into hover flight (AW-109SP only).

XFILL SYNC (L1) in the PFD Screen First Soft Menu Level appears when all of the following conditions are met:

1) Crosslink status is enabled; And

2) Crosslink synchronization status is not enabled; And

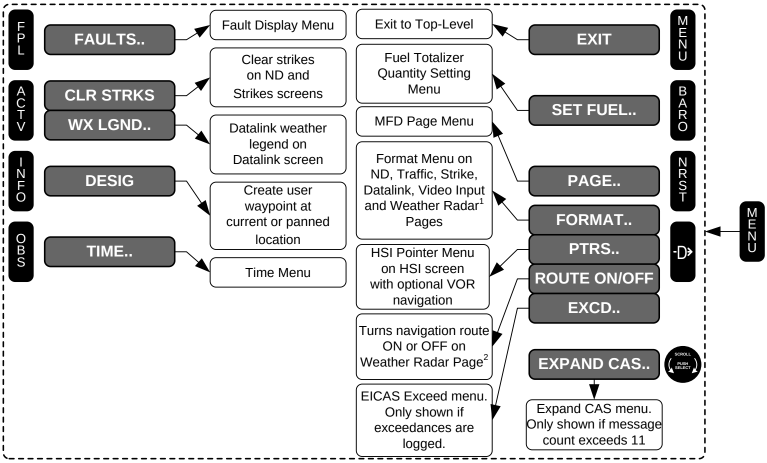
3) Discrete input for Crossfill Inhibit is not enabled; And

4) Side in command is valid; AND

5) AFCS Status is set to invalid.

5.5.3. First-Level (MFD)

IDUs other than #1 may show various MFD pages as described in the MFD Page Menu section. MFD first-level options are as follows.



[1] When MFD WX RDR Format menu exists (see Weather Radar Appendix for MFD WX RDR Format Menu). The MFD WX RDR Format menu exists when the weather radar type is either RDR-2000 or RDR-2100 and an external RCP is not installed.

[2] When MFD WX RDR Format menu does not exist.

Figure 5-4: First-Level MFD

1) **FAULTS (FPL) (L1)**: Activates fault display menu option.

2) **CLR STRKS** or **WX LGND (ACTV) (L2)**: On ND page or Strike page with WX-500 option enabled, **CLR STRKS** activates strike clear option for the Goodrich/L-3 WX-500. On Datalink page, **WX LGND** activates datalink weather legend.

3) **DESIG (INFO) (L3)**: Same function as PFD page first-level.

4) **TIME (OBS) (L4)**: Same function as PFD page first-level.

5) **SET FUEL (BARO) (R2)**: Activates fuel totalizer set menu option.

6) **PAGE (NRST) (R3)**: Activates MFD display page select menu option.

7) **FORMAT, PTRS,** or **ROUTE ON/ROUTE OFF**  **(R4)**:

a) **FORMAT**: On ND, Traffic, Strike, Datalink, and Video Input pages, activates appropriate page format menu option.

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

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

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

Top-level and first-level menus, called lower-level menus, and the eight pushbuttons and encoder control them as seen in Figure 5-1.

5.6.1. Flight Plan (FPL) Menu

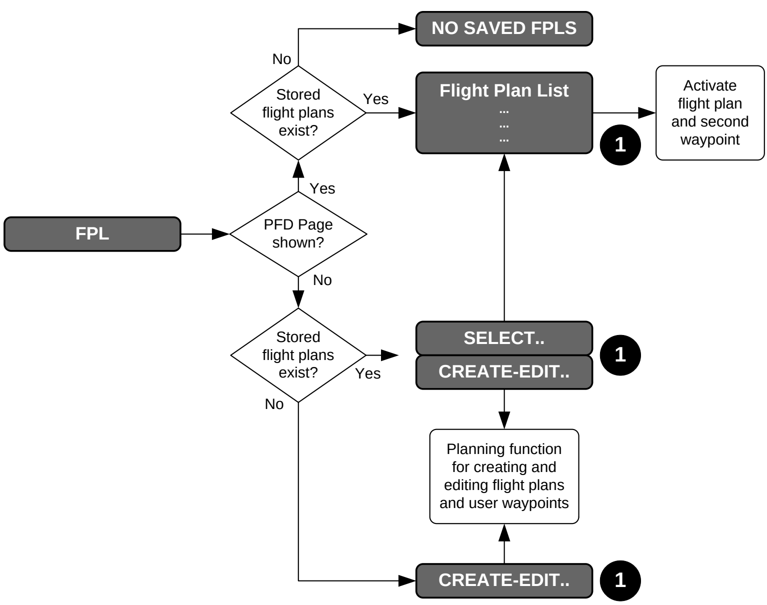


Figure 5-5: Flight Plan Menu

5.6.2. Flight Planner Page

The Flight Planner page is used for following functions on pilot-modifiable elements in the IDU database.

1) Manage stored flight plans (activate, create, edit, delete, and reverse);

2) Manage user waypoints (create, edit, and delete); and

3) Perform RAIM predictions.

These operations demand pilot attention and are not normal operating conditions for the IDU. When the Flight Planner page is in use, the Flight Planner page takes over the IDU's controls and disables the menu operations described in this document. Normal menu operation and IDU control function are restored upon:

1) Exit the Flight Planner page; or

2) Because the Flight Planner page takes over the IDU's controls, limitations are placed upon access and display of the Flight Planner page. When the Flight Planner page is accessed, it only appears on the MFD. This is done to preserve access to crucial PFD Page controls such as altimeter settings.

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

5.6.3. MFD Page Shown on IDU

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

5.6.4. Create an Overfly User Waypoint

When flying over intended waypoint, press **MENU** then **DESIG** on the PFD or MFD. A user waypoint is created at the present position and automatically named "OF###", where '###' is the next in sequence overfly user waypoint number available. When in the Pan Mode and the aircraft position is slewed, a second user waypoint is created at the original position. Change the waypoint name may by using the "**EDIT USER WPT**" function on the MFD.

Figure 5-6: Creation of Overfly User Waypoint

NOTE:

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

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

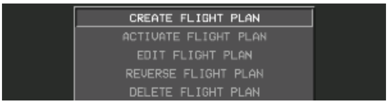
1) Press **FPL (L1)**.

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

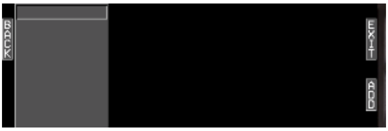
5.6.6. Flight Plan (FPL) Menu Create-Edit (MFD Only) (Step-By-Step)

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

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



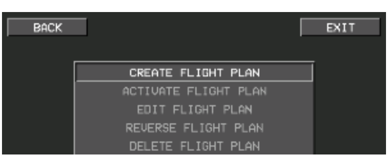
3) Push ❶ to enter.



4) Press **ADD (R2)** to begin creating first waypoint.

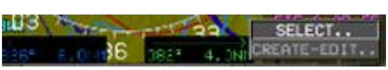
5) Either use ❶ to create a new waypoint or press **NRST APT..**, **NRST VOR..**, **NRST NDB..**, **NRST FIX..**, or **NRST USR..**, and make desired selection. Push ❶ to enter.

6) When finished, press **SAVE (R4)** to store the new flight plan as one of 100 flight plans in memory. When 100 flight plans are present, the CREATE FLIGHT PLAN option is absent.



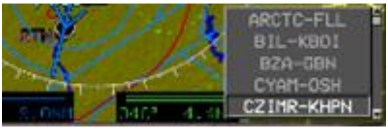
7) If no other action is necessary, press **BACK (L1)** to return to function select page or **EXIT (R1)** to exit the menu.

5.6.7. Activate Flight Plan (MFD Only) (Step-By-Step)



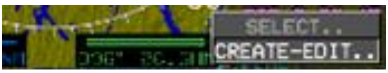
1) Press **FPL (L1)**.

2) Scroll ❶ to **SELECT..** and push to enter.



3) Scroll ❶ to desired saved flight plan and push to enter to exit and return to normal operation.

Or



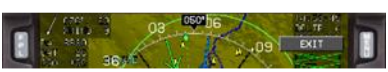
4) From inside the **CREATE-EDIT..** flight planner, push ❶ to enter.

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

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

7) If no other action is necessary, press **BACK (L1)** to return to function select page or **EXIT (R1)** to exit the menu.

5.6.8. Edit Flight Plan (MFD Only) (Step-By-Step)

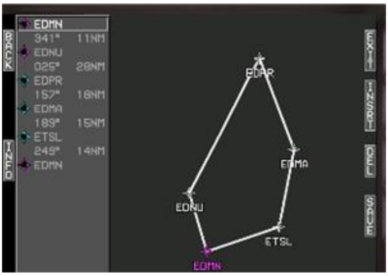


1) Press **FPL (L1)**.

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

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

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



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

6) To save, press **SAVE (R4)**.

7) If no other action is necessary, press **BACK (L1)** to return to function select page or **EXIT (R1)** to exit the menu.

5.6.9. 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 action is necessary, press **BACK (L1)** to return to function select page or **EXIT (R1)** to exit the menu.

5.6.10. 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 **DELETE FLIGHT PLAN** and push to enter.

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

5) Push ❶ to **CONFIRM DELETE FPL**.

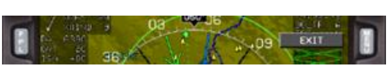
6) Next flight plan is highlighted. If no other action is necessary, press **BACK (L1)** to return to function select page or **EXIT (R1)** to exit the menu.

5.6.11. 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)

Follow the step-by-step procedure defined below to create a user waypoint using latitude and longitude.



1) Press **FLP (L1)**.

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

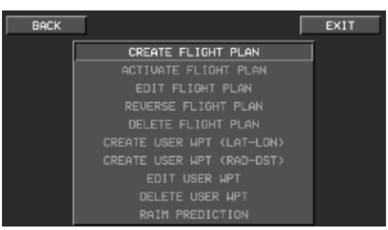
3) Scroll ❶ to **CREATE USER WPT (LAT-LON)** and push to enter.

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

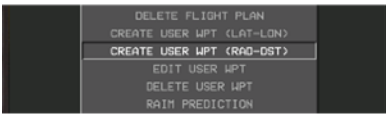


If desired, specify the approach bearing to user waypoint in degrees 1°-360°. **OFF** value disables VFR approaches to the user waypoint. Once all fields are entered, press **SAVE (R4)** to save the user waypoint and return to the editing screen.

5.6.12. Create User Waypoint (RAD-DST) (MFD Only) (Step-By-Step)

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

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



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

The identifier is automatically named RD### where ### is the next available radial distance waypoint number.*

4) After all fields have been entered, press **SAVE (R4)** to save and return to the editing screen.

* **Reference Waypoint**: The pilot is prompted to enter an identifier for the reference waypoint on the second line. Use ❶ to enter the reference waypoint in the same manner as a waypoint is entered for a flight plan. If there is a single result from the search, the pilot is advanced to the radial entry box. If there is no result from the search, the pilot is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is displayed, and upon selection, the pilot is advanced to the radial entry box. **INFO** menu appears at this level and provides access to information for the highlighted result.

Radial Entry: The third line is for pilot to specify a radial from the reference waypoint in increments of degrees.

Distance Entry: The fourth line allows the pilot to specify a distance from the reference in increments of tenths of nautical miles.

5.6.13. Edit User Waypoint (MFD Only) (Step-By-Step)

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

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

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

4) Scroll ❶ to desired waypoint to be edited.

5) Use ❶ to enter alphanumeric characters Follow prompts to edit information. Push ❶ to step through all character spaces.

6) To back up, press **BACK** (**L1**) and continue to the end of all character spaces.

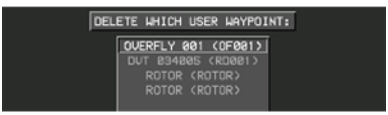
7) Select another waypoint to edit or push **SAVE** (**R4**) to save changes to return to the EDIT USER WPT menu.

5.6.14. Delete User Waypoint (MFD Only) (Step-By-Step)

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

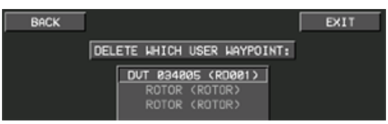
2) Scroll ❶ to **CREATE-EDIT..** and push to enter.

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



4) Scroll ❶ to desired waypoint to be deleted.

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



6) If no other waypoints to delete, press **EXIT (R1)** to exit the menu and return to the MAP.

NOTE:

Pilot alterations of user waypoint parameters while in flight do not automatically update to an active flight plan.

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

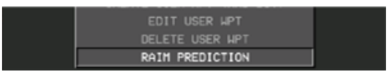
1) EDIT the user waypoint as described above
2) Open a flight plan which uses the user waypoint
3) Delete the existing waypoint from the flight plan
4) Save and Exit
5) Reload the flight plan if it were in use.

5.6.15. RAIM Prediction

When selected, the RAIM prediction screen is only shown if the GPS/SBAS receiver is capable of performing a RAIM Prediction. There must be no faults along with a current almanac in memory. The **FAULTS** menu may be monitored to determine if the GPS/SBAS receiver is capable of performing a RAIM prediction.

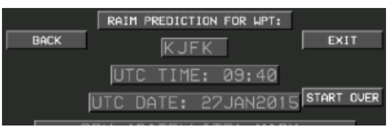
1) Press **FPL (L1)**.

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



3) Scroll ❶ to **RAIM PREDICTION** and push to enter.

SEE NOTE BELOW.



4) If another RAIM Prediction is necessary, press **START OVER** (**R2**) to start the process again or press **EXIT** (**R1**) to exit the RAIM Prediction menu.

NOTE:

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

1) **Designated Waypoint**: The pilot is prompted to enter an identifier for the designated waypoint. If there is a single result from the search, the pilot is advanced to the UTC time entry box. If there is no result from the search, the pilot is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented and, upon selection, the pilot is advanced to the UTC time entry box. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted results.

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

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

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

5) **EXIT**: Allows exit of the RAIM prediction screen at any time.

6) Once a designated waypoint and UTC estimated time of arrival are entered, **CALC (R2)** appears for the pilot to initiate the RAIM Prediction. Press **CALC (R2)** to check the UTC estimated time of arrival and ensure it is within the current almanac (i.e., <3.5 days from current date and time). If it is, a Predictive FDE Request message requesting "Detection Availability" with a required HAL of 0.3NM is sent to the GPS/SBAS receiver. In response, the GPS/SBAS receiver replies with a sequence of Predictive FDE Response messages. These messages are parsed and used to fill in the RAIM Prediction result area at the bottom of the screen. The RAIM Prediction result area shows the RAIM Prediction results as "OK" or "XX" for ETA ± in 5-minute increments. Once a prediction is complete, **START OVER (R2)** appears to allow the pilot to perform another prediction without having to exit the RAIM Prediction screen.

5.7. Active Flight Plan (ACTV) Menu

5.7.1. Main Menu

See Section 7 IFR Procedures for Active Flight Plan description.

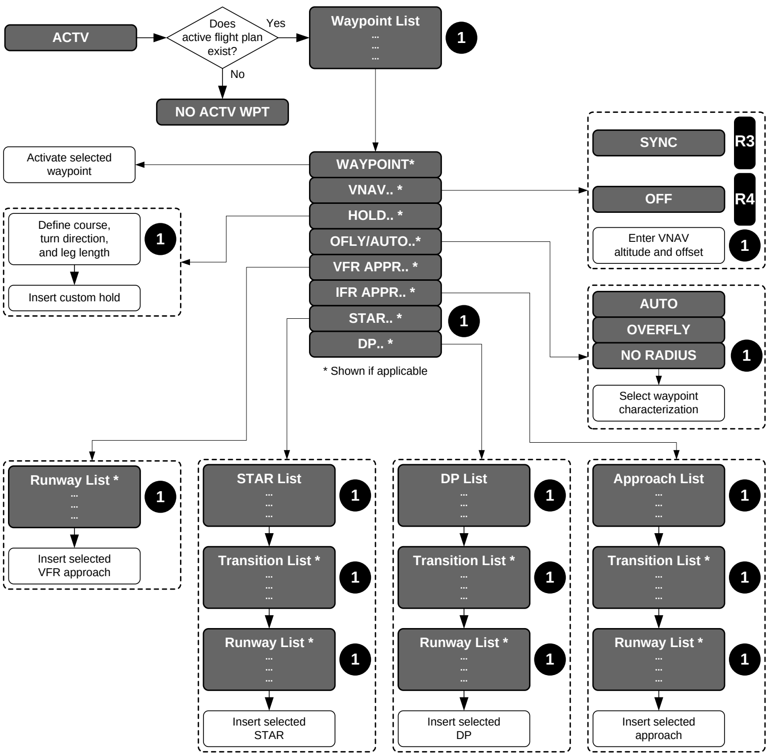


Figure 5-7: Active Flight Plan Main Menu

5.7.2. Active Flight Plan (ACTV) Menu Options

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

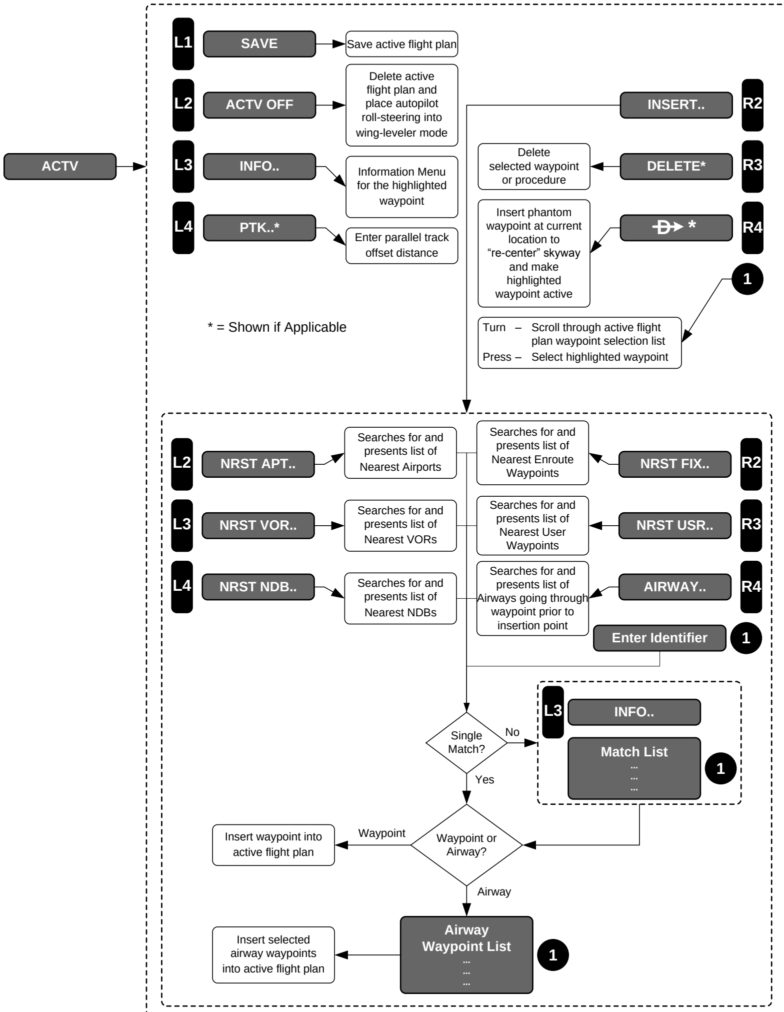


Figure 5-8: Active Flight Plan Menu Options

1) **SAVE** (**L1**): Saves active flight plan. Stored flight plans are saved without procedures or phantom waypoint (this is a safety item as procedures potentially change every 28 days). Stored flight plans are named by their first and last waypoints. If the new stored flight plan has the same start and end points as a previously saved flight plan but has different routing, a number

(0-9) is appended to the name to uniquely identify up to 10 routings with the same start and end points.

2) **ACTV OFF** (**L2**): Deletes active flight plan. The pilot is prompted to confirm deletion prior to completion of the operation.

3) **INFO** (**L3**): Activates information menu option for highlighted waypoint.

4) **PTK** (**L4**): Shown if the active leg can be offset allowing the pilot to specify a parallel offset distance that applies to the active and contiguous legs. The range of parallel offsets are from 20NM left of track to 20NM right of track in 1NM increments.

5) **INSERT**/**ADD** (**R2**): Allows the pilot 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 reads **ADD**, otherwise the tile reads **INSERT**. When the highlighted waypoint is the second or subsequent waypoint of a procedure, the tile does not appear. This prevents corruption of IFR approaches, STARs, and DPs. When activated, the pilot is prompted to enter an identifier. Performing a search for waypoints requires the entry of at least two characters. If only one character is entered, only airways are searched.

   For waypoints, if there is a single result from the search, the result is inserted or added to the active flight plan. If there is no result from the search, the pilot is re-prompted to enter 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. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result.

   For airways, a search is performed for all airways going through the highlighted waypoint and matching the entered identifier (i.e., to get a list of all Victor airways, Q-Routes and T-Routes going through the highlighted waypoint, enter an identifier string of “V”, “Q” or “T”). If there is a single result from the search, a list of airway waypoints is shown for the pilot to select the desired exit point. If there is no result from the search, the pilot is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching airway identifiers is presented and, upon selection, a list of airway waypoints is shown for the pilot to select the desired exit point. Upon selecting the desired exit point, all airway waypoints from the previous waypoint to the desired exit point are inserted or added to the active flight plan.

6) **NRST APT (L2)**: Performs a search for 20 airports within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no airports within 240NM with a runway length greater than or equal to the minimum runway length setting), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result, which includes datalinked weather information when available. With optional datalink, **WX LGND (L2)** and **EXPND WX (L3)** are available at this level to show a weather symbol legend and highlighted result METAR and TAF text respectively.

7) **NRST FIX (R2)**: Performs a search for 20 fixes within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no fixes within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result.

8) **NRST NDB (L4)**: Performs a search for 20 NDBs within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no NDBs within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result.

9) **NRST USR (R3)**: Performs a search for 20 user waypoints within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current

aircraft location. If there are no results (i.e., no user waypoints within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result.

10) **NRST VOR** (**L3**): Performs a search for 20 VORs within 240NM nearest to the waypoint prior to the insertion point or, if there is no waypoint prior to the insertion point, current aircraft location. If there are no results (i.e., no VORs within 240NM), **NO RESULTS** is displayed. Otherwise, a selection list is displayed including identifier, bearing, and distance to each result. Upon selecting a result from the selection list, the item is inserted or added to the flight plan. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result.

    Identifier Entry Box: The pilot may 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, it is inserted or added to the active flight plan. If there is no result from the search, the pilot is re-prompted to enter an identifier. If there are multiple results from the search, a selection list with matching identifiers is presented and, upon selection, the selected waypoint is inserted or added to the active flight plan. **INFO (L3)** appears at this level to aid in selection and give access to information for the highlighted result, which includes datalinked weather information when available. With optional datalink, **WX LGND (L2)** and **EXPND WX (L3)** are available at this level to show a weather symbol legend and highlighted result METAR and TAF text respectively.

11) **DELETE (R3)**: Not shown if the highlighted waypoint is a parallel offset entry or exit waypoint (these types of waypoints are deleted by removing the parallel offset). Otherwise, if the highlighted waypoint is a non-procedure waypoint, the function deletes the highlighted waypoint from the active flight plan. If the highlighted waypoint is part of a procedure, the function deletes the entire procedure from the active flight plan. The pilot is prompted to confirm deletion prior to completion of the operation. This tile does not appear if the highlighted waypoint is a non-procedure waypoint and there are fewer than three non-procedure waypoints in the active flight plan. This is because an

active flight plan must always have at least two non-procedure waypoints. The tile also does not appear when the highlighted waypoint is suppressed or when the highlighted position is one position past the end of the active flight plan.

12) **Direct**  **(R4)**: Not shown if the highlighted waypoint is a parallel offset entry or exit waypoint. Otherwise, inserts a phantom waypoint at the current aircraft location and makes the highlighted waypoint active. The phantom waypoint is a fly-over defined entry waypoint, and the leg prior to the phantom waypoint is designated a discontinuity. This assures the skyway is "re-centered" to provide guidance to the new active waypoint. This tile does not appear when the highlighted waypoint is suppressed or when the highlighted position is one position beyond the end of the active flight plan.

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

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

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

3) Scroll ❶ to desired option and push to enter.

4) As one option, a VNAV setting is entered.

5) As another option, deleting the next waypoint is accomplished.

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

1) With the desired flight plan selected and activated, the next steps may be accomplished on the PFD or MFD.

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

3) Scroll ❶ to desired waypoint. Push to enter.

4) Scroll ❶ to **VNAV..** then to desired altitude and push to enter.

5) If no OFFSET is necessary, push ❶ to enter.

6) View active flight plan for further editing or press **EXIT (R1)** to clear active flight plan from view.

5.7.5. 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.

3) Press **SAVE (L1)** to save active flight plan as one of the 100 stored flight plans. (Any procedure within the saved active flight plan is not saved.)

5.7.6. Active Flight Plan (ACTV) Menu (AW-109SP)

The active waypoint is the lateral navigation color, as defined in the AW-109SP Lateral Navigation Color Logic table in Section 3 Display Symbology. If a valid MOT flight pattern has been received from the AFCS and is being used as the active flight plan, the Active Flight Plan Menu is disabled.

5.8. Information (INFO) Menu

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

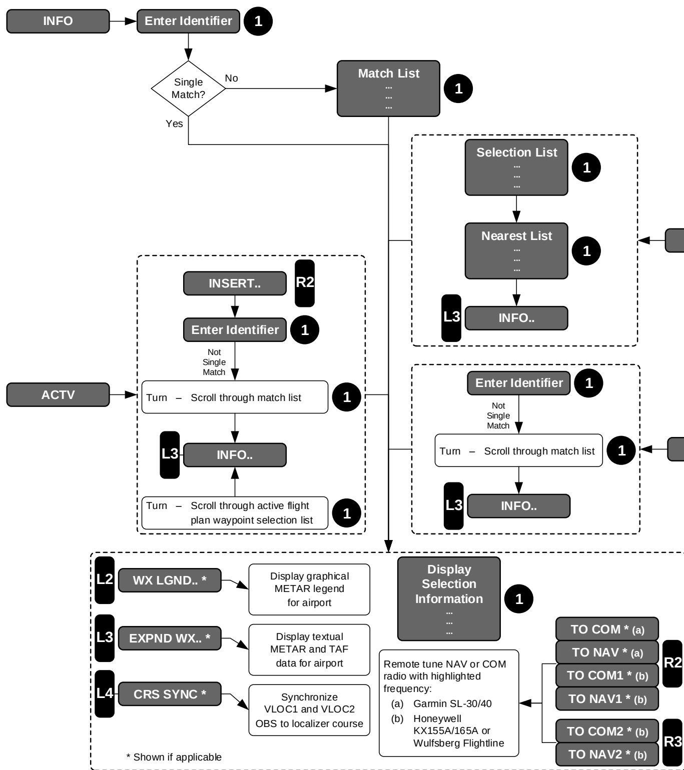


Figure 5-9: Information Menu

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

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

For remote tuning, a single frequency is associated with the waypoint, tiles allow transmission of the frequency to remote NAV or COM radios. **TO COM1** or **TO NAV1 (R2)** while a **TO COM2** or **TO NAV2 (R3)** is shown. 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 is addressed to COM radios.

NOTE:

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

When the information is presented for an ILS or localizer waypoint and the current VLOC1 or VLOC2 omnibearing selectors are not synchronized with the localizer course, **CRS SYNC (L4)** allows one-touch synchronization of **VLOC1 (L3)** and **VLOC2 (L4)** omnibearing selectors to the localizer course.

Figure 5-10: CRS SYNC

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

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

2) Push ❶ to view information.

5.8.2. Information (INFO) Menu (AW-109SP)

If Swiss Grid mode is active, waypoint information shows X, Y, and Z Swiss Grid parameters instead of latitude and longitude.

CAUTION:

Swiss Grid should not be used outside of Switzerland.

5.9. Omnibearing Selector (OBS) Menu

The OBS menu allows the pilot to control the setting of the omnibearing selector for purposes of showing course deviations. The OBS for **FMS (L2)** allows the pilot to specify either a manual or automatic OBS setting in which the active OBS is controlled by the active flight plan. The OBS for VLOC1 allows the pilot to specify the active OBS setting for the VLOC1 navigation function. The OBS for VLOC2 allows the pilot to specify the active OBS setting for the VLOC2 navigation function. Manual **FMS**, **VLOC1**, and **VLOC2 OBS** settings are settable in increments of 1°. **OBS SYNC (R3)** is 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)** is available to toggle between automatic and manual OBS settings.

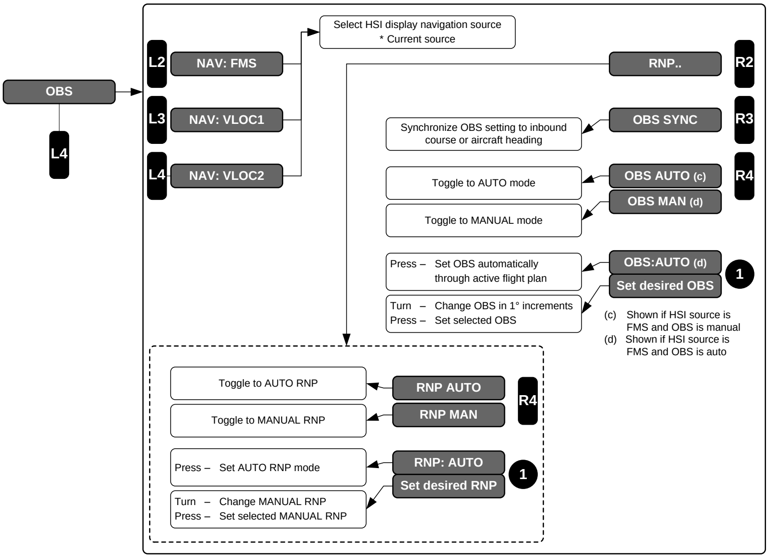


Figure 5-11: Omnibearing Selector (OBS) Menu

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

If a True North mode discrete input is not configured, the OBS menu allows the pilot to toggle between “TRUE NORTH” and “MAG NORTH” modes.

The OBS function also permits the pilot to select between manual and automatic RNP settings. Upon selecting **RNP**, **RNP AUTO/RNP MAN**  **(R4)** is available to toggle between automatic and manual RNP settings. Manual RNP is selectable between 0.10NM and 15NM as follows:

1) 0.01NM increments between RNP 0.10 and RNP 0.3

2) 0.1NM increments between RNP 0.3 and RNP 2

3) 1NM increments between RNP 2 and RNP 15

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

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

2) Press **OBS (L4)** and make HSI source selection or change to **OBS MANUAL (R4).**

5.9.2. Omnibearing Selector (OBS) Menu (AW-109SP)

If the AFCS is in NAV mode, press **OBS (L4)** to display the following choices for selecting a NAV Preview source: **PRV**:**VLOC1** and **PRV:VLOC2**. These tiles appear instead of the normal **NAV:VLOC1** and **NAV:VLOC2**. While the AFCS is in NAV mode, it only couples to FMS and cannot couple to either **VLOC1** or **VLOC2**. The NAV Preview Status (set by selecting one of the NAV preview sources as described above) is synchronized on-side only.

5.10. Heading Bug (HDG) Menu

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

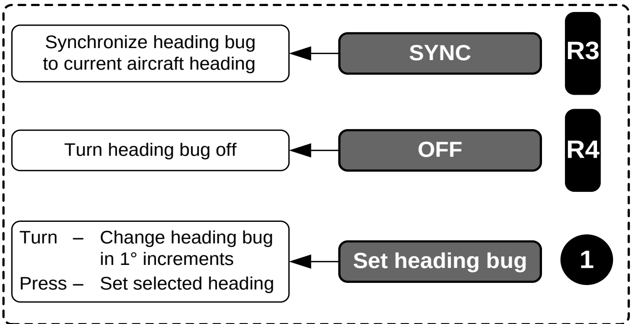


Figure 5-12: Heading Bug (HDG) Menu

5.10.1. Heading Bug (HDG) Menu (PFD Only) (Step-By-Step)

1) Scroll ❶ to enter Heading mode.

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

3) Push ❶ to select new heading or press **SYNC** (**R3)** to sync current heading.

5.10.2. Heading Bug (HDG) Menu (AW-109SP)

The heading bug is set with the RBP, thus the Heading Bug Menu is disabled on the IDU. Nearest (NRST) Menu Upon activating the nearest menu, an option list appears to allow the pilot to select from a list of the nearest following categories:

1) Airports
2) VORs
3) ILSs
4) NDBs
5) Fixes
6) User waypoints
7) ARTCC frequencies
8) FSS frequencies
9) Weather

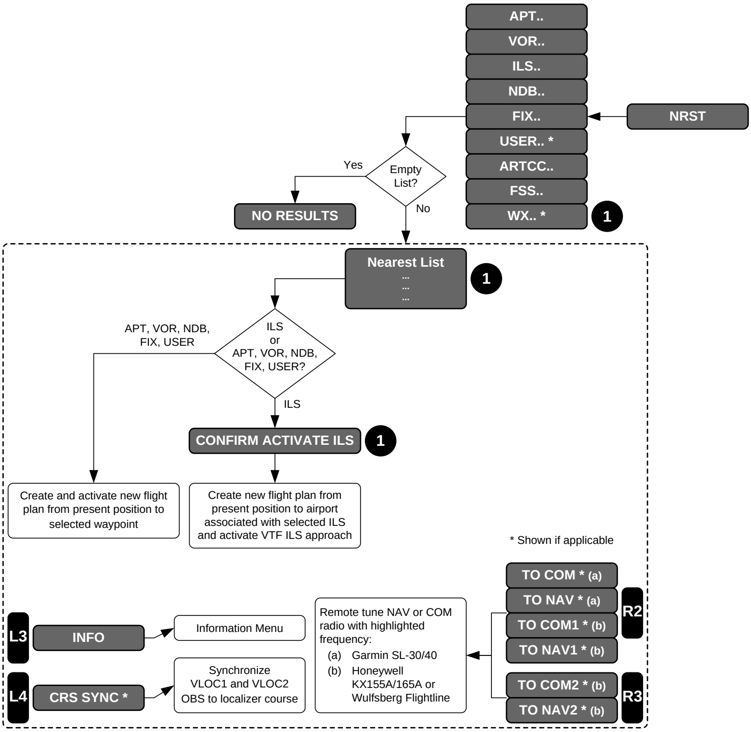


Figure 5-13: Nearest (NRST) Menu

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

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

NOTE:

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

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

In the case of **NRST ILS** where the current VLOC1 or VLOC2 OBS does not match the localizer course, **CRS SYNC (L4)** is 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 is created from present aircraft position to the selected waypoint. Upon selecting a waypoint of type ILS, **CONFIRM ACTIVATE ILS** is displayed. When the pilot confirms the ILS activations, the following actions occur:

1) A direct flight plan to the airport associated with the ILS is created;

2) A vectors-to-final ILS approach to the ILS is activated;

3) If the heading bug is turned OFF, the heading bug is activated to current heading to act as a starting point for receiving vectors (autopilot enabled systems only);

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

5) HSI source is switched as follows:

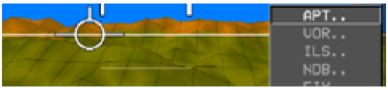
   a) If there is only one nav radio installed, the source for the selecting side is changed to VLOC1. The source for the other side does not change.

   b) If there are two nav radios installed, the default sensor for the selecting side controls which source is used. The source for the other side does not change.

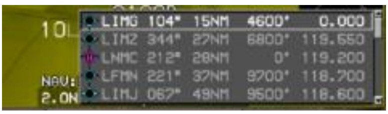
6) Connected nav radios are remote tuned to ILS frequency.

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

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



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



3) Scroll ❶ to desired airport and select to either **INSERT**, **INFO**, or send frequency to **COMM1** or **COMM2.**

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

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

2) Scroll ❶ to select ILS from list. Push to enter.

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

4) Push ❶ to confirm and activate ILS.

5.12. Direct Menu

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

If the default entry is the active waypoint and accepted by the pilot, a phantom waypoint is inserted at the current aircraft location. The phantom waypoint is a fly-over defined entry waypoint, and the leg prior to the phantom waypoint is designated a discontinuity. This assures the skyway is “re-centered” to provide guidance to the new active waypoint. The rest of the active flight plan remains unchanged.

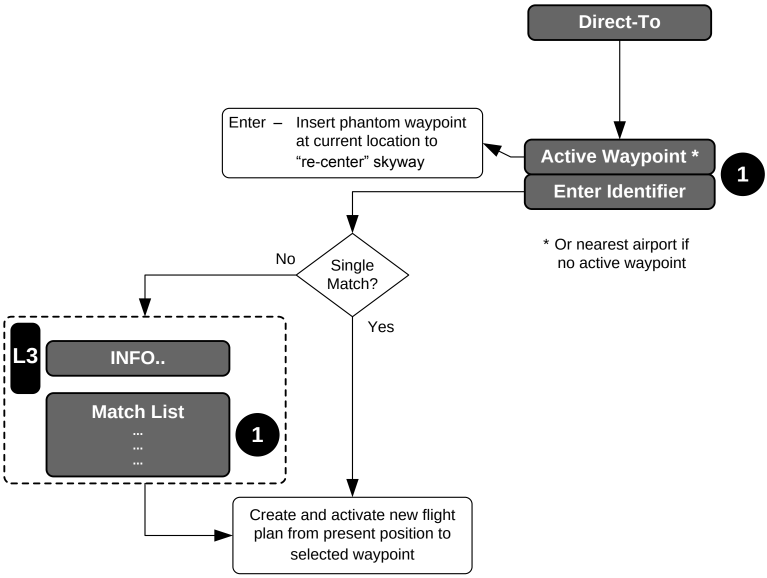


Figure 5-14: Direct Menu

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

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

If there is no result from the search, the pilot is re-prompted to enter an identifier.

If there are multiple results from the search, a selection list with matching identifiers is presented. Upon selection, the resulting action depends upon whether the aircraft is in the air or on the ground. If in the air, a new active flight plan is created from present aircraft position to the selected waypoint. If on the ground, a search is conducted for a database airport within 6NM. If an airport is found, a new active flight plan is created from the found airport to the selected waypoint. Otherwise, a new active flight plan is created from present aircraft position to the selected waypoint. **INFO (L3)** appears at this level to aid in selection and give access to the information function for the highlighted result.

5.12.1. Direct Menu (Step-By-Step)

1) Press  **(R4)** to enter the Direct menu.

2) The active waypoint or, in absence of an active waypoint, the nearest airport appears.

3) Either push ❶ to insert a phantom waypoint at the current aircraft location or scroll ❶ to begin entering new identifier.

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

5) If necessary, search waypoints for selection. Scroll ❶ to desired selection. Push to enter.

5.13. Time (TIME) Menu

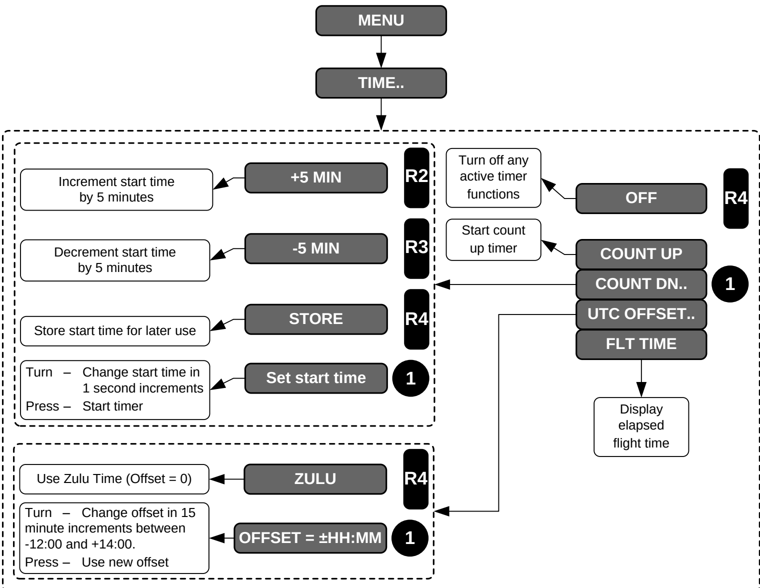


Figure 5-15: Time Menu

Upon selecting the timer menu, an option list appears to let the pilot choose the count up, countdown timer, or the flight time display.

OFF  **(R4)** is present to turn off any active timer functions.

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

If the pilot selects the UTC offset selection, he will be prompted to enter a UTC offset between -12:00 and +14:00 in 15 minute increments. A shortcut key to quickly select Zulu time (UTC offset = 0:00) is provided at this level.

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

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

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

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

3) Scroll ❶ to select **COUNT UP**, **COUNT DN..**, or **FLT TIME,** and push to enter.

4) If **COUNT UP** is desired, push ❶ to enter. A timer appears on the PFD area above the pitch scale.

5) To turn off timer, press **MENU (R1)** and **TIME.. (L4)** then press **OFF (R4)** on PFD or MFD.

5.14. PFD Source (SOURCE) Menu

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

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

If a Genesys ADAHRS is the selected AHRS and a DG/Slave discrete input is not configured for that AHRS, then a "AHRS SLAVE"/"AHRS DG" tile appears to toggle between the two AHRS modes. If in DG mode without slew discrete inputs is configured for the selected AHRS, then an “AHRS SLEW” tile appears to enter a submenu that allows adjustment of the DG mode slewing value.

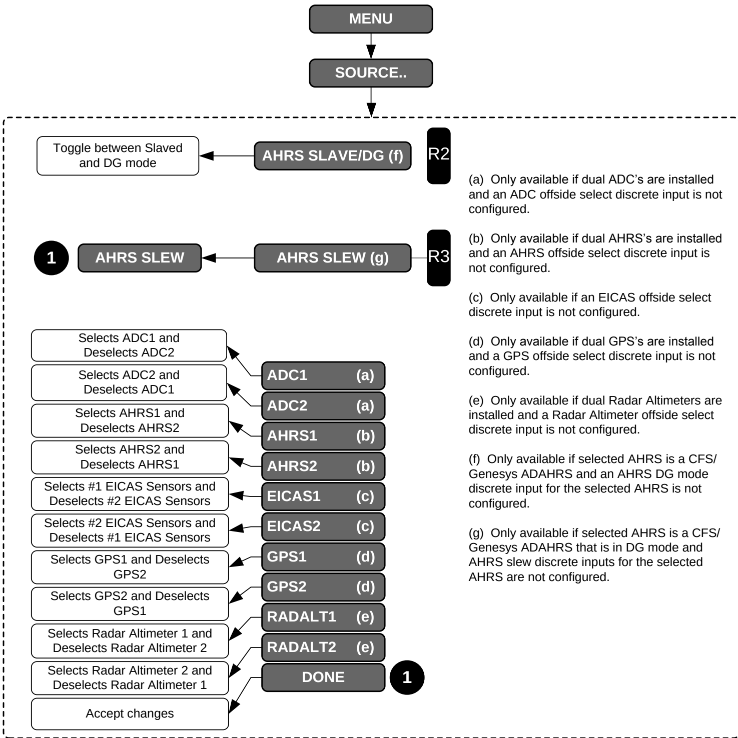


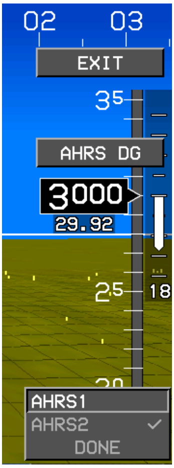
Figure 5-16: PFD Source Menu

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

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

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

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



4) When a dual AHRS are installed with an AHRS offside select discrete in not configured.

5) When Genesys AHRS is installed and in DG Mode without discrete inputs for the selected AHRS are not selected.

5.15. PFD Bugs (BUGS) Menu (N/A for AW-109SP)

Upon selecting the PFD Bugs menu, set either minimums **(MINS) (R3)**, an airspeed bug **(IAS) (L2)**, the VNAV climb or descent angle (**VNAV CDA)**  **(R4)**, or 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 pilot to either synchronize the minimum altitude to current altitude, turn the minimum altitude off, or set the minimum altitude in increments of 10 feet. The decision height option allows the pilot 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 allows the pilot to either, synchronize the airspeed bug to current airspeed, turn the airspeed bug off, or set the airspeed bug in increments of one knot indicated airspeed. On the low end, airspeed bug settings are no less than 60KIAS and no greater than $\mathbf{V_{NE}}$.

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 pilot to set the climb angle or the descent angle (as appropriate) in increments of 0.1° (a value of 0 is not allowed). Corresponding feet per nautical mile are shown adjacent to the climb or descent angle setting in parentheses.

In addition, a shortcut tile is available to set the climb or descent angle to 3°.

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

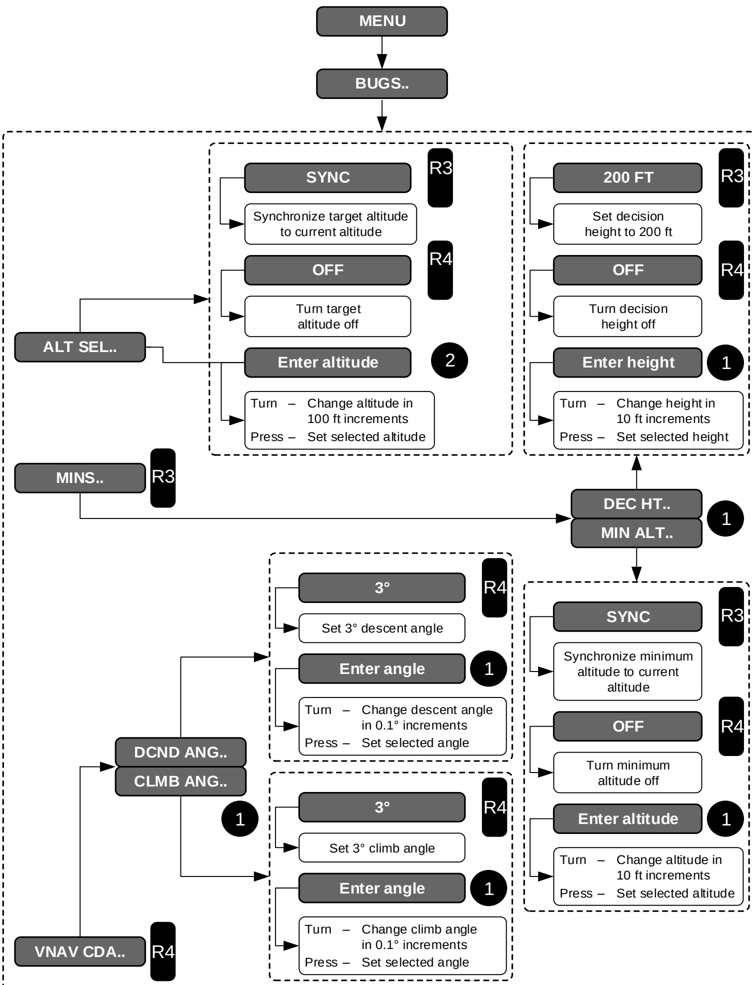


Figure 5-17: PFD Bugs (BUGS) Menu (N/A for AW-109SP)

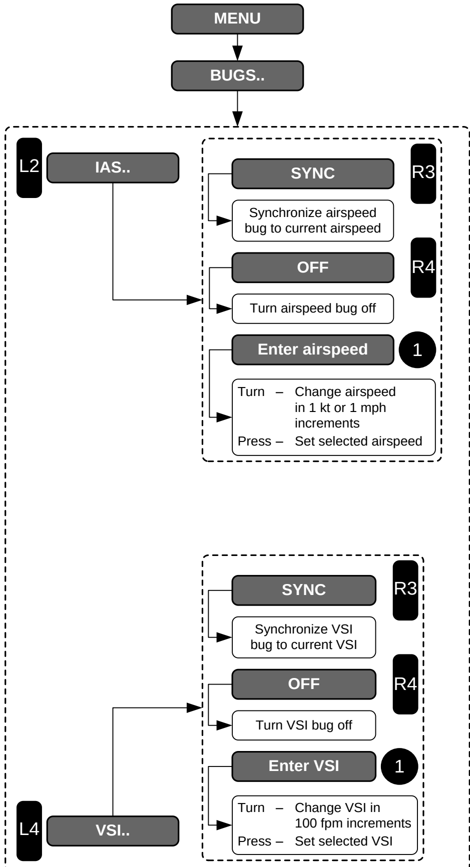


Figure 5-18: PFD Bugs (BUGS) Menu (N/A for AW-109SP) (Continued)

5.15.1. PFD Bugs (BUGS) Menu (Step-By-Step)

1) Press **MENU (R1)** then **BUGS (R2)** to enter the Bugs menu.

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

3) If **IAS (L2)** is entered, press **SYNC (R3)** or **OFF (R4)** to accept or turn off IAS bug.

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

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

6) If **DEC HT..** is selected, scroll ❶ to create new decision height. Push to enter.

7) DH displays on PFI below FPM or next to analog AGL display.

8) If **VNAV CDA (R4)** is selected, scroll ❶ to select either **DCND ANG..** or **CLIMB ANG...**. Push to enter.

9) If **DCND ANG..** is selected, Scroll ❶ to create the descent angle. Push to enter new descent angle or select default **3° (R4)**.

5.15.2. PFD Bugs (BUGS) Menu (AW-109SP)

All applicable bugs are set with the Remote Bugs Panel. Thus, the entire PFD Bugs Menu is disabled.

5.16. PFD Declutter (DCLTR) Menu

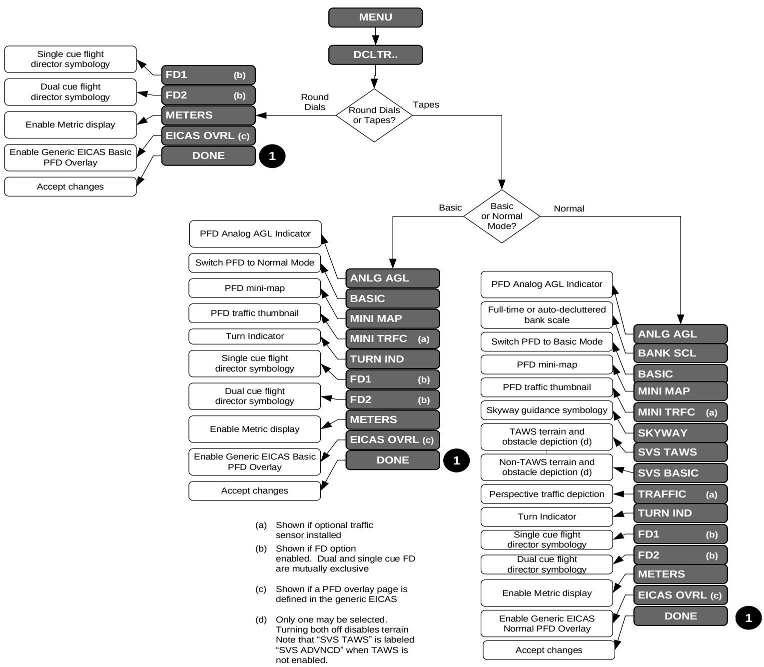


Figure 5-19: PFD Declutter (DCLTR) Menu

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

Table 5-4: PFD Declutter Options and Features

Declutter Options	Configuration			Notes
	Tapes	Basic	Round Dials	
PFD Analog AGL Indicator	✓	✓		

Table 5-4: PFD Declutter Options and Features

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

1) PFD analog AGL indicator;

2) Full-time or auto-decluttered bank scale display;

3) Basic Mode (switches PFD to Basic Mode);

4) PFD mini-map;

5) PFD traffic thumbnail;

6) Skyway guidance symbology;

7) Non-TAWS perspective terrain and obstacle depiction (mutually exclusive with TAWS perspective terrain and obstacle depiction);

8) TAWS perspective terrain and obstacle depiction (mutually exclusive with Non-TAWS perspective terrain and obstacle depiction);

9) Perspective traffic depiction;

10) Turn rate indication;

11) Single Cue Flight Director symbology (only shown with optional Flight Director symbology option and mutually exclusive with Dual Cue Flight Director symbology);

12) Dual Cue Flight Director symbology (only shown with optional Flight Director symbology option and mutually exclusive with Single Cue Flight Director symbology); or

13) Metric display of barometric altitude and target altitude bug setting.

In Basic Mode, the pilot may select or deselect the following items:

1) PFD analog AGL indicator;

2) Basic Mode (switches PFD back to Normal Mode);

3) PFD Mini traffic;

4) PFD Mini-map;

5) Turn Indicator;

6) FD1;

7) FD2; or

8) Meters.

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

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

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

3) If **BANK SCL** is unchecked and ❶ is scrolled to **DONE**, push to enter.

4) Bank Scale is removed while in level flight.

5) Scroll ❶ to **SVS TAWS** then **DONE** and push to enter.

6) If **SVS BASIC** mode is desired, scroll ❶ to **SVS BASIC** then **EXIT (R1)** or **DONE** and push to enter.

7) In the event of a TAWS warning, the system automatically switches back to **SVS TAWS** mode if terrain were disabled.

5.17. PFD Declutter (DCLTR) Menu (AW-109SP)

Bank Scale and Flight Director options are removed from the PFD Declutter Menu.

5.18. PFD Altimeter Menu

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

1) **QNH/QFE (L2)**: Toggles between QNH altimeter operation and QFE altimeter operation. When in QNH mode, QNE operation automatically is selected when above the transition altitude with a standard altimeter setting. The following definitions:

    a) **QFE**: Barometric setting resulting in the altimeter displaying height above a reference elevation (e.g., airport or runway threshold).

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

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

2) **TRANS ALT (L3)**: Allows the pilot 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, **18000’** is available to quickly set 18,000 feet as the transition altitude.

3) **MBAR/IN HG (L4)**: Allows the pilot to select the barometric setting units (inHg or mbar).

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

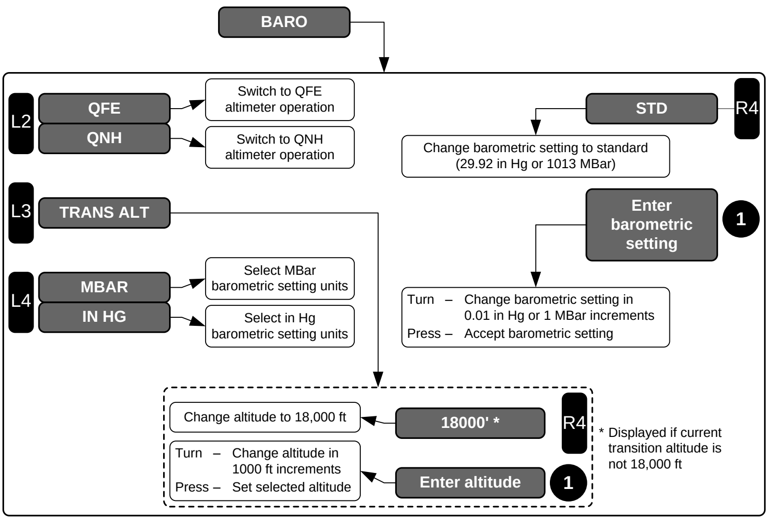


Figure 5-20: PFD Altimeter Menu

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

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

2) Scroll ❶ to set proper QNH and push to enter.

3) Crosscheck proper QNH under altitude indication.

4) Press **BARO (R2)** again and **STD (R4)** to reset QNH to 29.92 and push to enter.

5.19. MFD Fault Display (FAULTS) Menu

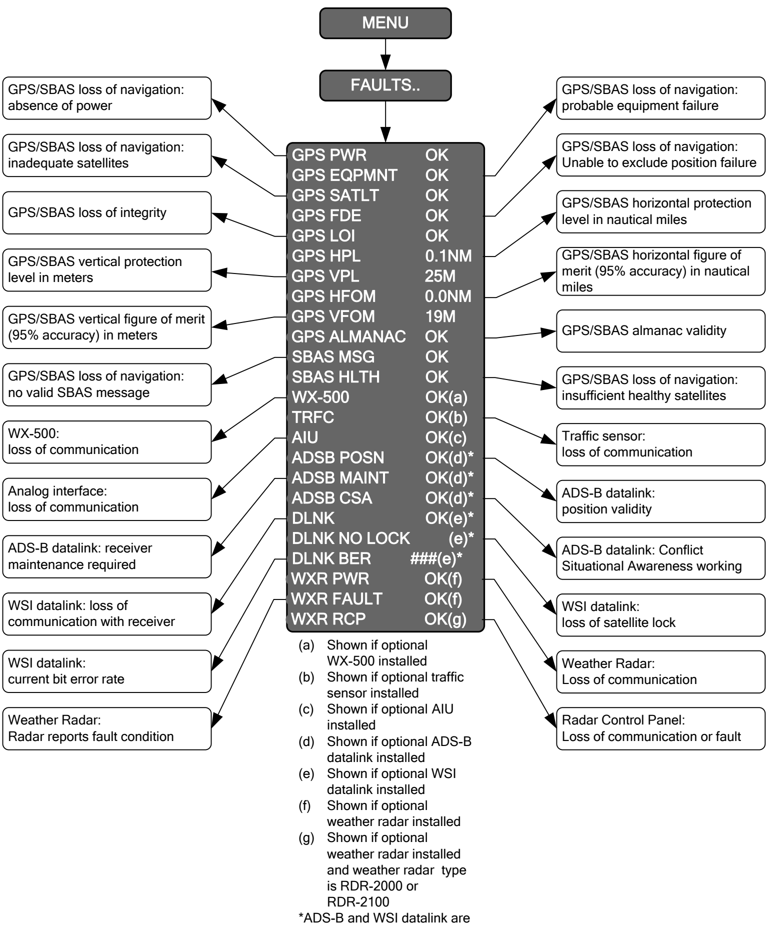


Figure 5-21: MFD Fault Display Menu

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

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

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

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

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

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

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

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

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

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

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

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

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

    a) An Attitude or Range Fault Condition exists.

    b) A Control Fault Condition exists.

    c) A T/R Fault Condition exists.

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

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

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

16) If WSI datalink is enabled, the datalink item indicates either loss of communications with the datalink receiver (DLNK X), loss of satellite lock (DLNK NO LOCK), or the current bit error rate or the datalink (DLNK BER ###). WSI datalink is mutually exclusive with ADS-B datalink.

17) If ADS-B datalink is enabled, an indication of ADS-B position validity (ADSB POSN), an indication of whether maintenance of the ADS-B receiver is required (ADSB MAINT), and an indication of whether the Conflict Situational Awareness algorithm is working (ADSB CSA). ADS-B datalink is mutually exclusive with WSI datalink.

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

    a) Loss of weather radar communication, or

    b) Weather radar mode is OFF.

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

    a) A Cooling Fault Condition exists.

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

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

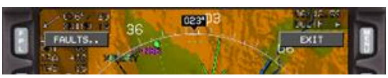
d) An Attitude or Range Fault Condition exists.

e) A Control Fault Condition exists.

f) A T/R Fault Condition exists.

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 data.

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



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

2) View status of GPS and equipment parameters.

5.20. MFD FUEL Totalizer Quantity Setting (SET FUEL) MENU

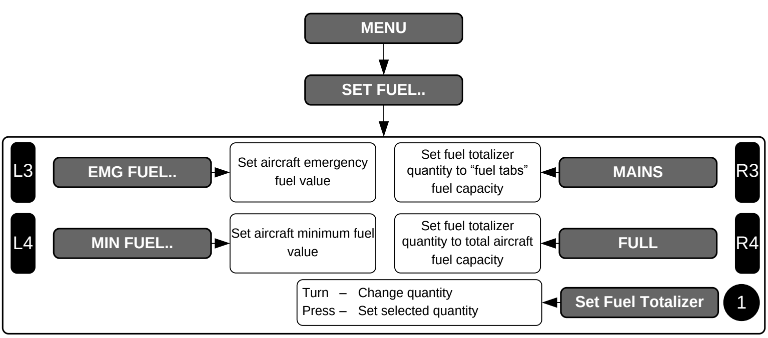


Figure 5-22: MFD Fuel Totalizer Quantity Menu

The fuel quantity setting menu allows the pilot to:

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

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

5.20.1. MFD Fuel Totalizer Quantity Setting (SET FUEL) Menu (AW-109SP)

FUEL SET menu is removed due to acquisition of fuel quantity from the MFD Page.

5.21. MFD Page (PAGE) Menu

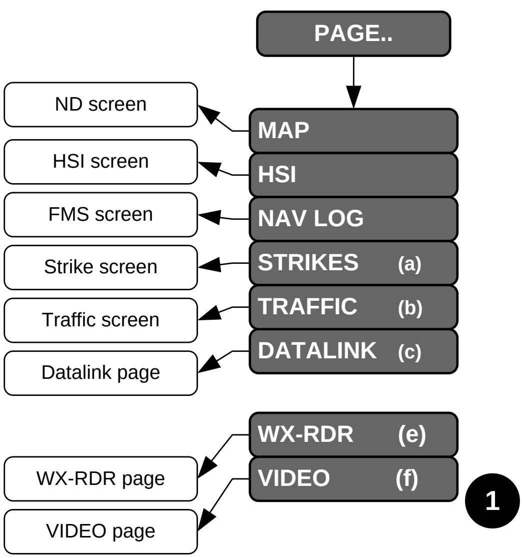


Figure 5-23: MFD Page (PAGE) Menu

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

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

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

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

4) **STRIKES**: Shows the Strike page (See Strikes Appendix).

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

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

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

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

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

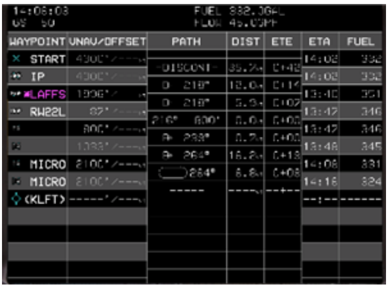
1) Press **MENU (R1)**.

2) Press **PAGE.. (R3)** to view page selection menu.

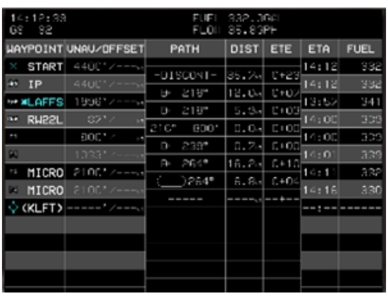
3) Push and scroll ❶ to select either **MAP**, **HSI**, **NAV LOG**, **STRIKES**, **TRAFFIC**, **DATALINK**, **HOVER**, **WEATHER RADAR**, or **VIDEO** and push to enter.

5.22. MFD NAV Log Page

1) Press **MENU (R1)** then **PAGE (R3)** and scroll ❶ to **NAV LOG** and push to enter.



2) **NAV LOG** page cannot be formatted or used to edit the active flight plan.



3) **NAV LOG** page shown for AW-109SP aircraft.

5.23. MFD ND Page Format (FORMAT) Menu

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

1) **CENTER/ARC**: Toggles between a centered and arced ND display format (if not panning).

2) **HDG UP/N UP**: Toggles between a heading up and a North up ND display format (if not panning).

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

4) **SYMB DCLTR**: Activates an option list for the pilot to choose either automatic navigation symbol declutter or manual navigation symbol declutter. If the pilot chooses manual navigation symbol declutter, a further option list appears to allow the pilot to individually select:

a) large airports;

b) IFR airports;

c) VFR airports;

d) VORs;

e) NDBs;

f) fixes;

g) terminal fixes; and

h) user waypoints.

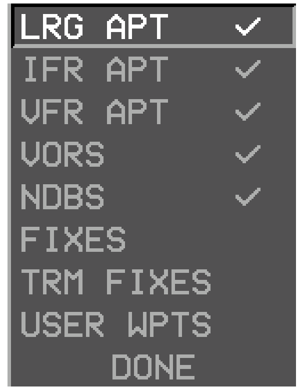


Figure 5-24: MFD Symbol Declutter

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

5) **FNCT DCLTR**: Activates an option list for the pilot to individually toggle display of:

a) airspace;

b) borders;

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

d) estimated time of arrival (ETA);

e) high-altitude airways;

f) low-altitude airways;

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

h) ADF #2 pointer (if dual ADF symbology is enabled);

i) VOR1 pointer (if VOR symbology is enabled);

j) VOR2 pointer (if dual VOR symbology is enabled);

k) Strikes (if WX-500 option is enabled);

l) Terrain;

m) Traffic (if traffic option is enabled); and

n) Weather radar (if weather radar option is enabled).

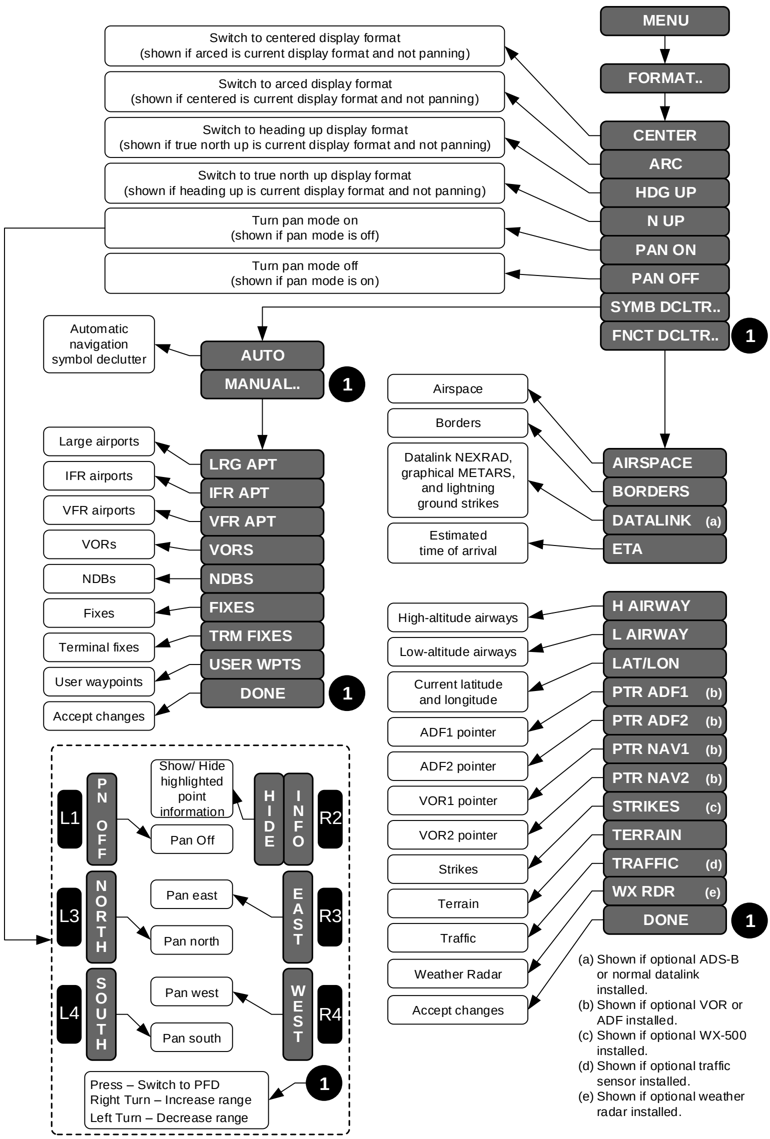
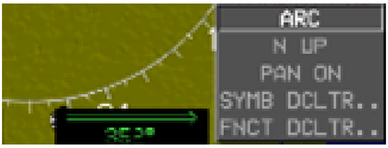
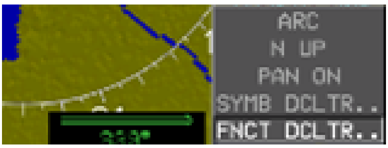


Figure 5-25: MFD ND Page Format Menu

5.23.1. MFD ND Page Format (FORMAT) Menu (Step-By-Step)



1) Press **MENU (R1)** and **FORMAT.. (R4)**.



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

3) Scroll ❶ to **LAT/LON,** scroll to **DONE,** and push to enter.

4) Or if AW109SP, scroll ❶ to **SWS GRD**, push ❶ to check, scroll to **DONE**, and push to enter.

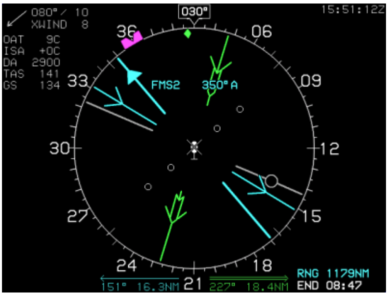
5) AW-109SP option for **SWS GRD** results in the PFD showing SWISS GRID.

CAUTION:

Swiss Grid should not be used outside of Switzerland.

5.24. MFD HSI Page

1) Press **MENU (R1)** then **PAGE (R3)** and scroll ❶ to **HSI** and push to enter.



2) HSI page displayed for rotorcraft other than AW-109SP.

3) HSI displayed for the AW-109SP.

5.25. MFD HSI Pointer (PTRS) Menu

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

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

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

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

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

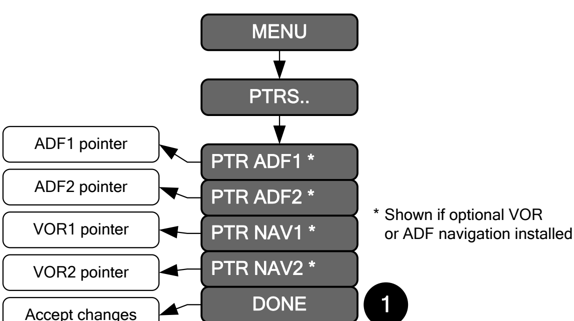


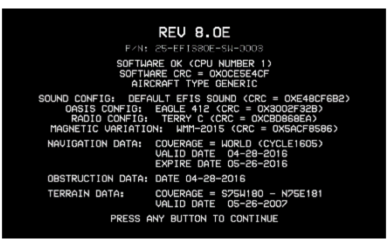
Figure 5-26: MFD HSI Pointer (PTRS) Menu

Section 6 Quick Start Tutorial

Quick Reference Guide (DOC 64-0000100-080E)

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

… or the AW-109SP Rotorcraft Flight Manual



Power up the EFIS. The system performs a built-in test routine. If all tests pass, the system displays a screen identifying the database coverage. Press any button to acknowledge, and the system begins a two-minute countdown while awaiting sensor initialization. (For purposes of flight planning, etc., press any button to override this countdown.)

❶

The right encoder is numbered #1 (❶).

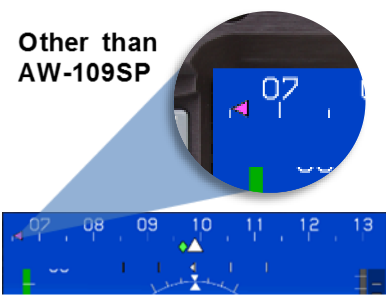
PFD

Press **BARO (R2)** and scroll ❶ to desired QNH and push to enter.

Press  **(R4)** for Direct To menu. If in the air, the nearest airport appears. Scroll ❶ to alpha or numerical character then push to confirm and advance to the next position. Push to enter, until all five spaces have been either entered or viewed.

A magnetic waypoint bearing appears on the heading scale as shown on other than AW-109SP in magenta color and the AW-109SP in cyan color

Other than AW-109SP

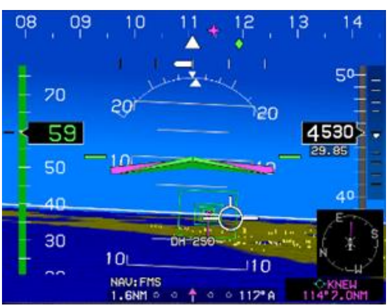


AW-109SP

A direct route to the active waypoint is activated and appears as magenta tethered balloon on the PFD as shown for rotorcraft other than the AW-109SP.

On the AW-109SP PFD, the active waypoint appears as a cyan colored tethered balloon.

Active waypoint information, including waypoint type and identifier, elevation or crossing altitude, and bearing and distance are displayed below the Analog AGL indicator or Mini Map as configured.



Indicated airspeed is on the left, altitude is on the right, and heading is across the top. An FMS/VLOC CDI is located on the bottom. The VSI appears on the right side of the altitude tape on rotorcraft other than AW-109SP.

(AW-109SP)

On the MFD, press **MENU (R1)** to view soft menu selections for easy access with press of appropriate IDU button on rotorcraft other than AW-109SP.

On the MFD, press **MENU (R1)** to view soft menu selections for easy access with press of appropriate IDU button on AW-109SP.

Flight Plans (Stored Routes)

Activate Flight Plan on PFD or MFD

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

Create Flight Plan on MFD

1) Press **FPL (L1)**.
2) Scroll ➊ to **CREATE-EDIT..** and push to enter.
3) Select **CREATE FLIGHT PLAN** and push to enter.
4) Press **ADD (R2)** to create first waypoint with ➊ by entering waypoints from beginning to end, or press **NRST APT (L2)**, **NRST VOR (L3)**, **NRST NDB (L4)**, **NRST FIX (R2)**, or **NRST USR (R3)**, select next waypoint, and push to enter.
5) Press **SAVE (R4)** to save flight plan.
6) Press **EXIT (R1)** to exit Flight Planner.

Waypoints

Edit a User Waypoint on MFD

1) Press **FPL (L1)**.
2) Scroll ➊ to highlight **CREATE-EDIT..** and push to enter.
3) Scroll ➊ to **EDIT USER WPT** and push to enter.
4) Scroll ➊ to highlight waypoint to edit and push to enter.
5) Scroll and push ➊ through menu for all changes.
6) Edit waypoint and press **SAVE (R4)** to save changes.
7) Press **EXIT (R1)** to exit menu.

Create a User Waypoint on PFD or MFD

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

2) Press **DESIG (L3)**.

Add Waypoint to an Active Route on PFD or MFD

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

2) Scroll ➊ to location on waypoint list where added waypoint is to be inserted above.

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

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

   a) Scroll ➊ to make selection and push to enter, or

   b) Use ➊ to enter waypoint identifier and push to enter.

Delete Waypoint from an Active Route on PFD or MFD

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

2) Scroll ➊ to waypoint to delete. If part of a published procedure, press **DELETE (R3)** to prompt **CONFIRM DEL PROC**.

3) Push ➊ to **CONFIRM DEL PROC** and push to enter.

Omnibearing Selector Function

Automatic OBS (FMS OBS Only) on PFD or MFD

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

2) Push ➊ **OBS:AUTO** to enter.

Manual OBS on PFD or MFD

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 ➊ to desired OBS value and push to enter, or press **OBS SYNC (R3)** and push to enter. (N/A AW-109SP)

4) If HSI source is **NAV VLOC1 (L3)** or **NAV VLOC2 (L4)** scroll ➊ to desired course (OBS:XXX° (XXX°)) and push to enter.

Approaches/Track

Select a VFR Approach on PFD or MFD

(The active flight plan must contain an eligible airport for runway selection and VFR approach creation.)

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

2) Scroll ➊ to highlight the desired airport or user waypoint, push to enter.

3) Scroll ➊ to highlight **VFR APPR..** and push to enter.

4) Scroll ➊ to select desired runway and push to enter.

Change Runway during VFR Approach on PFD or MFD

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

2) Scroll ➊ to highlight the following and push to enter:

   a) Eligible airport

   b) **VFR APPR..**

   c) Desired runway

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

Select an IFR Approach on PFD or MFD

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

2) Scroll ➊ to the desired eligible airport and push to enter.

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

4) Scroll ➊ to desired approach and push to enter.

5) Scroll ➊ to desired transition and push to enter.

6) Scroll ➊ to desired runway and push to enter.

Change Runway on IFR Approach on PFD or MFD

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

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

3) Select **APPR:** Scroll ➊ to desired approach. Push to enter.

4) Select **TRANS:** Scroll ➊ to desired transition. Push to enter.

5) Select **RW:** Scroll ➊ to desired runway. Push to enter.

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

XFILL SYNC Operation

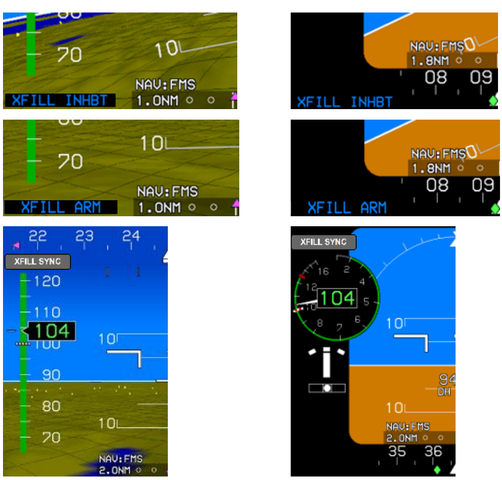
XFILL Sync Operation on PFD

(Crossfill is the normal default mode of operation.)

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

2) When the pilot and co-pilot systems are not synchronized, XFILL ARM appears in lower left corner of the PFD.

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



Section 7 IFR Procedures

Table of Contents

List of Figures and Tables

7.1. Active Flight Plan

Upon activation of the active flight plan menu, the application checks for the existence of an active waypoint. If there is no active waypoint, “NO ACTIVE WPT” is issued. Otherwise, a nav log of waypoints in the active flight plan is presented. The nav log shows each waypoint identifier and characterization (default, overfly [**OF**] or no radius [**0R**]), a symbol designating waypoint type and what type of procedure (if any) the waypoint is associated with, VNAV altitudes and offsets associated with each waypoint, and information related to the flight plan path between each waypoint. In the case of an approach with a Final Approach Segment data block, the VNAV Offset readout associated with the Missed Approach Point is “GPI” to designate distance to the Glidepath Intercept point. When courses are presented as part of the path information, they are displayed referenced to magnetic North with the degree (°) symbol.

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

A suppressed waypoint (designated by brackets) is an airport associated with an IFR or VFR approach procedure. After an approach procedure is activated, the associated airport is no longer part of the active flight plan for guidance purposes. However, the associated airport is still shown in the nav log for it to be highlighted for information or to activate other procedures to the airport. Since only one approach may be active at any given time, only one waypoint may be suppressed at any given time.

A skipped waypoint is a waypoint associated with a dynamic termination leg with a zero length. These are either:

1) An altitude termination leg when current aircraft altitude is above the termination altitude; or

2) System-created (i.e., not NavData specified) intercept to a “Course to a Fix” leg where there is insufficient distance to calculate an intercept heading.

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

Upon selection of a waypoint from the selection list, the EFIS checks whether the selected waypoint meets the criteria for waypoint activation, manual VNAV parameter entry, custom holding pattern entry, manual overfly characterization, VFR approach entry, IFR approach entry, STAR entry, or DP entry. If it does, an option list is presented as follows:

1) **WAYPOINT**: If the selected waypoint is neither suppressed, skipped, nor a manual termination, make the selected waypoint the active waypoint.

2) **VNAV**: If the selected waypoint is neither suppressed, skipped, a manual termination, part of an IFR approach, nor part of a VFR approach, enter a manual VNAV altitude and offset for the selected waypoint. This level includes tiles to synchronize the VNAV altitude to current altitude and to remove the manual VNAV altitude and offset entry. VNAV altitudes are settable in increments of 100 feet, and offsets are settable in increments of 1NM.

3) **HOLD**: If the selected waypoint is neither suppressed, skipped, a manual termination, part of an IFR approach after the FAF/FAWP, part of a VFR approach, a holding waypoint, nor a DP anchor waypoint, enter a manual holding pattern at the selected waypoint. Define the course, turn direction (left or right), and leg length (expressed as either distance or time) for the manual holding pattern. Holding pattern course is settable in increments of 1° and leg length is settable in increments of 1NM or a tenth of a minute.

4) **OFLY/AUTO**: If the selected waypoint is neither suppressed, skipped nor a manual termination, change the waypoint's overfly characterization. The choices are:

    a) **AUTO**: Reset automatic overfly characterization by FMS.

    b) **OVERFLY**: Force the overfly characterization to be an overfly adjust-exit waypoint and force the inbound course to go directly to the waypoint regardless of the amount of course change required.

    c) **NO RADIUS**: Force the turn radius at the waypoint to be zero. This forces the inbound course and outbound course to go directly to and from the waypoint regardless of the amount of course change required.

NOTE:

It is not possible to track a “NO RADIUS” path perfectly, but the FMS path guidance quickly recaptures the outbound course after automatic waypoint sequencing. Designating a waypoint as a “NO RADIUS” waypoint affects the turn radius used to calculate procedure turn and holding pattern leg paths.

5) **VFR APP**: If the selected waypoint is a user waypoint with an approach bearing, a VFR approach to the user waypoint based upon the approach bearing is created, and the user waypoint is suppressed. If the selected waypoint is a VFR airport or an IFR airport with surveyed runways, the pilot is presented with a list of runways. After selecting a runway, a VFR approach to the runway is created, and the airport waypoint is suppressed. Activating a VFR approach deletes any pre-existing IFR or VFR approaches. If a heading bug is not already active, activating a VFR approach activates the heading bug on current aircraft heading and is used to define the course intercept angle.

6) **IFR APP**: If the selected waypoint is an airport with an IFR approach, the pilot is presented with a list of available approaches (including, if applicable, the five-digit channel number, followed by a selection list of available transitions, if there are more than one) and a list of runways (if there are surveyed runways at the airport). After selection, the appropriate IFR approach is created, and the airport waypoint is suppressed. Activating an IFR approach deletes any pre-existing IFR or VFR approaches. If there is a pre-existing STAR to the airport, the IFR approach waypoints are inserted after the STAR waypoints. If a heading bug is not already active, and the activated transition is “Vectors to Final,” activating an IFR approach activates the heading bug on current aircraft heading for purposes of defining the course intercept angle.

7) **STAR**: If the selected waypoint is an airport with a STAR, the pilot is presented with a list of available STARs, followed by a list of available transitions (if there are more than one) and a list of runways (if there are surveyed runways at the airport). After selection, the appropriate STAR is created. Activating a STAR deletes any pre-existing STAR. If there is a pre-existing approach (IFR or VFR) to the airport, the STAR waypoints are inserted prior to the approach waypoints.

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

7.2. IFR Procedures

Pilots operating in a radar environment are expected to associate departure headings or an RNAV departure advisory with vectors or the flight path to their planned route or flight. Use of both types of departure procedures, Obstacle Departure Procedures (ODP) are printed either textually or graphically, and Standard Instrument Departure procedures (SIDs) are always printed graphically. All DPs, either textual or graphic, may be designed using either conventional or RNAV criteria. RNAV procedures have RNAV printed in the title.

ODPs are not found in the navigation database, and therefore the climb angle found in the PFD BUGS menu should be set to comply with the steeper than normal climb gradient during the departure until established on the enroute structure. ODPs are recommended for obstruction clearance and may be flown without ATC clearance, unless an alternate departure procedure (SID or radar vector) has been specifically assigned by ATC.

Approach minima are never coded in NavData. On some approaches, the altitude coded at the MAP for a non-precision approach coincides with an MDA (normally where the final approach course does not align with the runway), but more often the coded altitude is some height above the threshold.

7.3. Overview of Procedures and Instrument Approaches

This Genesys Aerosystems EFIS provides 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 supporting RNAV (GPS) approaches to LNAV, LP, LNAV/VNAV, and LPV lines of minima within system coverage. Some locations close to the edge of the coverage may have lower availability of vertical guidance.

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

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

Another non-precision GPS/SBAS Approach is certified as an LP (Localizer Performance) approach where terrain or obstructions prohibit the certification of the LPV vertically guided approach. This approach takes advantage of the angular lateral guidance and smaller position errors (provided by GPS/SBAS) to provide a lateral only procedure similar to an ILS Localizer. LP procedures may provide lower minima than a LNAV procedure due to the narrower obstacle clearance surface. In the LP approach, vertical guidance is for information only and is based on SBAS or BARO information.

The Genesys Aerosystems EFIS guides the pilot through every step of the approach procedure with Highway in the Sky 3-D symbology. The system defines a desired flight path based upon the active flight plan. The current position of the aircraft is determined relative to the desired path in order to determine lateral deviation for display on the GPS/SBAS CDI and VDI. The IDU auto-sequences from one waypoint to the next in accordance with the flight plan along the flight path with the following exceptions:

1) The pilot has selected a manual GPS/SBAS OBS (SUSPEND shown).

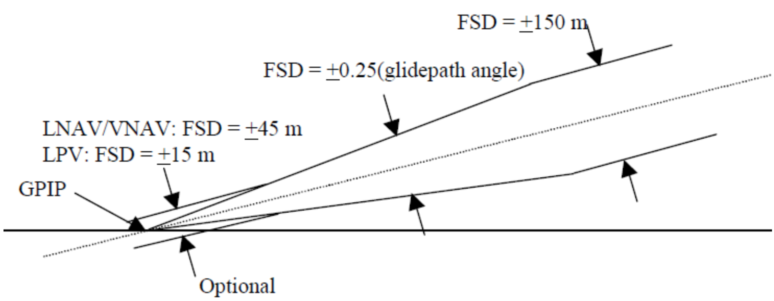
2) The active waypoint is the missed approach waypoint, and the missed approach procedure has not been armed (**ARM**) or initiated (**MISS**) (SUSPEND shown).

3) The aircraft is in a published or manually created holding pattern, and the pilot has not chosen to continue (**CONT**) out of the holding pattern (SUSPEND shown).

4) The active waypoint is the last waypoint of the active flight plan (no flag shown).

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

7.3.1. Vertical Deviation Indicator Linear Limits



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

Figure 7-1: Vertical Deviation Indicator Linear Deviation

7.3.2. Highway in the Sky (Skyway)

When not decluttered, the PFD displays 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 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 are shown with the dimensions being a constant 400 feet wide (±200 feet from the desired lateral path) by 320 feet tall (±160 feet from the desired vertical path) spaced horizontally 2000 feet. The skyway boxes disappear after one minute to indicate degraded navigation performance.

Table 7-1: Highway in the Sky Configuration

Type HITS Lines	**Fully Integrated Autopilot**	**Partially Integrated Analog Autopilot** (HDG Mode and/or NAV/APR mode discrete inputs)	**Un-Integrated Autopilot or No Autopilot**
Dashed	Not coupled to skyway		
Solid	Coupled to Skyway	Coupled to skyway. Autopilot is either in HDG mode with LNAV heading/roll-steering sub-mode engaged or in NAV/APR mode with the FMS, FMS1, or FMS2 as the selected navigation source.	Always Solid

Skyway box altitude is controlled by VNAV altitude, aircraft altitude, aircraft climb performance, and climb/descent angle setting. If no VNAV altitude is set, the skyway boxes describe the desired lateral flight path 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 are controlled individually with a resolution of 0.1° on the PFD. VNAV is guided by VNAV waypoints determined by VNAV altitude and VNAV offset from flight plan waypoints. There are two sources for VNAV altitudes, the navigation database and manual input through the ACTV menu which are then 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), an automatic VNAV altitude is continuously calculated for the waypoint based upon an immediate climb to the altitude constraint at the higher of actual climb angle or the climb angle setting (dynamic climb angle). When “look-ahead” finds a further VNAV altitude constraint below the previous VNAV altitude constraint (i.e., descent commanded), an automatic VNAV altitude is calculated for the waypoint based upon a descent to reach the VNAV altitude constraint at the associated waypoint using the descent angle setting. If no further VNAV altitude constraints are found, the automatic VNAV altitude is set to the last valid VNAV altitude constraint.

When a VNAV climb is desired, the boxes are drawn at a vertical position the higher of: (a) the dynamic climb angle emanating from the aircraft's present position (aircraft-referenced); (b) the dynamic climb angle emanating from the next waypoint VNAV altitude (geo-referenced forward); or (c) the climb angle setting emanating from the previous waypoint VNAV altitude (geo-referenced backward). The geo-referenced backward calculation is only considered when the current leg is part of a procedure and is designed to provide pilot awareness, if a specified climb gradient is not being met. Once the boxes intercept the VNAV altitude, further boxes are drawn with a zero angle to show a level off followed by a level flight segment as an anticipatory cue for planning. Climb guidance is depicted in Figure 7-2, Figure 7-3, and Figure 7-4.

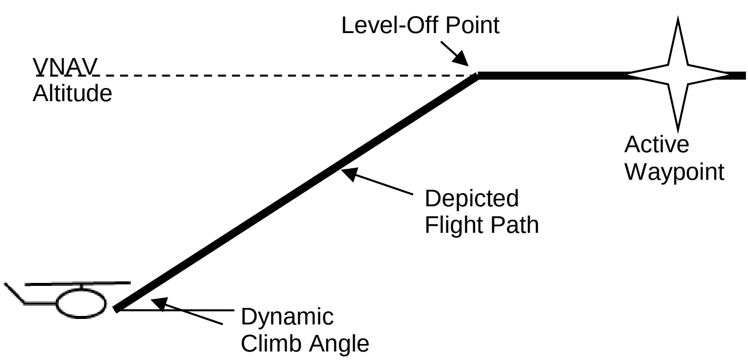


Figure 7-2: Highway in the Sky (Aircraft Referenced)

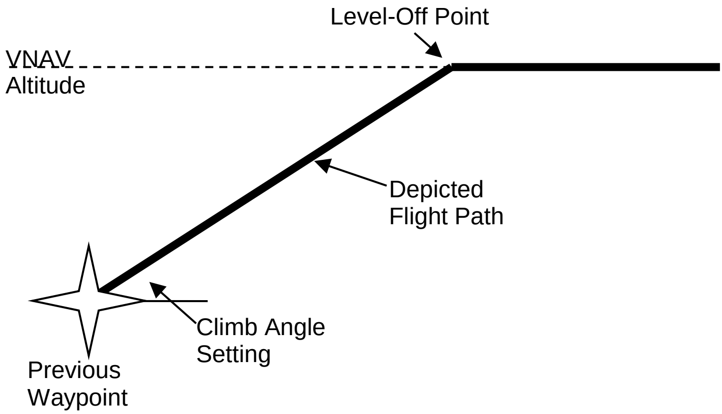


Figure 7-3: Highway in the Sky (Geo-Referenced Backward)

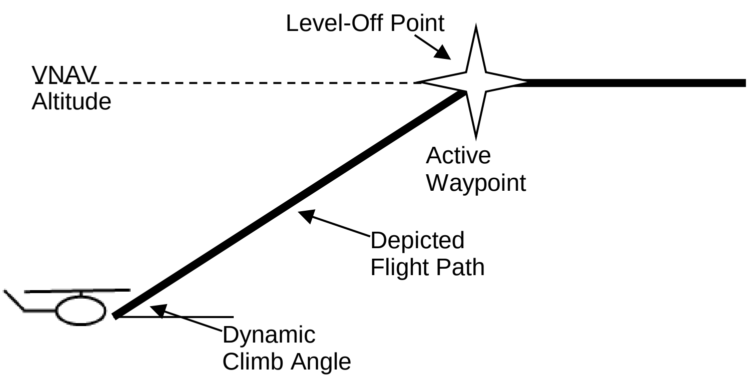


Figure 7-4: Highway in the Sky (Geo-Referenced Forward)

When a VNAV descent is desired, boxes are drawn with a zero angle until reaching a descent point. Further boxes are drawn downward at an angle corresponding to the descent angle setting. The descent point is defined by the intercept of a line emanating upward from the subsequent VNAV waypoint at the descent angle setting and a line representing level flight at the previous VNAV altitude. On the final approach segment of an IFR approach, descent angle and VNAV waypoint are defined as follows.

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

Condition	VNAV Waypoint	Descent Angle
IFR Approach with valid Final Approach Segment data block	Glidepath Intercept Point as defined in Final Approach Segment data block	Descent Angle as defined in Final Approach Segment data block
No or invalid Final Approach Segment data block No intermediate waypoints exist between Final Approach Fix and Missed Approach Point.	Missed Approach Point location	Straight line from Final Approach Fix to Missed Approach Point location and altitudes.
No or invalid Final Approach Segment data block Intermediate waypoints exist between Final Approach Fix and Missed Approach Point.	Missed Approach Point location	Steepest descent angle based upon straight lines from 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° is used.

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

Further, the paradigm is biased towards keeping the aircraft at the highest altitude possible for the longest period of time, an important safety benefit for operators of single-engine aircraft. The climb paradigm compensates for an aircraft's ability to climb more steeply than specified and warns of being below a desired climb gradient when the aircraft is unable to meet the specified climb angle. The descent paradigm encourages flying stabilized approaches.

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

7.3.3. Waypoint Sequencing

Where automatic waypoint sequencing is suspended due to reasons 1, 2, or 4 in § 7.3, the EFIS automatically switches from TO operation to FROM operation when appropriate. If not suspended, automatic waypoint sequencing occurs upon the following conditions:

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

2) Aircraft location is within two turn diameters (based upon current True Airspeed and 15° angle of bank) of the active waypoint location; and

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

The desired flight path is created from a sequence of straight, left turning, and right turning leg segments designed to provide smooth skyway, GPS/SBAS CDI, and lateral autopilot guidance. Each leg between waypoints is composed of up to nine segments. Radii for turning segments (other than DME arc or Radius to a Fix segments) are calculated with the parameter speed determined as follows:

1) If the waypoint is part of a DP and within 30 NM of the departure runway, speed is the preprogrammed Procedure Speed.

2) If the waypoint is part of a STAR and within 30 NM of the arrival runway, speed is the preprogrammed Procedure Speed.

3) If the waypoint is part of an IAP or VFR Approach Procedure, speed is the preprogrammed Procedure Speed.

4) If the waypoint is part of a Holding Pattern, speed is the preprogrammed Procedure Speed.

5) Otherwise, speed is the current True Airspeed or preprogrammed Procedure Speed, whichever is higher.

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

7.3.4. Fly-Over Waypoints

For creating the desired flight path, each waypoint is designated as a fly-by waypoint or a fly-over waypoint. Waypoints are further subdivided into waypoints with a defined entry heading and waypoints with a defined exit heading. Waypoint auto-sequencing for fly-by waypoints occurs at the bisector of the turn. Waypoint auto-sequencing for fly-over waypoints occurs over the waypoint.

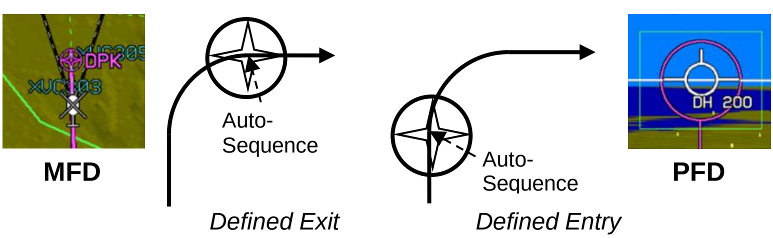


Figure 7-6: Fly-Over Waypoints

The following waypoints are Fly-Over with Defined Entry Heading:

1) Exit from holding pattern and procedure turn;

2) Entry into holding pattern;

3) Missed Approach Point;

4) 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);

5) Last waypoint;

6) Start waypoint (waypoint created by creating a new active flight plan with the Direct-To function – avoids S-turns);

7) Reference (takeoff runway end) waypoint of a DP;

8) Waypoint leading into discontinuity; and

9) Altitude, DME, or Radial termination legs (ARINC 424 path types CA, FA, VA, CR, VR, CD, FD, and VD).

10) Waypoints marked as overfly in the navigation database.

The definitions of leg type designators are as follows.

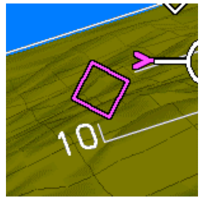
Table 7-3: RNAV Path Terminator Leg Type

Path	**Designator**		**Terminator**
Constant DME arc	A	A	Altitude
Course to	C	C	Distance
Direct Track	D	D	DME Distance
Course from a Fix to	F	F	Fix
Holding Pattern	H	I	Next Leg
Initial	I	M	Manual Termination
Constant Radius	R	R	Radial Termination
Track Between	T	V	Heading To

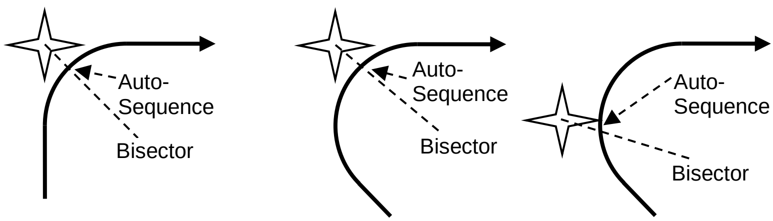
Examples: **CF**= Course to Fix, and **FM**= Course from a Fix to a Manual Termination, etc. (See Section 9 Appendix for table of Path Terminators for ARINC 424 Path-Terminator Leg Types.)

7.3.5. Fly-By Waypoints

MFD



PFD



Normal

Large Turn -- Defined Exit

Large Turn -- Defined Entry

Figure 7-7: Fly-By Waypoints

The following waypoints are Fly-Over with Defined Exit Heading:

1) Entry into procedure turn; and

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

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

4) Course to a fix legs that are not to the FAF/FAWP are Fly-By with defined Entry Heading. All other waypoints are Fly-By with the entry adjusted and have a defined Exit Heading.

NOTE:

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

Leg segments for paths are constructed by the IDU as follows.

Table 7-4: 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.
	Fly-Over Defined Exit Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic or arc path from entry waypoint to exit waypoint.

Table 7-4: Leg Segments for Paths Constructed by the IDU

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

Table 7-4: Leg Segments for Paths Constructed by the IDU			
Path Type	**Entry Waypoint**	**Exit Waypoint**	**# of Segments and Description**
			waypoint and exit waypoint are same point. 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.
Holding Pattern	Fly-Over Defined Entry Heading	Fly-Over Defined Entry Heading	WGS-84 geodesic path to entry of inbound turn. Inbound turn. Degree of turn varies depending upon entry procedure and heading. WGS-84 geodesic path to holding fix for direct and teardrop entries. WGS-84 geodesic path to entry of turn to holding pattern heading for parallel entries. Turn to holding pattern heading for parallel entries. This leg is not used for direct and teardrop entries. Turn to holding pattern outbound leg (180°). Holding pattern outbound leg (length based upon either time or distance as specified by navigation database).

Table 7-4: Leg Segments for Paths Constructed by the IDU

Path Type	Entry Waypoint	Exit Waypoint	# of Segments and Description
			Turn to holding pattern inbound leg (180°). Holding pattern inbound leg (length based upon either time or distance as specified by navigation database).

7.3.6. Direct-To

If the IDU generates a WGS-84 geodesic path to a designated “To” fix, the aircraft captures this path without “S-turning” or undue delay. Where the selected “To” fix is in the active flight plan, the required transition is created as follows:

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

2) Leg prior to the phantom waypoint is designated as a discontinuity.

3) Phantom waypoint is designated as 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) “Start” waypoint is designated as a Fly-Over Defined Entry Heading waypoint where the entry heading is current aircraft track.

7.4. Magnetic Course

The source of magnetic variation used for paths defined using magnetic course is in accordance with the following:

1) If the leg is part of a database terminal area procedure and the magnetic variation is specified by the State for the procedure, the magnetic variation to be used is the value specified.

2) If the leg is not part of a procedure and the active fix is a VOR, the magnetic variation to be used is the published station declination for the VOR.

3) If the leg is not part of a procedure and the terminating fix is not a VOR, the magnetic variation to be used is defined by the system using an internal model.

The EFIS is capable of computing magnetic variation at any location within the region where flight operations may be conducted using Magnetic North reference. The assigned magnetic variation is calculated using the NIMA GEOMAG algorithm and World Magnetic Model appropriate to the five-year cycle in a MAGVAR database.

7.4.1. AHRS Modes for Heading Source

AHRS Slaved—EFIS Magnetic North: Standard mode of operation. Everything displayed relative to Magnetic North drift free.

AHRS Slaved—EFIS True North: Everything is displayed relative to True North with drift free heading. This is the preferred way to operate in areas where navigation is done relative to True North. (See Section 9 Appendix for limitations on Earth's magnetic flux horizontal field)

AHRS Free/"DG"—EFIS Magnetic North: Use this mode when operating around significant magnetic disturbances in areas where navigation is done relative to Magnetic North. Ensure the compass rose is slewed to a Magnetic North value.

AHRS Free/"DG"—EFIS True North: Method of operation in high-latitude areas where navigation is accomplished relative to True North. Heading is not drift free and requires periodic correction. This mode may also be used when operating around significant magnetic disturbances in areas where navigation is done relative to True North. Ensure the compass rose is slewed to a True North Value.

7.4.2. GPS Altitude

WGS-84 ellipsoid altitude received from the GPS/SBAS is converted to geodetic (MSL) altitude using the EGM 2008 geoidal database which is revised on a 12-year cycle.

7.4.3. 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 projects the last known GPS/SBAS position forward using TAS and heading corrected for last known wind as it continues to navigate using this position and the active flight plan. The system provides the capability to determine bearing to an airport based upon the dead reckoning position.

7.4.4. Parallel Offsets

The parallel offset is a route parallel to, but offset from, the original active route. The basis of the offset path is the original flight plan leg(s) and one or more offset reference points as computed by the EFIS. The computed offset reference points are located so that they lie on the intersection of lines drawn parallel to the host route at the desired offset distance and the line that bisects the track change angle. An exception to this occurs where the parallel offset ends. In this case, the offset reference point is located abeam of the original flight plan waypoint at the offset distance.

The parallel offset function does not propagate through route discontinuities, unreasonable path geometries as follows:

1) Legs that are parts of approach procedures (IFR and VFR); or

2) Legs with complex geometries or that begin or end with dynamically terminations. (ARINC 424 path types other than CF, DF, or TF or any leg where the starting waypoint is not a fixed position); or

3) Legs that begin at an aircraft starting position (reference waypoint in a DP or Start/Phantom waypoints created by the Direct-To function.

The parallel offset function does not propagate through the following:

1) Any waypoint at the beginning or end of a route discontinuity; or

2) Any waypoint at the beginning or end of a prohibited leg type; or

3) A waypoint with an unreasonable path geometry (defined as a turn greater than 120°.

When the parallel offset function begins or ends within a flight plan due to the above constraints, parallel offset entry or exit waypoints are inserted into the flight plan. Discontinuities precede parallel offset entry waypoints and follow parallel offset exit waypoints. This allows the pilot to navigate to and from the parallel offset as required. A parallel offset entry waypoint (“PTK+”) is shown in Figure 7-8.

Figure 7-8: Parallel Offset Entry Waypoint PTK+ (AW-109SP)

The EFIS provides guidance to parallel tracks at a selected offset distance. When executing a parallel offset, the navigation mode and all performance requirements of the original route in the active flight plan are applicable to the offset route. The EFIS provides for entry of offset distance in increments of 1 NM, left or right of course, and is capable of offsets of at least 20 NM. When IDU is operating in offset mode, it is clearly indicated with an advisory flag with blue letters on a black background, i.e., PTK = L 20NM. When in offset mode, the EFIS provides reference parameters (e.g., cross-track deviation, distance-to-go, time-to-go) relative to the offset path and offset reference points.

Once a parallel offset is activated, the offset remains active for all flight plan route segments until removed automatically (transitioning through a parallel track exit waypoint), until the flight crew enters a “Direct-To” routing or activates a new flight plan route, or until (manual) cancellation.

Figure 7-9: Parallel Offset Entry Waypoint PTK- (AW-109SP)

NOTE:

If a parallel offset is entered in the active flight plan and then cancelled, that active flight plan is no longer eligible for configuring another parallel offset without deleting and reopening due to the creation of a discontinuity.

7.5. Default GPS/SBAS Navigation Modes

In the default GPS/SBAS operating mode, the IDU has Enroute, Terminal, LNAV Approach, LNAV/VNAV Approach, LP Approach, LPV Approach, VFR Approach, and Departure navigation modes. Mode annunciation, alert limits (horizontal and vertical), and CDI FSD (horizontal and vertical) are automatically determined by navigation mode as follows.

Table 7-5: Default GPS/SBAS Navigation Modes	
Navigation Mode	**Annunciation**
Enroute	None
Terminal	TERMINAL
LNAV Approach	LNAV APPR
LNAV/VNAV Approach	LNAV/VNAV APPR
LP Approach	LP APPR
LPV Approach	LPV APPR
VFR Approach	VFR APPR
Departure	TERMINAL

The system automatically switches to default navigation modes based upon region of operation as follows.

Table 7-6: 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 <u>and</u> 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; <u>and</u> within 30 NM of the active runway*; <u>and</u> the FAWP is the active waypoint*; <u>and</u> 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).
Approach (LNAV,	IFR Approach has been selected; <u>and</u>

Table 7-6: Default Navigation Modes Based Upon Region of Operation

Default Navigation Mode	Definition of Region
LNAV/VNAV, LP or LPV)	within 30 NM 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 30 NM 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 30 NM of the departure airport, arrival airport, or runway.
Enroute	Not in Departure, Approach, or Terminal Modes.

NOTE:

During RNP 0.3 Approach (manually or coded) the scale remains in RNP 0.3.

7.6. GPS/SBAS CDI Scale

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

	To Enroute	**To Terminal**	**To Approach**
From Enroute		Change from ±2 NM FSD to ±1 NM FSD over distance of 1 NM; start transition when entering terminal mode.	
From Terminal	Change from ±1 NM FSD to ±2 NM FSD over distance of 1 NM; start transition when entering enroute mode.		If VTF, switch immediately. Otherwise, change from ±1 NM FSD to approach FSD over distance of 2 NM; start transition at 2 NM from FAWP
From Approach		Change to ±1 NM.	
From Departure		If initial leg is aligned with runway, change from ±0.3 NM FSD to ±1 NM FSD at the turn initiation point of the first fix in the departure procedure.	

NOTE:

For RNP 0.3 routes, Time to Alert is the same as for the approach. For RNP 0.3, the EFIS uses a 10-second TTA when using GPS-only, and a 2-second TTA when using EGNOS.

7.7. Approach Type Selection

The IDU selects the approach type (LNAV, LNAV/VNAV, LP, or LPV) when entering approach mode with the following order of precedence and prerequisites:

1) **LPV**:
   a) LPV Enable is enabled (AW-109SP Only);
   b) ARINC-424 “Level of Service” indicates LPV minimums are published;
   c) Valid long-term, fast, and ionospheric SBAS corrections are available and being applied to at least 4 GPS satellites;
   d) Final Approach Segment data block exists and passes CRC; and
   e) Horizontal and vertical alert limits from Final Approach Segment data block are predicted to be supported.
2) **LP**: (Same precedence and prerequisites as **LPV**)
3) **LNAV/VNAV**:
   a) ARINC-424 “Level of Service” indicates LNAV/VNAV minimums are published;
   b) If a Final Approach Segment data block exists, (LPV Enable is enabled AW-109SP only);
   c) If a Final Approach Segment data block exists, it passes CRC; and
   d) Horizontal alert limit of 556 m. (.3 NM) is predicted to be supported.

NOTE:

Because the IDU inherently supports barometric VNAV, it is not a prerequisite for the vertical alert limit to be predicted or supported. Nor is it a prerequisite for valid long-term, fast, and ionospheric SBAS corrections be available and applied to at least four GPS satellites. Rather, the vertical alert limit (50 m) and SBAS correction tests are used to determine whether to present guidance based upon GPS altitude or barometric altitude.

4) **NAV**: This is the default approach type and is selected when none of the above selections is made. There are no prerequisites for selecting LNAV.

The IDU continuously displays the approach type (mode indication) after selection. The IDU does not degrade the approach type after selection unless the approach procedure is reselected or changed.

NOTE:

These GPS/SBAS modes still appear during a ground based approach such as an ILS approach (see Figure 7-10).

Some instrument procedures include notes saying “RNP 0.3 required” and are coded as an RNAV procedure. In these cases, select manual RNP to see the RNP and ANP values on the PFD.

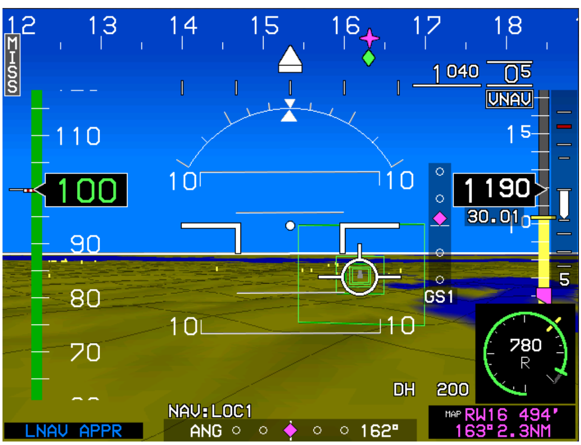


Figure 7-10: GPS Mode (LNAV APPR)

7.8. Approach Path Definition as VTF IFR Approach

In addition, the IDU provides the capability for the pilot to manually select a VTF IFR approach, indicating the pilot does not intend to fly the entire procedure. When a VTF IFR approach is selected, the IDU creates an “IP” waypoint on the extended final approach course to provide deviations relative to the extended final approach course. The “IP” is designated as a fly-over defined exit heading waypoint, and the leg prior to the “IP” is designated as a discontinuity. Until the FAWP has been sequenced, the IDU indicates a VTF IFR approach has been selected (with mode annunciation VECTORS) to advise the pilot guidance is not relative to a published approach path and TERPS or ICAO DO 8168 clearances are not assured.

7.9. VTF VFR Approach

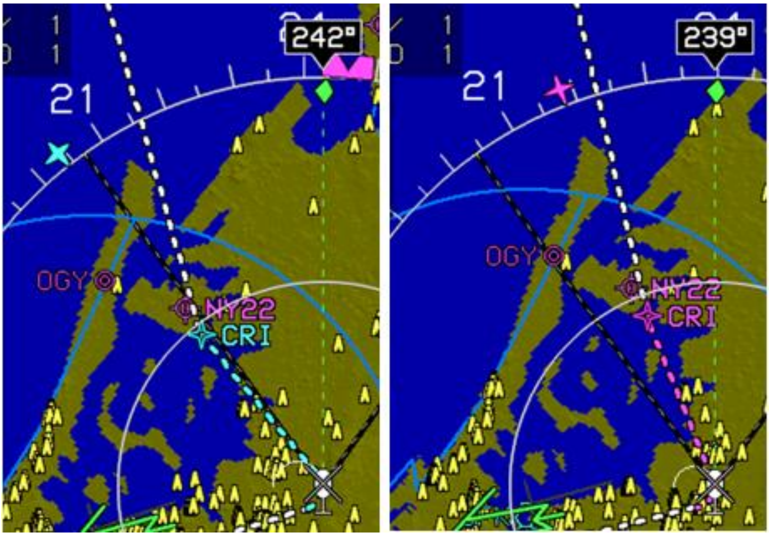
The pilot may select a VFR approach to a runway or user waypoint with a defined approach bearing. When a VFR approach is selected, the IDU creates an "IP" waypoint approximately 12 NM on the extended final approach course to provide deviations relative to the extended final approach course. The "IP" is designated as a fly-over defined exit heading waypoint, and the leg prior to the "IP" is designated as a discontinuity.

During this VTF VFR approach, the aircraft is proceeding towards the IP. Since the IP is designated as a discontinuity, proceeding direct is not possible. When attempting to proceed direct to the IP, only the active leg between the IP and RW01 is activated.

Figure 7-11: Navigating to FAF on VTF VFR Approach

7.10. Missed Approach and Departure Path Definition

The pilot may initiate the missed approach with manual action. Once on the final approach segment (dashed line course similar to instrument approach chart portrayal), the pilot has 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, the pilot may take this action before crossing the MAWP, in which case the equipment arms the missed approach for automatic initiation at the MAWP. If a missed approach is not initiated prior to crossing the MAWP, the IDU automatically switches to FROM mode at the MAWP and continues on the same course.



AW-109SP Missed Approach dashed line

Other Rotorcraft Missed Approach dashed line

Figure 7-12: Missed Approach and Departure Path

If the pilot initiates the missed approach, the IDU provides guidance relative to the procedure. If a missed approach is armed prior to crossing the MAWP, the desired path, to and after the MAWP, is defined by the procedure. If the first leg in the missed approach procedure is not a straight path aligned within 3° of the final approach course, the FSD changes to terminal mode FSD (±1 NM) when the missed approach is initiated. Otherwise, the FSD changes to ±0.3 NM, when the missed approach is initiated (departure mode), and changes to terminal mode FSD (±1 NM) at the turn initiation point of the first waypoint in the missed approach procedure.

The pilot may manually select DP guidance and, if the first leg in the DP is not a straight path aligned within 3° of the runway heading, terminal mode FSD (±1 NM) is used. Otherwise, the FSD is ±0.3 NM (departure mode) and changes to terminal mode FSD (±1 NM) at the turn initiation point of the first waypoint in the DP.

7.11. Loss of Navigation Monitoring

The IDU continuously monitors, independent of any pilot action, for loss of navigation capability. In Manual RNP mode or Automatic

RNP mode prior to sequencing the FAWP, the loss of navigation caution is displayed using a 10 second time to alert if the RNP value is less than 2 NM and a 30 second time to alert otherwise. The **FAULTS** menu enables the pilot to distinguish the cause of the loss of navigation caution. The caution returns to its normal state upon termination of the responsible condition.

7.12. Discontinuities

Where the IDU is unable to construct a smooth flight path as described above due to active flight plan waypoint spacing (i.e., spacing too close for turn radius), a discontinuity is placed between the waypoints. When a discontinuity exists, no path nor skyway is drawn between the waypoints. The pilot cannot activate the waypoint exiting the discontinuity, as it is not possible to provide path guidance to this waypoint. Attempts to activate the waypoint exiting the discontinuity results 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.

7.13. Selection of an Instrument Procedure

When an instrument procedure is selected and active, the receiver notifies the pilot of the most accurate level of service supported by the combination of the GPS/SBAS signal, receiver, and selected approach, using naming conventions on the minima lines of the selected approach procedure. Once the level of service has been given, the EFIS operates in this mode for the duration of the procedure, unless the level of service 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. These examples are created from either AW-109SP configured displays or other rotorcraft configured displays as noted:

1) SID (Step-By-Step) with AW-109SP configuration.

2) STAR (Step-By-Step) with AW-109SP configuration.

3) ILS Instrument Approach (Step-By-Step) in other rotorcraft configuration.

4) LOC BC Instrument Approach (Step-By-Step) with AW-109SP configuration.

5) RNAV (GPS) Instrument Approach to LPV Minima (Step-By-Step) in other rotorcraft configuration.

6) Copter RNAV (GNSS) Approach (Step-By-Step) with AW-109SP configuration.

7) NRST ILS Instrument Approach (Step-By-Step) in other rotorcraft configuration.

8) VOR DME Instrument Approach (Step-By-Step) in other rotorcraft configuration.

9) Copter RNAV (GPS) 028º (Step-By-Step) in other rotorcraft configuration.

7.13.1. Standard Instrument Departure (SID) (Step-by-Step)

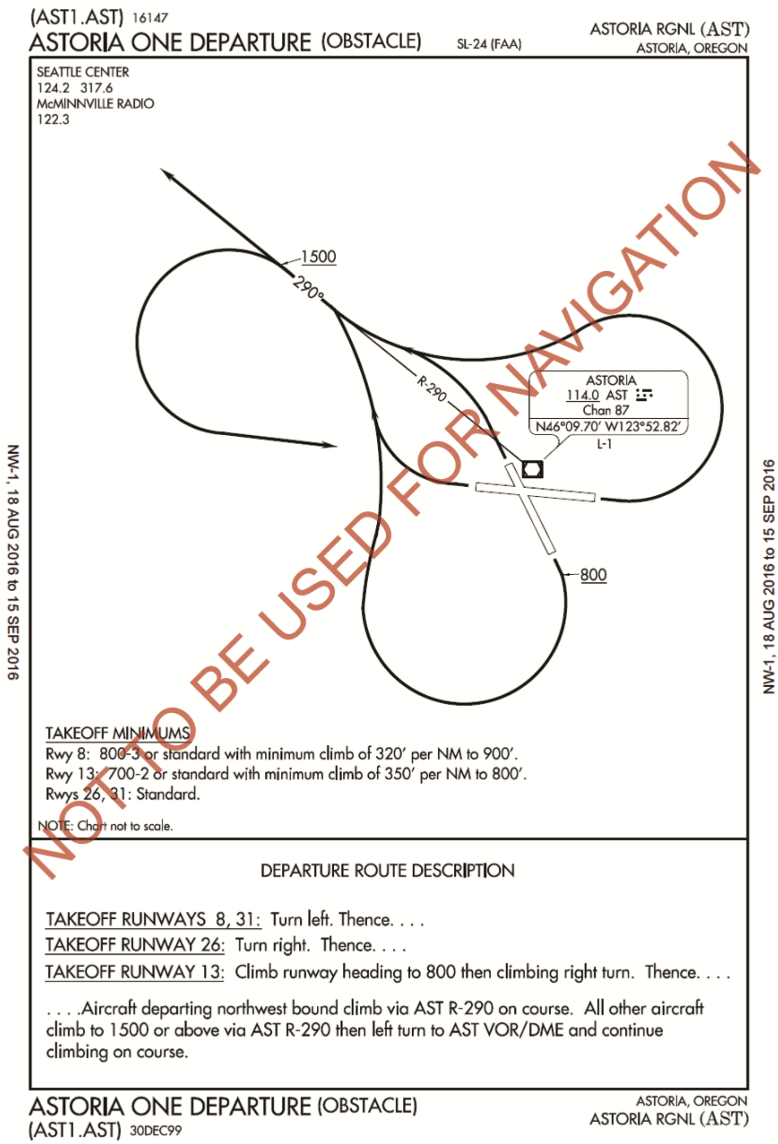


Figure 7-13: Standard Instrument Departure (SID)

1) Press **ACTV (L2)**. Scroll ❶ to **KAST**. Push to enter.

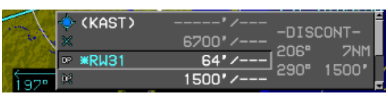
2) Scroll ❶ to **DP..** and push to enter.

3) Scroll ❶ to desired DP and push to enter.

4) Scroll ❶ RW31and push to enter. DP is loaded with **RW31** transition.

5) Scroll ❶ to RW31 and push to enter.

6) Scroll ❶ to airport (KAST) to view DP in active flight plan.



7) RW31 is now the next waypoint in the active flight plan.

7.13.2. Standard Terminal Arrival Route (STAR) (Step-by-Step)

If the selected waypoint is an airport with a published STAR, select from a list of available STARs, transitions, and runways. After selection, the appropriate STAR is created and displayed on the MAP page. Activating a STAR deletes any pre-existing STAR and is inserted prior to any approach waypoints if previously entered.

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 are inserted after the STAR.

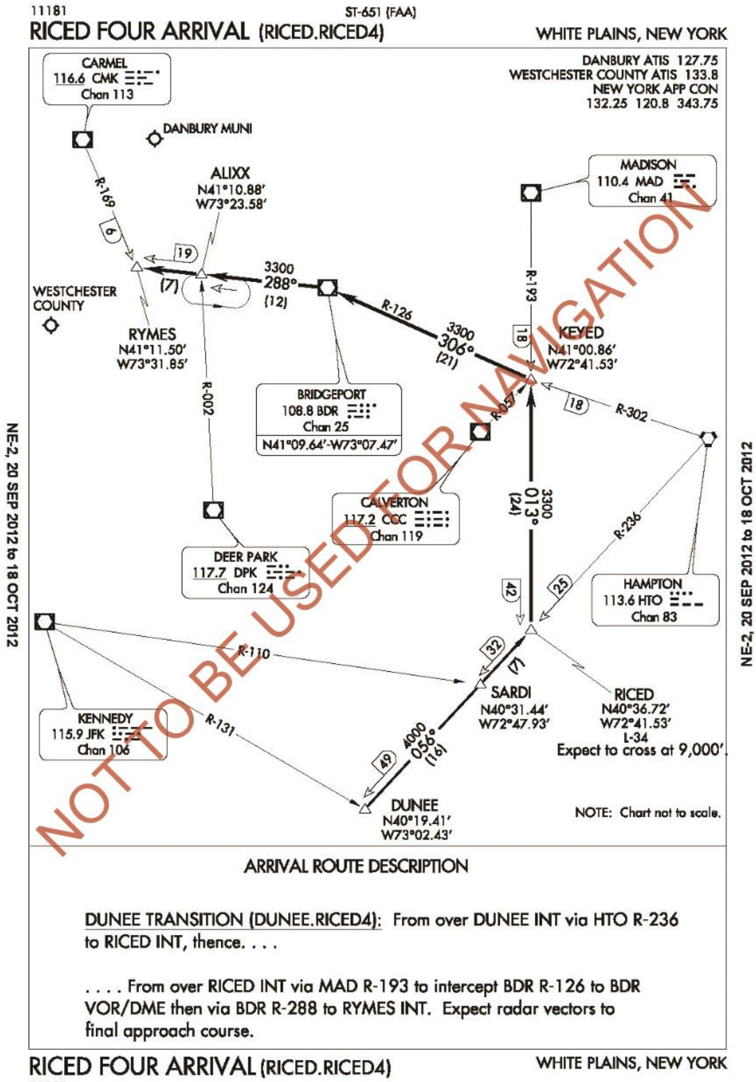
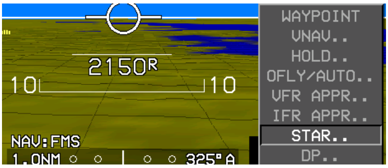
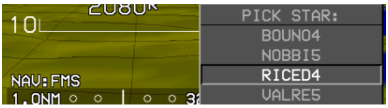


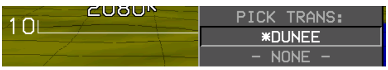
Figure 7-14: Standard Terminal Arrival Route (STAR)

1) With arrival airport in active flight plan highlighted, push ❶ to enter.

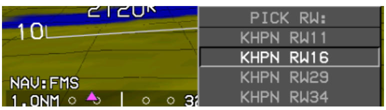


2) Scroll ❶ to desired **STAR:** and push to enter.





3) Scroll ❶ to desired **TRANS:**. Push to enter.



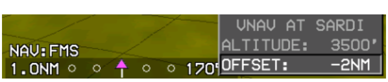
4) Scroll ❶ to desired **RW:** and push to enter.

5) Press **ACTV (L2)** to view STAR in active flight plan and active waypoint.

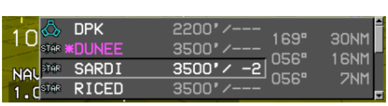
Assume ATC assigned a clearance to cross SARDI at 3500’ 2 NM prior to crossing.

6) Press **ACTV (L2)** and scroll ❶ to the waypoint in the clearance and push to enter.

7) Scroll ❶ to **VNAV..** and push to enter.



8) Scroll ❶ to enter assigned altitude, push to enter, and scroll ❶ CCW to enter -2 NM and push to enter to comply with ATC crossing clearance.



9) Altitude is shown on active flight plan with offset of 2 NM prior to reaching SARDI.

7.13.3. ILS Instrument Approach (Step-by-Step)

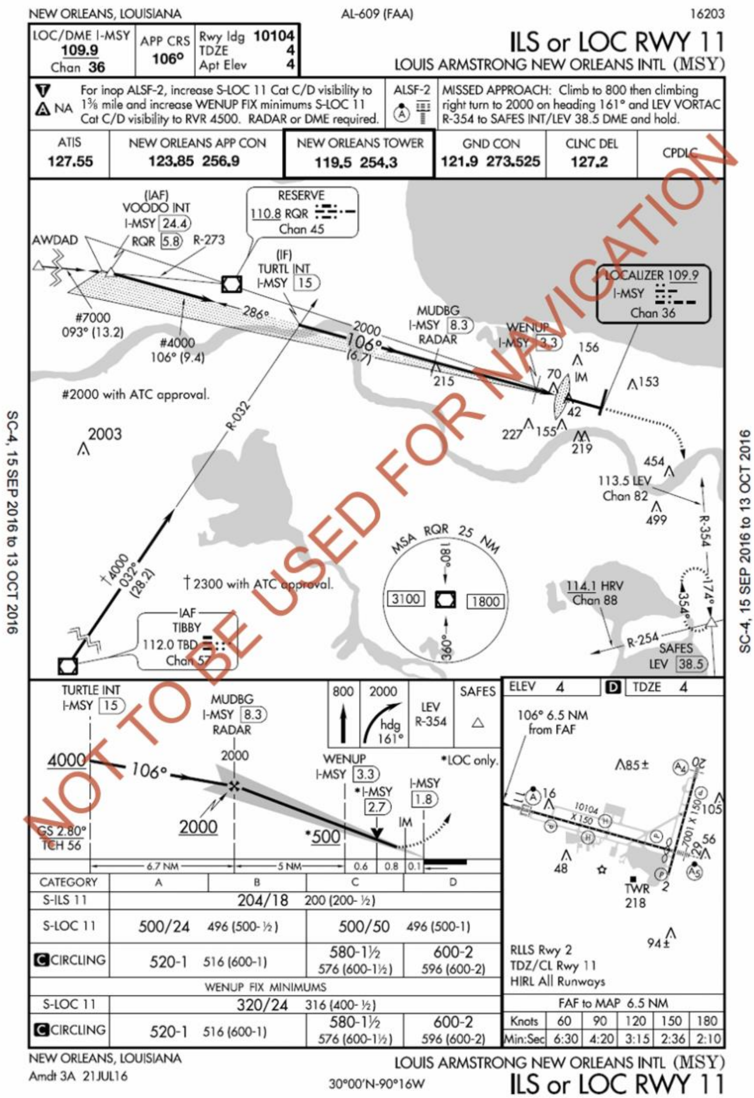
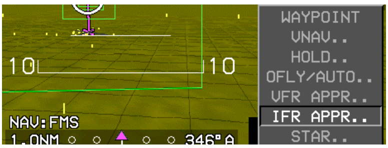


Figure 7-15: ILS RWY 10 (MSY)

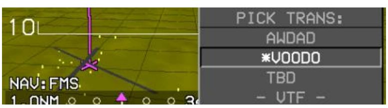
All approach operations typically begin with the same basic steps. The following example selects the ILS RWY 10 at Louis Armstrong

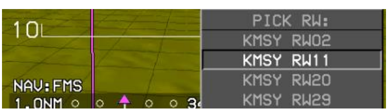
New Orleans INTL (KMSY). The PFD BUGS menu may be accessed on the PFD or Remote Bugs Panel if equipped.

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



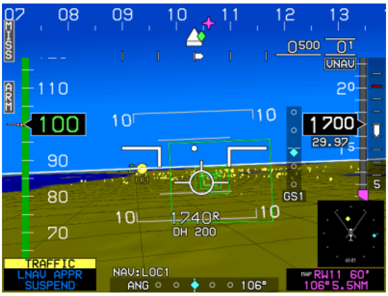
2) Scroll ❶ to **IFR APPR..** and push to enter.





3) Scroll ❶ to desired approach, transition, and runway. Push to enter for each option.

4) Procedure turn at **MUDBG** is depicted in the active flight plan.



5) Barometric Minima is set at 500’ MSL, and DH is set to 200’.

6) PFD BUGS may be set on PFD or RBP if equipped.

7) At FAF, press **ARM (L2)** to arm the missed approach procedure for automatic waypoint sequencing at MAWP.

8) On MFD, press **MENU (R1)**, then **PAGE.. (R3)**, then scroll ➊ to **HSI** and push to enter.

9) HSI shows on course and glidepath after passing MUDBG.

10) As an option, press **MENU (R1)** then **ZOOM ON (R3)** for a narrow field of view for realistic view of runway and surrounding areas.

11) Below minimums and ready for landing.

7.13.4. LOC Back Course Instrument Approach (Step-by-Step)

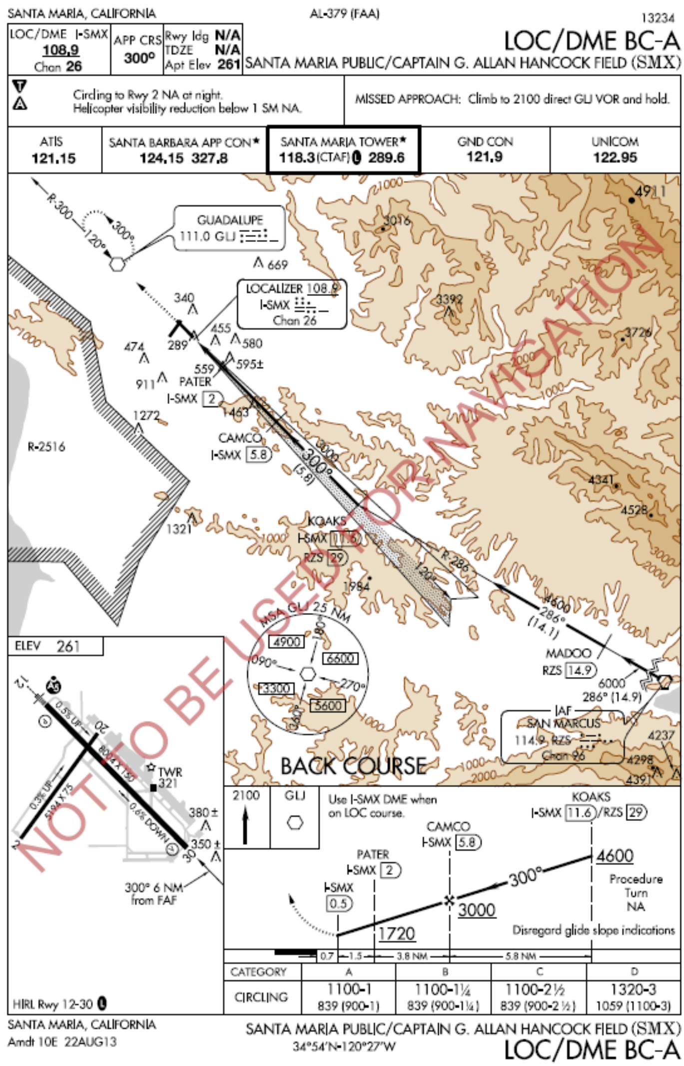


Figure 7-16: LOC Back Course Approach

1) Press **ACTV (L2)**, scroll ❶ to KSMX, and push to enter.

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

3) Scroll ❶ to **LBCA** and push to enter.

4) Scroll ❶ to transition and push to enter.

5) Scroll ❶ to runway and push to enter.

6) An active waypoint leg is created for direct to RZS.

7) ATC provides clearance direct to KOAKS maintain 6000'.

8) Press **ACTV (L2)**. Scroll ❶ to **KOAKS**, press **(R4)**, then push ❶ to enter.

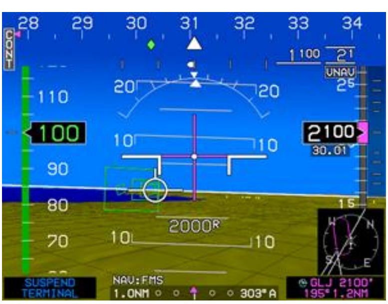
9) Passing the FAF, **ARM (L2)** appears without a SUSPEND advisory due to step-down fix ahead.

10) Press **OBS (L4)**. Scroll ❶ to set final approach course 300º then push to enter.

11) Approaching step-down fix **PATER** with FLY BY symbol appearing as a point in space.

12) After passing **PATER**, SUSPEND appears until **ARM (L2)** is pressed to arm auto waypoint sequencing at the MAWP.

13) Press **MENU (R1)** then **ZOOM OFF (R3)** to return the PFD to normal wide field of view.



14) Once established in published holding, a **CONT** tile is present with SUSPEND until **CONT (L1)** is pressed.

7.13.5. RNAV (GPS) Instrument Approach to LPV Minima (Step-By-Step)

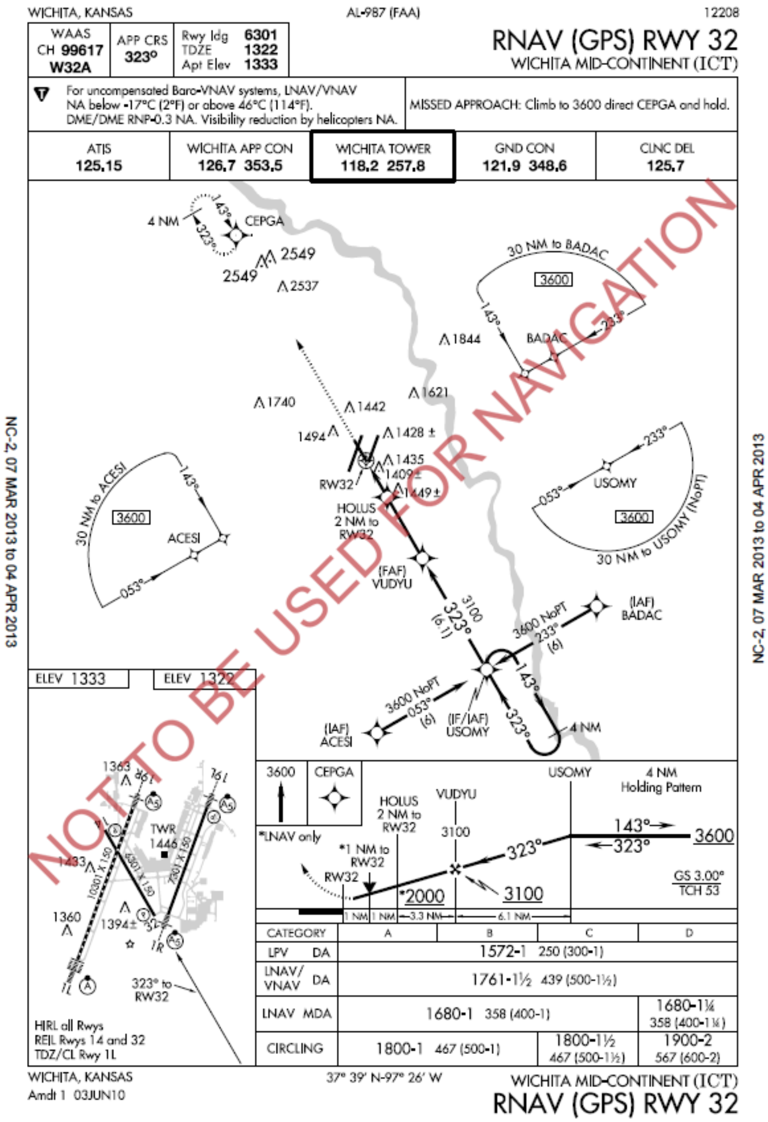


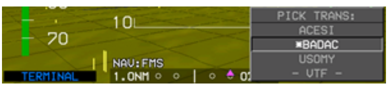
Figure 7-17: RNAV (GPS) Instrument Approach to LPV Minima

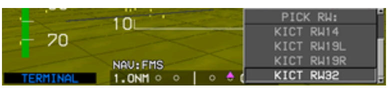
1) Select airport and **IFR APPR..** as in previous examples.

2) After reviewing the approach chart, scroll ❶ to **RNAV32 (99617)** then push to enter.

NOTE:

Verify the WAAS channel 5-digit number is identical to instrument approach chart reference.





3) Scroll ❶ to desired transition and runway then push to enter as described in previous examples.

4) Press **ACTV (L2)**. Scroll ❶ to waypoint, press  **(R4)** then push ❶ to enter.

5) Scroll ❶ to desired map scale for best view.

6) Observe active leg magenta line and next leg in white.

7) Inside FAF, press **ARM (L2)** prior to step down FIX, HOLUS.

8) Approaching HOLUS on glidepath with Minimums set at 1580'.

9) Approaching Minimums on glidepath with runway insight.

7.13.6. Copter RNAV (GNSS) Approach (Step-By-Step)

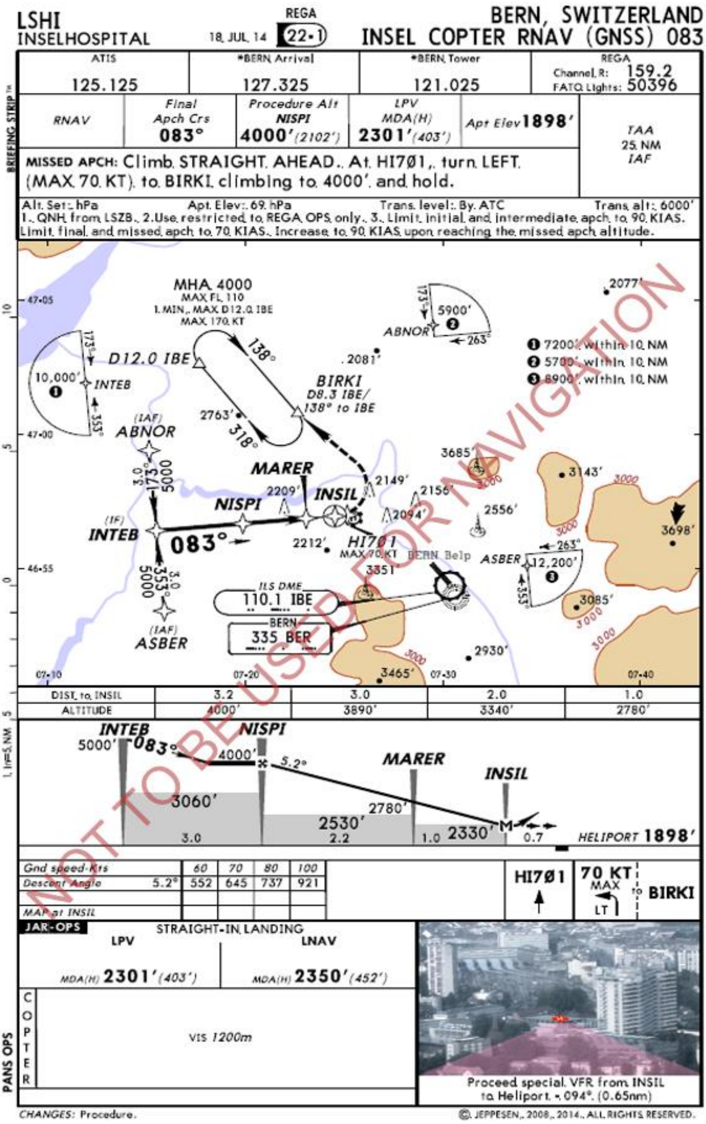
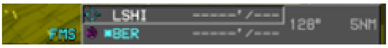


Figure 7-18: Copter RNAV (GNSS) Approach



1) Press **ACTV (L2)**. Scroll ❶ to **LSHI**. Push to enter.

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

3) Since only one approach is available, push ❶ to enter. Then scroll ❶ to desired transition and push to enter.

4) Since only one runway is available, push ❶ to enter.

5) On MFD, press **MENU (R1)**, press **PAGE.. (R3)**, then scroll ❶ to **NAV LOG** and push to enter.

6) For a better view of the procedure, press **MENU (R1)** then scroll ❶ to **ARC** and push to enter.

7) With the ARC view set, scroll ❶ (CW for larger and CCW for smaller) to set MAP scale for best orientation and view.

8) Approaching NISPI FAF slightly below the glideslope on the LPV approach.

9) On glidepath approaching the FAF with the fly-by waypoint appearing ahead. With 70 IAS and groundspeed 54 Kts.

10) Passing the FAF, press **ARM (L2)** to allow for arming the missed approach procedure upon passing the MAWP.

11) Press **MISS (L1)** anytime on the PFD, if a go-around is necessary, or it automatically begins sequencing the Missed Approach procedure upon passing the MAWP.

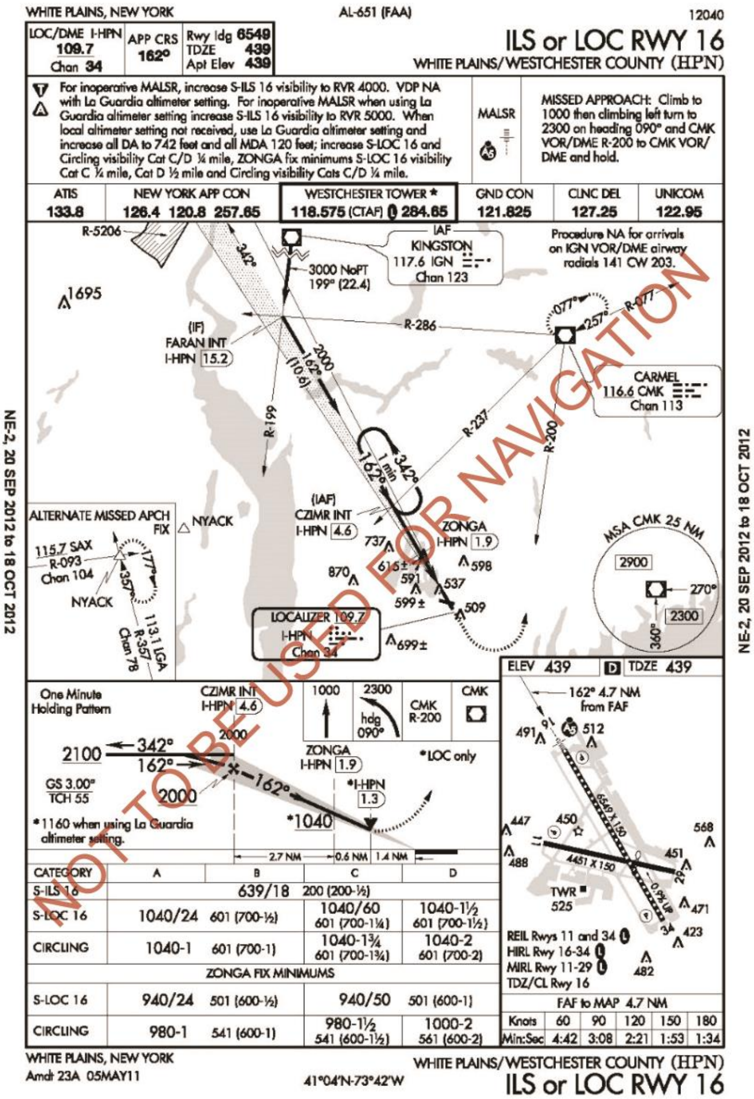
12) PFD BUGS must be set on the RBP in the AW-109SP.

NOTE:

When in LPV mode, the altitudes for the FAF, MAP, and any waypoints between the FAF and MAP are calculated based upon the internally protected FAS Data Block. Additionally, in LPV mode, the altitude presented for the MAP is, in fact, the altitude for the GPIP (Glidepath Intercept Point) as contained in the FAS Data Block. The offset field is populated, because the altitude presented is not the altitude for the MAP. The abbreviated “GPI” indicates the vertical navigation offset is to the GPIP.

For this approach, the altitude for NISPI has been calculated based upon FAS Data Block parameters as 3997’. The EFIS disregards the 4000’ contained in the normal NavData coding as required by the TSO. The altitude at the GPIP, which is downrange from INSIL is 1895’. Unless the missed approach is activated, the pilot can expect the AW-109SP AFCS to continue tracking the LPV glideslope beyond INSIL towards the GRIP. At 50’ radar altitude, algorithms internal to the AFCS level the helicopter.

7.13.7. NRST ILS Instrument Approach (Step-By-Step)



CATEGORY	A	B	C	D
S-ILS 16	639/18		200 (200-½)	
S-LOC 16	1040/24	601 (700-½)	1040/60 601 (700-1¼)	1040-1½ 601 (700-1½)
CIRCLING	1040-1	601 (700-1)	1040-1¾ 601 (700-1¾)	1040-2 601 (700-2)
ZONGA FIX MINIMUMS				
S-LOC 16	940/24	501 (600-½)	940/50	501 (600-1)
CIRCLING	980-1	541 (600-1)	980-1½ 541 (600-1½)	1000-2 561 (600-2)

FAF to MAP 4.7 NM					
Knots	60	90	120	150	180
Min:Sec	4:42	3:08	2:21	1:53	1:34

Figure 7-19: NRST ILS Instrument Approach

1) On PFD (shown here) or MFD, press **NRST (R3)** and scroll ❶ to **NRST ILS..** and push to enter.

2) Scroll ❶ to desired ILS option and push to enter.

3) Push ❶ to **CONFIRM ACTIVATE ILS**.

4) Confirmed active waypoint is the FAF for this ILS approach and manage HDG BUG which may have been turned on depending upon autopilot configuration.

5) Press **ACTV (L2)** to view active flight plan and active waypoint.

6) Press  **(R4)**, if ATC clearance allows for proceeding direct to FAF.

7) On PFD only, scroll ❶ to open HDG menu and press **OFF (R4)** to turn off HDG BUG if appropriate.

8) On MFD, active route is direct to the FAF. Adjust display for best orientation with afore-mentioned controls.

9) Press **ARM (L2)** to arm the Missed Approach procedure for automatic waypoint sequencing upon passing the MAWP.

10) Minimums have been set with PFD BUGS menu on the PFD or RBP if equipped. LOC1 is automatically set with correct final approach course.

11) Below published Baro Minima and over the Middle Marker with the analog AGL indictor selected while below the glideslope.

12) Passing the Inner Marker outside the MAWP while going below the glidepath.

13) Beyond the MAWP with automatic switching of OBS to FMS with 0.3 NM FSD and HITS guidance for the missed approach procedure.

7.13.8. VOR/DME Instrument Approach (Step-By-Step)

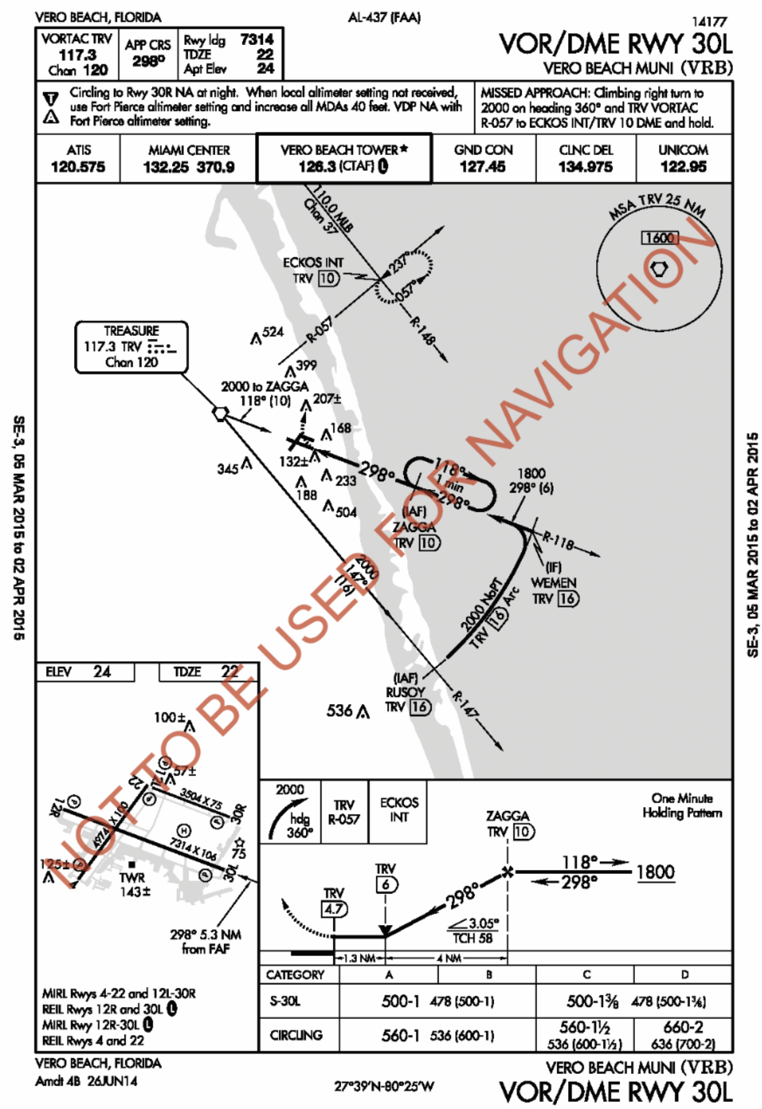
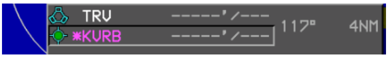
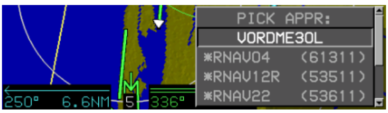


Figure 7-20: VOR/DME Instrument Approach

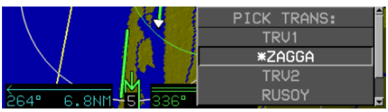


1) With KVRB in the active flight plan, scroll ❶ to **KVRB**. Push to enter.

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



3) Scroll ❶ to approach procedure. Push to enter.



4) Scroll ❶ to transition and push to enter. (* Most logical choice for avenue of arrival.)

5) Scroll ❶ to runway and push to enter.

6) Active flight plan appears with active waypoint information.

7) In this example, EFIS is set to maintain 3000' MSL with the PFD BUGS menu or RBP, and the VNAV altitude is bypassed.

8) While in holding pattern at ZAGGA, auto waypoint sequencing is suspended until **CONT (L1)** is pressed.

9) ASEL target altitude is turned off with PFD BUGS menu or RBP as applicable.

10) Passing the FAF, with SUSPEND **ARM (L2)** is pressed.

11) As an option, press **MENU (R1)** then **ZOOM ON (R3)** to narrow field of view.

12) Runway appears with markings as if seen through the windscreen.

13) During Missed Approach procedure, OBS switches to FMS with 0.3 NM FSD and the first waypoint, if the MAP as active waypoint.

7.13.9. Copter RNAV (GPS) Instrument Approach (Step-By-Step)

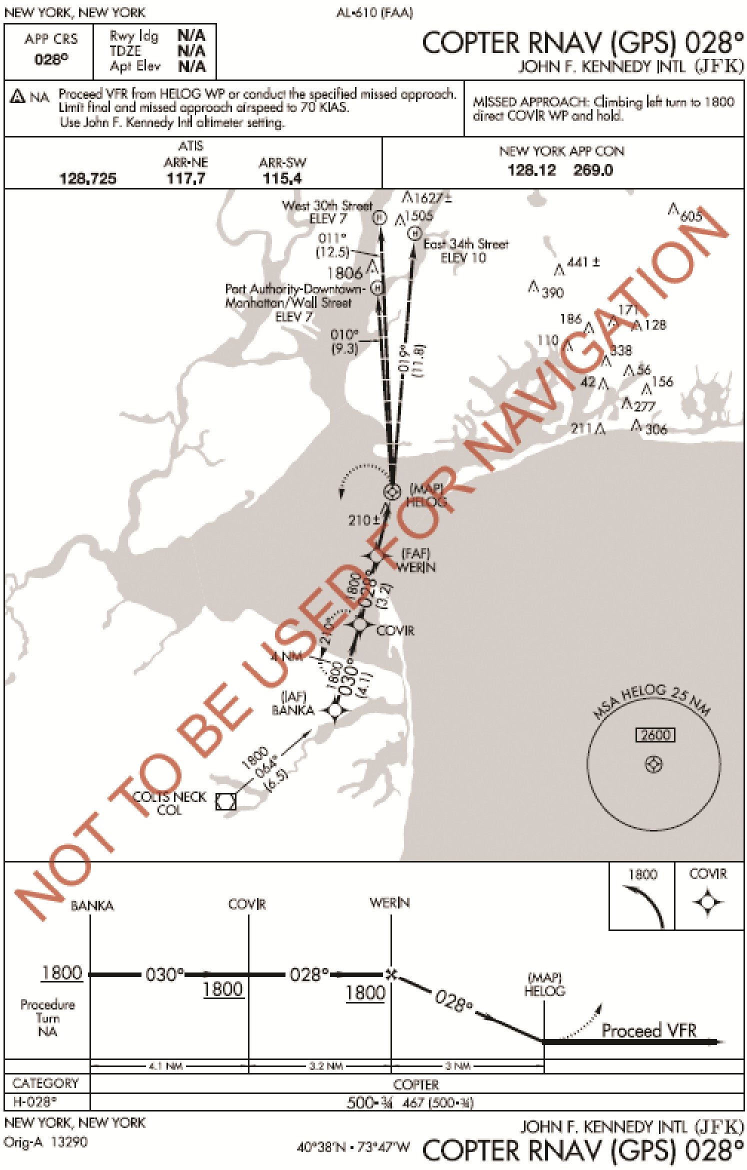


Figure 7-21: Copter RNAV (GPS) Approach

1) Press **ACTV (L2)**. With Heliport 6N5 as the highlighted active waypoint, press **INSERT (R2)** and either select from **NRST APT (L2)** list or enter **KJFK** with ❶ and push to enter.

2) With active flight plan open, scroll ❶ to **IFR APPR...** Push to enter.

3) Scroll ❶ to ***GPS028 H**. Push to enter.

4) Scroll ❶ to pick **TRANS:** to ***BANKA**. Push to enter.

5) Scroll ❶ to pick **RW:** Select any runway since a landing is planned at the heliport at East 34th street (6N5).

6) ATC clears flight for Copter RNAV (GPS) 028 approach landing at 6N5 heliport maintain 1800'.

Press (R4) and push ❶ to enter.

7) If no other clearance is received, push ❶ to

accept crossing BANKA as a waypoint.

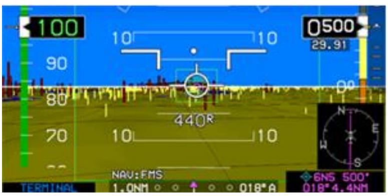
8) Press **MENU (R1)** then **BUGS.. (R2)** and **MINS.. (R3)** then scroll ❶ to **MIN ALT..** and push to enter.

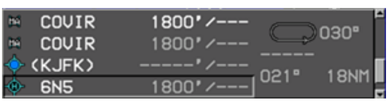
9) Scroll ❶ to the published Minimum altitude 500' and push to enter.

10) 2.1 NM outside of the FAF with VDI appearing.

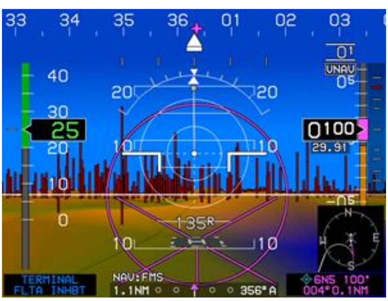
11) Inside the FAF on VNV-G glidepath and waypoint sequencing suspended.

12) Press **ARM (L2)** to arm MAP and return to auto waypoint sequencing.



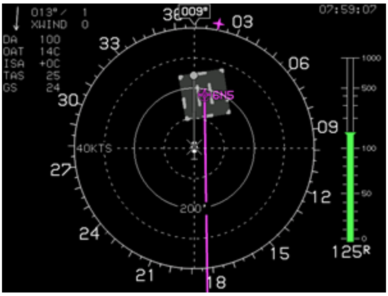


13) After passing **HELOG** (MAWP), press **ACTV (L2)**, scroll ➊ to 6N5, press  **(R4)**, and push ➊ to enter.



14) With heliport in sight and descending to 100', the active waypoint symbol appears over the heliport.

15) On MFD, press **MENU (R1)** then **PAGE.. (R3)** and scroll ➊ to **HOVER** and push to enter.



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.

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.

GPS receivers do not "Fail Down" to lower levels of service once the approach has been activated. If only VERT LON appears, the pilot may elect to use the LNAV minima, if the rules under which the flight is operating to allow changing the type of approach being flown after commencing the procedure. If the lateral integrity limit is exceeded on an LP approach, a missed approach is necessary since there is no way to reset the lateral alarm limit while the approach is active.

Section 8 Terrain Awareness Warning System

Enhanced HTAWS and HTAWS

Table of Contents

List of Figures and Tables

8.1. Enhanced HTAWS and HTAWS (Terrain Awareness Warning System) Functions

The IDU provides TSO-C194 HTAWS functionality. Depending on aircraft configuration and external sensors/switches, the system is configurable as an Enhanced HTAWS or HTAWS. Functions provided by HTAWS are:

1) **Terrain Display**: Display of terrain and obstacles on PFD and ND.

2) **Forward Looking Terrain Awareness** (**FLTA**): Uses terrain and obstruction databases to alert to hazardous terrain or obstructions in front of the aircraft.

3) **Excessive Rate of Descent** (**GPWS Mode 1**): Alerts when the rate of descent is hazardously high as compared to height above terrain (i.e., descending into terrain).

4) **Excessive Closure Rate to Terrain** (**GPWS Mode 2**): Alerts when the rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain).

5) **Sink Rate after Takeoff or Missed Approach** (**GPWS Mode 3**): Alerts when sink rate is detected immediately after takeoff or initiation of a missed approach.

6) **Flight into Terrain when not in Landing Configuration** (**GPWS Mode 4**): Alerts when descending into terrain without properly configuring the aircraft for landing.

7) **Excessive Downward Deviation from an ILS Glideslope** (**GPWS Mode 5**): Alerts when an excessive downward glideslope deviation is detected on the final approach segment of an ILS approach.

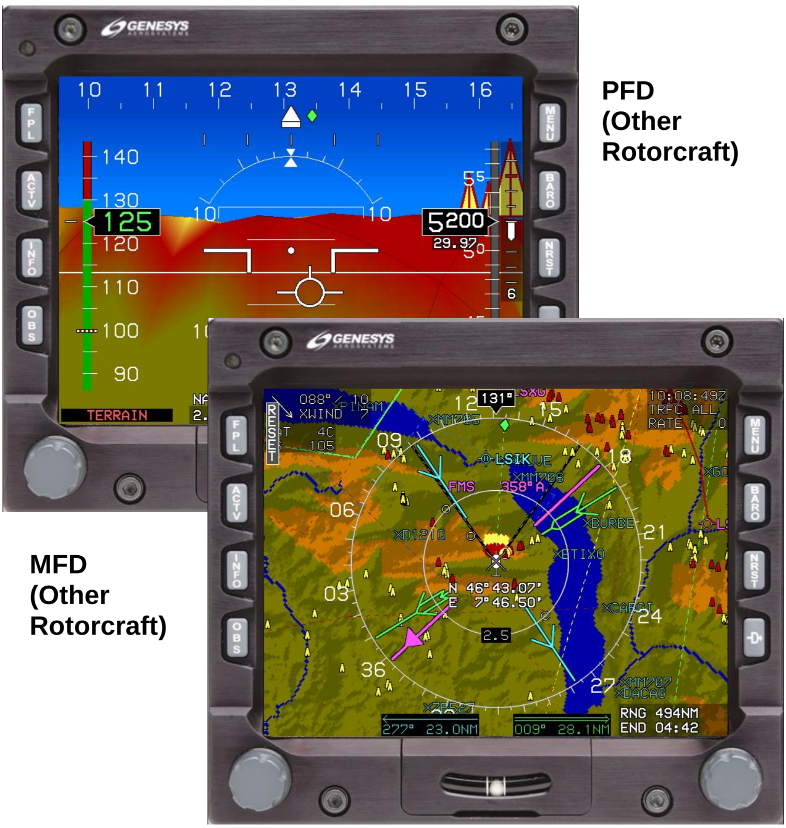
Table 8-1: TAWS Functions Provided by the EFIS

Aircraft Type	TAWS Class	Terrain Display	FLTA	GPWS Mode				
				1	2	3	4	5
Rotorcraft RG	Enhanced	✓	✓	✓	✓	✓	✓	✓
Rotorcraft FG	Enhanced	✓	✓	✓	✓	✓		✓
Rotorcraft	Normal	✓	✓			✓		

Notes: RG = Retractable Gear; FG = Fixed Gear

8.1.1. Terrain Display

The display of terrain on the PFD and MFD are described in Sections 3 Display Symbology and 5 Menu Functions and Step-By-Step Procedures where applicable.



PFD (Other Rotorcraft)

MFD (Other Rotorcraft)

Figure 8-1: Terrain Display (Other Rotorcraft)

PFD
(AW-109SP)

MFD
(AW-109SP)

Figure 8-2: Terrain Display (AW-109SP)

8.2. Forward Looking Terrain Alert Function

FLTA function uses the following information to alert to hazardous terrain or obstructions within a search envelope in front of the aircraft:

1) Terrain database
2) Obstruction database
3) Airport and runway database
4) Aircraft position
5) Aircraft track
6) Aircraft groundspeed
7) Aircraft bank angle
8) Aircraft altitude
9) Aircraft vertical speed

Other Rotorcraft

AW-109SP

Figure 8-3: FLTA INHBT

8.2.1. FLTA Modes

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

8.2.2. GPS/SBAS Navigation Mode Slaving

The EFIS performs TSO-C146c GPS/SBAS functions in addition to the TAWS functions. As a result, GPS/SBAS navigation mode is available as an input to the TAWS. The pilot may select an IFR procedure (Approach, DP, or STAR) which changes the GPS/SBAS navigation mode to Enroute, Terminal, Departure, or IFR Approach as appropriate. In addition, the EFIS allows the pilot 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 is the reference point for automatic FLTA inhibiting. The advantage is the GPS/SBAS navigation modes are a direct indication to the FLTA function of pilot intent.

8.2.3. Default FLTA Mode

If the default FLTA navigation mode is higher in precedence than the GPS/SBAS navigation mode, FLTA mode is slaved to the default FLTA navigation mode. These modes, in order of precedence, are:

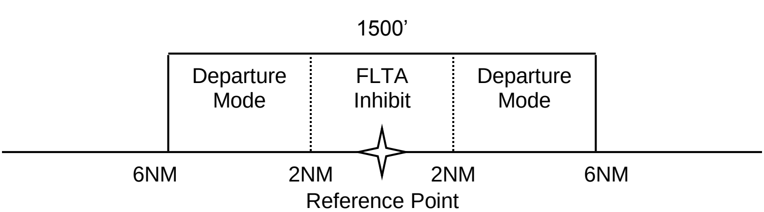


Figure 8-4: Default FLTA INHBT

1) **Departure Mode**: Enabled when in Ground Mode. Reference point for automatic FLTA inhibiting and mode envelope definition is the last point at which the ground definition was satisfied (this is near the liftoff point). Departure Mode ends upon climbing through **1500 feet** above or traveling more than **6NM** from the reference point.

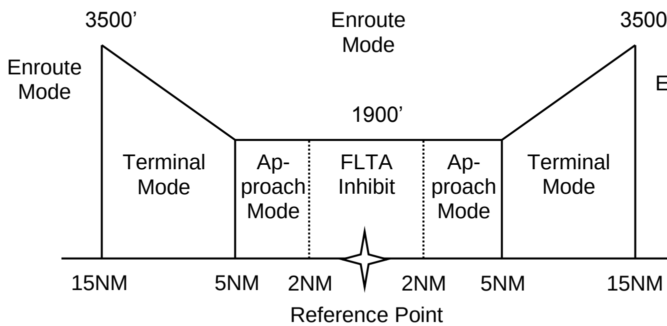


Figure 8-5: FLTA INHBT Mode Areas

2) **Other Modes**: For other default FLTA modes, reference point for automatic FLTA inhibiting and mode envelope is the nearest runway threshold or the nearest user waypoint with a defined approach bearing. TAWS continuously searches all runway thresholds at the nearest three airports to determine the nearest runway threshold. TAWS performs a search for the nearest three airports and nearest user waypoints with a defined approach bearing every 3NM of distance traveled. Modes are as follows:

   a) **Approach Mode**: Exists when within 1900 feet and 5NM of the reference point.

   b) **Terminal Mode**: Exists from 5NM to 15NM from the reference point when below an altitude varying from 1900 feet (at 5NM) to 3500 feet (at 15NM) above the reference point.

   c) **Enroute Mode**: Exists when not in any other mode.

8.3. 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. Dimensions of the search envelope depend upon TAWS type, FLTA mode, aircraft groundspeed, aircraft bank angle, and vertical speed. Basic envelope parameters are as follows.

1) **TAWS Type**: Determines value of several parameters used to calculate the search envelope as described in Table 8-2.

Table 8-2: FLTA Search Envelope for HTAWS

Envelope	Parameter	Notes
Level-Off Rule	10% of vertical speed	Used for level off leading
Range	36 seconds of the forward range search envelope	Reduced to 24 seconds when Low Altitude Mode is engaged. GPS/SBAS HFOM is added to range.
Enroute Mode Level/Climbing Flight RTC	150 feet	Reduced to 100 feet when Low Altitude Mode is engaged.
Terminal Mode Level/Climbing Flight RTC	150 feet	Reduced to 100 feet when Low Altitude Mode is engaged.
Approach Mode Level/Climbing Flight RTC	150 feet	Reduced to 100 feet when Low Altitude Mode is engaged.
Departure Mode Level/Climbing Flight RTC	100 feet	
Enroute Mode Descending RTC	100 feet	
Terminal Mode Descending RTC	100 feet	
Approach Mode Descending RTC	100 feet	
Departure Mode Descending RTC	100 feet	

2) **Aircraft Track**: Terrain search envelope is aligned with aircraft track.

3) **Aircraft Groundspeed**: Used in conjunction with the range parameter to determine look-ahead distance. In addition, used

in conjunction with FLTA mode to determine the search volume width as follows:

a) **Enroute Mode**: Search volume width is based upon a 30° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.5NM either side of track.

b) **Terminal Mode**: Search volume width is based upon a 15° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.5NM either side of track.

c) **Approach Mode**: Search volume width is based upon a 10° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.3NM either side of track.

d) **Departure Mode**: Search volume width is based upon a 10° change in track followed by 30 seconds of flight at aircraft groundspeed. Maximum width is 0.3NM either side of track.

After calculating search volume width as described above, the GPS/SBAS HFOM is added to search volume width.

1) **Aircraft Bank Angle**: Used to expand the search volume in the direction of a turn and requires at least 10° of bank. In addition, search volume expansion is delayed so at 10° of bank, the bank angle must be continuously held for 3.25 seconds which is reduced linearly with increased bank angle so at 30° of bank there is no delay time.

2) **Aircraft Vertical Speed**: Used to determine which RTC values should be used. A three-second pilot reaction time is used is applied to the level-off rule parameters.

8.3.1. FLTA Alerts and Automatic Popup

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

1) On PFD screen, terrain rendering is enabled;

2) On navigation display screen, terrain rendering is enabled only if TAWS Inhibit is not enabled (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 is engaged as follows:

1) Display switched to navigation display.
2) Display switched to aircraft centered and heading up.
3) Display panning disabled.
4) Display scale set to:
5) 10NM (groundspeed > 200 knots);
6) 5 NM (groundspeed < = 200 knots and groundspeed > 100 knots); or
7) 2NM (groundspeed < = 100 knots).

After the popup mode is engaged, the pilot may change any setting automatically changed by the popup mode. In addition, **RESET** appears for 20 seconds to allow the pilot to reset the previous screen configuration with one button press. Popups only occur on IDU #0 or IDU #2 (with Enhanced HTAWS enabled) and do not occur if TAWS Inhibit is enabled.

NOTE:

Function is present in rotorcraft Enhanced HTAWS only.

Figure 8-6: Popup Mode Excessive Rate of Descent (GPWS Mode 1)

GPWS Mode 1 function uses aircraft vertical speed information and AGL altitude to alert when the rate of descent is hazardously high as compared to height above terrain. GPWS Mode 1 has a caution and warning threshold. When below the thresholds, a GPWS Mode 1 warning is generated. The curve is shown in Figure 8-7.

Table 8-3: HTAWS GPWS Mode 1 Envelope

Sink Rate (fpm)	AGL Altitude (ft.)	
	"Sink Rate" Caution Threshold	**"Pull Up" Warning Threshold**
< 1000	$62.5\% \times (\text{Sink Rate} - 600)$	$66\% \times \left(\begin{array}{c}\text{Caution}\\\text{Threshold}\end{array}\right)$
1000 to 3000	Lesser of: 750 or $25\% \times (\text{Sink Rate})$	

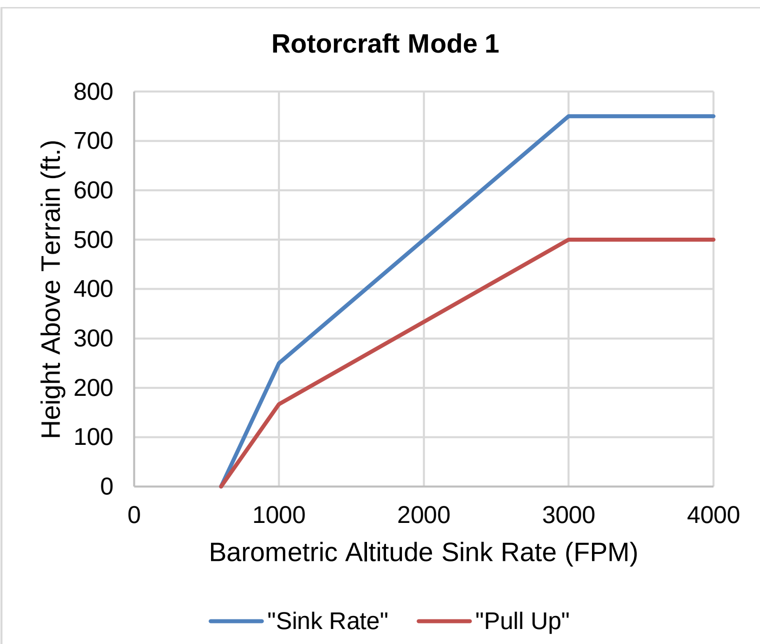


Figure 8-7: Rotorcraft GPWS Mode 1

8.4. Excessive Closure Rate to Terrain (GPWS Mode 2)

GPWS Mode 2 function is present in Enhanced HTAWS only and uses filtered AGL rate and AGL altitude to alert when the rate of change of height above terrain is hazardously high as compared to height above terrain (i.e., flying level over rising terrain).

Envelope selection is determined as follows.

Table 8-4: HTAWS GPWS Mode 2 Envelopes

Landing Gear	Mode 2A	Mode 2B
Retractable	Landing Gear Up	Landing Gear Down
Fixed	$\text{AGL Altitude} > 200\text{ ft}$ or $\text{Airspeed} > 80\text{ KIAS}$	$\text{AGL Altitude} \leq 200\text{ ft}$ and $\text{Airspeed} \leq 80\text{ KIAS}$

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

Table 8-5: HTAWS GPWS Mode 2A Envelopes (NOT in Landing Configuration)

<table>
<tr><th rowspan="2">AGL Rate (fpm)</th><th colspan="2">AGL Altitude (ft.)</th></tr>
<tr><th>“Caution, Terrain” Caution Threshold</th><th>“Pull Up” Warning Threshold</th></tr>
<tr><td>< 1905</td><td>$125\% \times (\text{AGL Rate} - 1600)$</td><td rowspan="2">$66\% \times \left(\text{Caution Threshold}\right)$</td></tr>
<tr><td>> 1905</td><td>20% of the lesser of:
<table>
<tr><th>Airspeed (KIAS)</th><th>AGL Rate (fpm)</th></tr>
<tr><td>< 90</td><td>3120</td></tr>
<tr><td>90 to 130</td><td>$3120 + 72 \times (\text{Airspeed} - 90)$</td></tr>
<tr><td>> 130</td><td>6000</td></tr>
</table>
or
AGL Rate</td></tr>
</table>

Table 8-6: HTAWS GPWS Mode 2B Envelopes (Landing Configuration)

AGL Altitude (ft.)	
"Caution, Terrain" Caution Threshold	**"Pull Up" Warning Threshold**
Lesser of: 300 or $20\% \times (\text{AGL Rate} - 2000)$	$66\% \times (\text{Caution Threshold})$

Envelope Depictions Mode 2 envelopes are shown in Figure 8-8.

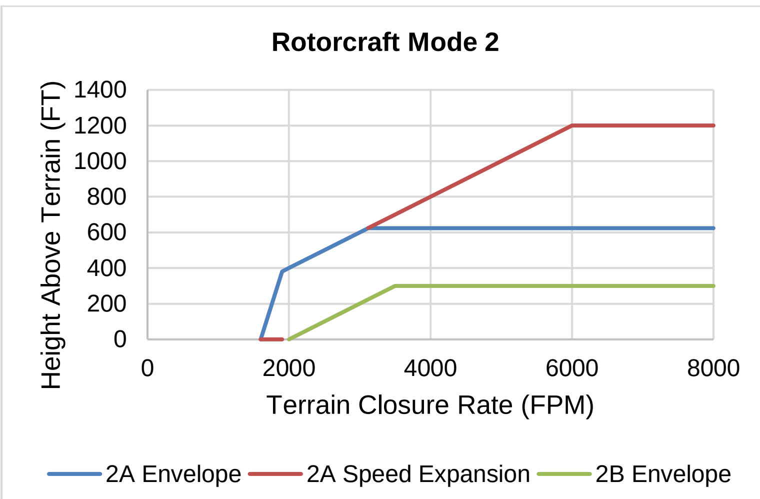


Figure 8-8: Rotorcraft GPWS Mode 2

8.5. Sink Rate after Takeoff or Missed Approach (GPWS Mode 3)

GPWS Mode 3 function uses aircraft vertical speed information and AGL altitude to alert when 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 **6 NM** from the last point at which the ground definition was satisfied (this is near the liftoff point), or transitioning to the second leg of a missed approach procedure. GPWS Mode 3 has a caution threshold based upon height above terrain and vertical speed. When below the caution threshold, a GPWS Mode 3 warning is generated as defined in Figure 8-9.

“**Don’t Sink**” AGL = 140 % of sink rate

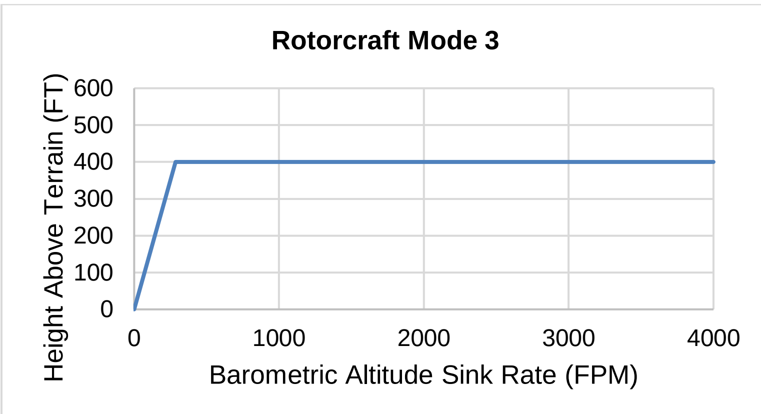


Figure 8-9: Rotorcraft GPWS Mode 3

8.6. Flight into Terrain when not in Landing Configuration (GPWS Mode 4)

GPWS Mode 4 function is present in Enhanced HTAWS and uses aircraft speed information and AGL altitude to alert when descending into terrain without properly configuring the aircraft for landing. There are two Mode 4 envelopes: Mode 4A, which gives cautions when landing gear is in other than landing configuration, and Mode 4B, which gives cautions when landing gear or flaps are in other than landing configuration. Applicability of Mode 4 envelopes to aircraft types are as follows.

Table 8-7: HTAWS GPWS Mode 4 Envelopes

Landing Gear	Mode 4A	Mode 4B
Retractable	Landing Gear Up	Not Applicable
Fixed	Not Applicable	Not Applicable

The rotorcraft Mode 4 envelope consists of a low-speed region and a high-speed region. In the low-speed region, TOO LOW appears in conjunction with a single “Too Low Gear” aural alert. In the high-speed region, TOO LOW appears in conjunction with a single “Too Low Terrain” aural alert. In addition, the rotorcraft Mode 4 has autorotation expansion and, when engaged, the aural alert is “Too Low Gear” regardless of speed.

Mode 4 alerting criteria require the Mode 4 envelope to be entered from above so changing aircraft configuration while within a Mode 4 envelope does not generate an alert.

Table 8-8: HTAWS GPWS Mode 4A Envelopes

Segment	Speed (KIAS)	AGL Altitude (ft.)
4A Low-Speed	< 100	150 (400 in autorotation)
4A High-Speed	≥ 100	

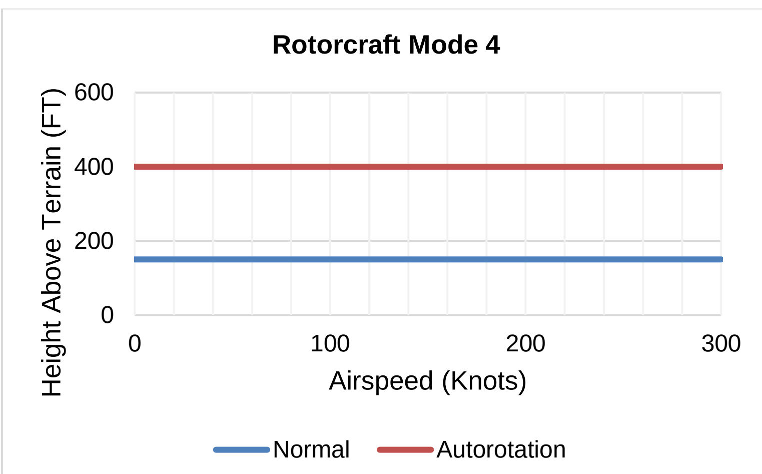


Figure 8-10: Rotorcraft GPWS Mode 4

8.7. Excessive Downward Deviation from an ILS Glideslope (GPWS Mode 5)

This function is present in Enhanced HTAWS only. The GPWS Mode 5 function uses ILS glideslope deviation information and AGL altitude to alert when an excessive downward glideslope deviation is detected on the final approach segment of an ILS approach. GPWS Mode 5 is armed when a valid glideslope signal is being received AND the aircraft is below **1000' AGL**.

GPWS Mode 5 has a caution and warning threshold. When below a threshold, a GPWS Mode 5 warning is generated. The curve compares glideslope deviation to AGL altitude as in Figure 8-11.

Table 8-9: HTAWS GPWS Mode 5 Envelopes

Caution Threshold	Warning Threshold
Greater of: $\begin{bmatrix} 1.3 + 1.4\% \times \\ (150 - \text{AGL Altitude}) \end{bmatrix}$ Dots or 1.3 Dots	Greater of: $\begin{bmatrix} 2 + 1\% \times \\ (150 - \text{AGL Altitude}) \end{bmatrix}$ Dots or 2 Dots

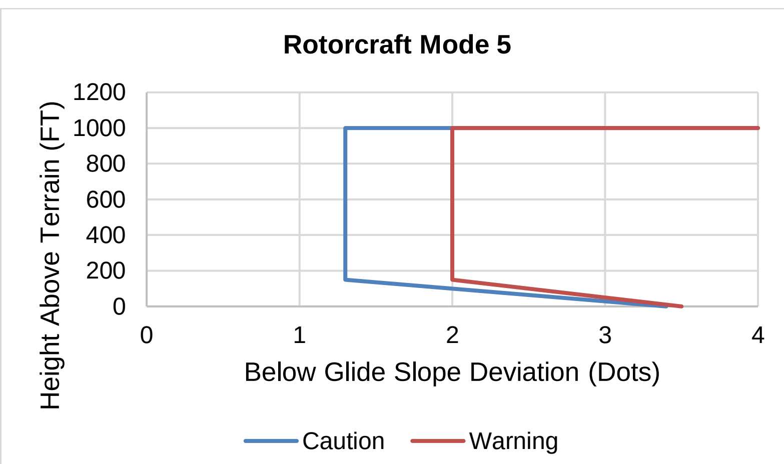


Figure 8-11: Rotorcraft GPWS Mode 5

8.8. External Sensors and Switches

The EFIS TAWS requires a variety of inputs from external sensors and switches to perform its functions. These inputs are as follows:

1) **GPS/SBAS Receiver**: Source of aircraft position, geodetic height, horizontal figure of merit (HFOM), vertical figure of merit (VFOM), loss of integrity (LOI), and loss of navigation (LON) inputs for the TAWS. The GPS/SBAS receiver connects directly to the EFIS IDU.

2) **Air Data Computer (ADC)**: Source of barometric altitude, outside air temperature, and vertical speed for the TAWS and connects directly to the EFIS IDU.

3) **ILS Receiver**: Glideslope receiver is the source of glideslope deviation for the TAWS.

4) **Radar Altimeter (RA)**: Source for radar altitude for the TAWS.

5) **Gear Position Sensors**: Landing gear position discretes, as configured in the system limits, are the source of landing gear position for the TAWS.

6) **TAWS Inhibit Switch**: As configured in the system limits, used for manual inhibiting of TAWS alerting functions. The TAWS Inhibit Switch is of the latching type and gives an obvious indication of actuation (e.g., toggle/rocker or pushbutton with indicator light and XFILL INHBT on the lower left corner of the PFD).

7) **Low Altitude Mode Switch**: As configured in the system limits, used for inhibiting and modifying HTAWS alerting functions to allow normal operation at low altitudes. The Low Altitude Mode Switch is of the latching type and gives an obvious indication of actuation (e.g., toggle/rocker or pushbutton with indicator light and TAWS LOW ALT on the lower left corner of the PFD).

8) **Audio Mute Switch**: Used for silencing active aural alerts. The Audio Mute Switch is of the momentary type and is connected directly to the EFIS IDU. The Audio Mute Switch is momentarily activated when silencing of active aural alerts is desired.

9) **Glideslope Deactivate Switch**: As configured in the system limits, 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 is as follows.

Table 8-10: External Sensors and Switches (Applicable TAWS)

Aircraft Type	**Rotorcraft RG**	**Rotorcraft FG**	**Rotorcraft**
HTAWS Class	Enhanced	Enhanced	Normal
GPS/SBAS	✓	✓	✓
ADC	✓	✓	✓
Gear Position Sensor	✓		
TAWS Inhibit Switch	✓	✓	✓
Audio Cancel Switch	✓	✓	✓
Low Altitude Mode Switch	✓	✓	✓
Low Torque Sensor	✓	✓	
ILS	✓	✓	
Radar Altimeter	✓	✓	
Glideslope Deactivate Switch	✓	✓	

Notes: RG = Retractable Gear; FG = Fixed Gear

8.9. TAWS Basic Parameter Determination

The fundamental parameters used for TAWS functions are.

Table 8-11: HTAWS Basic Parameters Determination

Parameter	**Source**	**Notes**
Aircraft position, groundspeed and track	GPS/SBAS	HFOM must be less than or equal to the greater of 0.3 NM or Horizontal alert limit (HAL) for mode of flight.
MSL Altitude	GPS/SBAS	Geodetic Height converted to MSL with the current EGM (Earth Gravity Model) database.

Table 8-11: HTAWS Basic Parameters Determination		
Parameter	**Source**	**Notes**
		In order for this to be considered valid for use as MSL altitude, the VFOM must be less than or equal to 106 feet. Secondary source of MSL altitude is barometric altitude from an air data computer. Barometric altitude is determined based upon a barometric setting in the following order of preference: 1) If either the pilot or co-pilot system is operating in QNH mode, the QNH barometric setting is used (on-side barometric setting preferred); or 2) If GPS/SBAS geodetic height has been valid within the last 30 minutes, a barometric setting derived from the GPS/SBAS geodetic height is used. If neither of the above conditions is met, MSL altitude is marked as invalid. When a reporting station elevation is determined and outside air

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		temperature is valid, a temperature correction is applied. TAWS uses the lower of the barometric altitude or the temperature-corrected altitude. In the case of QNH-mode barometric setting, reporting station elevation is derived from waypoint or active runway elevations in the active flight plan using the following logic: 1) If aircraft is in **TERMINAL**, **DEPARTURE**, **IFR APPROACH**, or **VFR APPROACH** mode and an active runway exists, reporting station elevation is the elevation of the active runway threshold. 2) Otherwise, if the aircraft is in **TERMINAL** mode, reporting station elevation is the elevation of the airport causing **TERMINAL** mode. 3) In **ENROUTE** mode, no reporting station

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		elevation is determined. In the case of GPS/SBAS geodetic height-based barometric setting, reporting station elevation is the GPS MSL altitude reported at the time the barometric setting was determined. The following definitions: **QFE**: Barometric setting resulting in the altimeter displaying height above a reference elevation (e.g., airport or runway threshold). **QNE**: Standard barometric setting (29.92 inHg or 1013 mbar) used to display pressure altitude for flight above the transition altitude. **QNH**: Barometric setting resulting in the altimeter displaying altitude above mean sea level at the reporting station.
Terrain Data	Terrain Database	Considered valid for use, when the following conditions apply: 1) Aircraft position is valid; 2) Aircraft position is within the boundaries

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		of the terrain database; and 3) Terrain database is not corrupt as determined by CRC-32 checks at system initialization and during runtime.
Obstacle Data	Obstacle Database	Considered valid for use, when the following conditions apply: 1) Aircraft position is valid; 2) Aircraft position is within the boundaries of the obstacle database; and 3) Obstacle database is not corrupt as determined by CRC-32 checks at system initialization.
AGL Altitude	Radar Altitude	Secondary source for AGL Altitude is MSL altitude less terrain altitude.
Vertical Speed	Instantaneous vertical speed	IVSI values come from barometric vertical speed from an ADC "quickened" with vertical acceleration from an AHRS. The secondary source for vertical speed is barometric vertical speed from an ADC. The tertiary source for vertical speed is GPS/SBAS

Table 8-11: HTAWS Basic Parameters Determination

Parameter	Source	Notes
		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	Considered valid for use, when the following conditions apply: 1) Aircraft position is valid; 2) Aircraft position is within the boundaries of the navigation database; and 3) Navigation database is not corrupt as determined by a CRC-32 check at system initialization.

8.10. TAWS Automatic Inhibit Functions (Normal Operation)

The following automatic inhibit functions occur during normal TAWS operation to prevent nuisance warnings:

1) **FLTA function** is automatically inhibited when in the Terminal, Departure, IFR Approach, or VFR Approach Modes and within 2 NM and 1900’ of the reference point.

2) **GPWS Modes 1 through 4** are automatically inhibited when below 50 feet AGL (radar altimeter AGL altitude) or below 100 feet AGL (terrain database AGL altitude).

3) **GPWS Mode 4** is inhibited while Mode 3 is armed.

4) **GPWS Mode 5** is inhibited below 200’ AGL. This form of automatic inhibit remains 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.

5) **FLTA function** is automatically inhibited when airspeed or groundspeed is below the HTAWS FLTA Inhibit Speed.

8.10.1. TAWS Automatic Inhibit Functions (Abnormal Operation)

The following automatic inhibit functions occur during the specified abnormal operations:

1) **Autorotation detection**: When the low torque sensor is active, an Enhanced HTAWS enters Autorotation Mode. In this mode:

   a) FLTA is inhibited;

   b) GPWS Mode 1 is inhibited;

   c) GPWS Mode 2 is inhibited; and

   d) GPWS Mode 4 uses a modified envelope (see § 8.6).

2) **System Sensor/Database Failures**: See Section 4 Revisionary Modes for system sensor failure results.

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Displaced	FLTA	GPWS Mode				
				1	2	3	4	5
GPS/SBAS (H)	AC Position	Inhibit	Inhibit					
TD	Terrain Elev.	Inhibit	Inhibit					

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Displaced	FLTA	GPWS Mode 1	GPWS Mode 2	GPWS Mode 3	GPWS Mode 4	GPWS Mode 5
ILS	Glide-slope Dev.							Inhibit
MSL	MSL Altitude	Inhibit	Inhibit					
GPS/SBAS (H) + RADLT	AC Position, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
GPS/SBAS (V) + ADC	MSL Altitude, VSI	Inhibit	Inhibit	Inhibit		Inhibit		
TD + RADLT	Terrain Elev. AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit
MSL + RADLT	MSL Altitude, AGL Altitude	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

Table 8-12: TAWS Automatic Inhibit Functions

Sensor	Parameters Lost	Terrain Displaced	FLTA	GPWS Mode 1	GPWS Mode 2	GPWS Mode 3	GPWS Mode 4	GPWS Mode 5
GPS/SBAS (V) + ADC + RADLT	MSL Altitude, VSI, AGL ALT	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit

8.10.2. TAWS Manual Inhibit Functions

The pilot may select the following manual inhibit functions:

1) **Terrain Display** function may be inhibited using an EFIS soft menu declutter control.

2) **All TAWS** alerting functions (including popup functionality) are manually inhibited by actuation of the external TAWS Inhibit Switch. The Terrain Display function, including display of FLTA warning (red) and caution (amber [yellow]) flags on the ND, is not affected by the TAWS Inhibit Switch.

3) **GPWS Mode 5** is manually inhibited by actuation of the momentary Glideslope Cancel Switch when below 1000’ AGL. GPWS Mode 5 manual inhibit automatically resets by ascending above 1000’ AGL.

8.11. TAWS Selections on PFD

The PFD Declutter menu includes three option possibilities for TAWS as follows:

1) SVS TAWS

2) SVS BASIC

3) None

The following figures show all possible scenarios including “None” where the aircraft pierces the TAWS FLTA Terrain envelope, and SVS TAWS automatically becomes enabled for the safest possible Warning Alert condition.

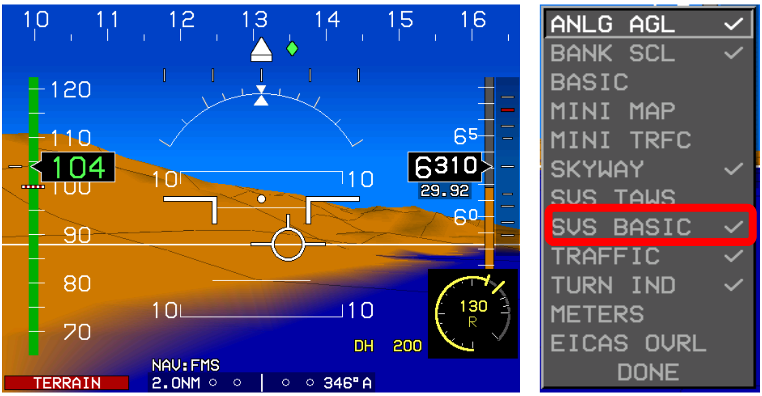
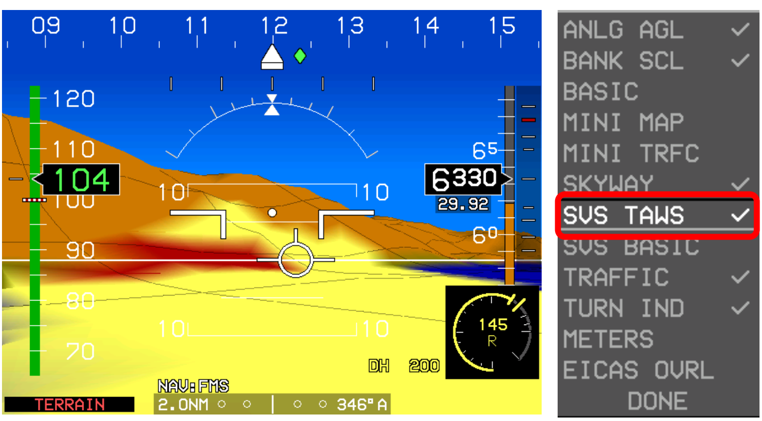


Figure 8-12: PFD SVS BASIC Option



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

Figure 8-13: PFD SVS TAWS Option

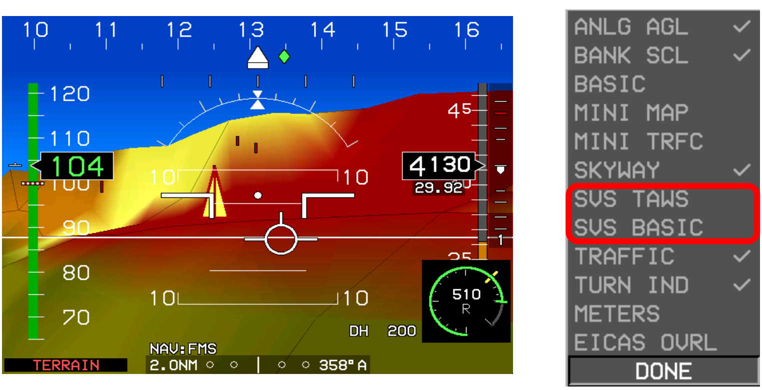
Figure 8-14: PFD SVS TAWS Option and Obstructions

Obstruction within TAWS FLTA caution envelope with aural annunciation “Caution Obstruction, Caution Obstruction”. The obstruction symbols flash.

Figure 8-15: PFD Obstruction Caution

Obstruction within TAWS FLTA warning envelope with aural annunciation “Warning Obstruction, Warning Obstruction”. The obstruction symbols flash.

Figure 8-16: PFD Obstruction Warning



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

Figure 8-17: Automatic PFD Terrain Warning

Section 9 Appendix

Table of Contents

List of Figures and Tables

9.1. Appendix

This section contains a variety of useful information not found elsewhere in the document and includes operating tips, system specifications, feedback forms, and failure modes.

9.2. Operating Tips

With the Genesys Aerosystems EFIS installed and certified in all categories of certified aircraft, numerous tips and suggestions are available for obtaining the maximum performance and benefit from this system. Additional operating tips are available with future releases of this publication.

9.3. Domestic or International Flight Planning

Due to the differences in every aircraft avionics suite installation, it is up to the pilot to determine what equipment code is applicable for domestic or international flight plans. It is solely up to the aircraft operator to determine what certifications pertain to them. All certifications are outlines in the Airplane or Rotorcraft Flight Manual Supplement. Helpful FAA links for this information may be found at:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/air_traffic_services/flight_plan_filing/

9.3.1. Descent Planning

Instead of performing conventional time/speed/distance/descent-rate calculations, use the waypoint symbol for descent planning. Simply maintain the cruise altitude until the “X” at the bottom of the waypoint symbol is 2-3 degrees below the horizon (as indicated by the pitch scale), and then begin a 2-3 degree descent. Maintain the correct descent angle by keeping the flight path marker positioned on the waypoint “X” symbol. Following the skyway boxes assures the VNAV descent angle is maintained.

9.3.2. Terrain Clearance

Use the flight path marker to evaluate climb performance in regards to terrain clearance. If climbing at the best climb speed to clear terrain and the flight path marker is overlaying the terrain, which must be cleared, the climb rate is insufficient. Either the course or climb rate must be altered to adequately clear the terrain. If the flight path marker is well clear of the terrain (overlaying blue sky), the climb is sufficient for the present time, and no further action is necessary until level off.

9.3.3. Departure Airport Information

On startup, all information for the departure airport is readily available. The altimeter is automatically set to the nearest IFR runway touchdown zone elevation. Press **NRST** to reveal the nearest airports when highlighted where all important data such as frequencies are displayed.

9.3.4. Unique Names for Flight Plans

Multiple routes between the same airport pairs are numbered automatically (KCEW-KDHN) [0], (KCEW-KDHN) [1], etc.). With some ingenuity, pilots may work around this and apply easily remembered differentiation. If a route is routinely flown from one airport to another but different routing is necessary due to weather, hot MOA areas, etc., two or more different flight plans may be created for the same destination.

As an example for departing Sikes on a northern routing (KCEWN) or a southern routing (KCEWS), create two different user waypoints at the departure airport named KCEWN and KCEWS followed by different routing to clear the MOA or whatever creates the necessity for specific routing.

9.3.5. Altimeter Settings

Use caution when setting the altimeter and inadvertently changing the transition level. If this is reset to a lower than normal altitude, CHK BARO (Other Rotorcraft) CHK BARO (AW-109SP) may appear due to the altimeter setting not on 29.92 inHg or 1013 mbar.

9.3.6. Warnings, Cautions, and Advisories

Review all conditions found in the Section 2 System Overview for warnings, cautions, and advisories. These conditions precisely define the scenario for the various warnings, cautions, and advisory flags as they appear including the time delay when applicable.

9.4. Magnetic vs. True North Modes of Operation

There are two modes for the ADAHRS:

1) Slaved mode (i.e., compass rose stabilized by Earth's magnetic flux horizontal field) is the normal mode. It works well over most of the surface of the earth (i.e., areas with a horizontal field of 5000nT or above, which includes about 2/3rds of Canadian NDA). ADAHRS senses magnetic flux with a 3D magnetometer. Performance in small horizontal fields is installation dependent as variable magnetic disturbances from the aircraft may begin to predominate.

2) Free or "DG" mode (i.e., compass rose not stabilized by the Earth's magnetic flux horizontal field and subject to drift) is used in areas of magnetic disturbances (oilrigs, MRI machines, etc.) or in areas where the horizontal field is too weak. In Free/"DG" mode, heading no longer corrects towards Earth's magnetic flux horizontal field, and the pilot may "slew" the heading solution.

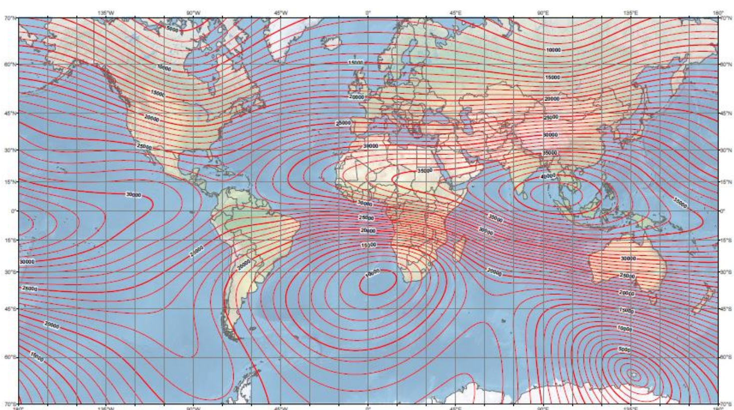


Figure 9-1: US/UK World Magnetic Model

There are two modes for the EFIS:

1) Magnetic North mode: Heading from the AHRS (whether slaved or Free/"DG") is used as-is and is expected to reflect Magnetic North. GPS Track is converted from True North-referenced to Magnetic North-referenced using a magnetic variation database. PFD scenes and compass rose symbols are aligned with Magnetic North, and wind is displayed referenced to Magnetic North.

2) True North mode: GPS Track is used as-is and reflects True North. When AHRS is in Slaved mode, heading from the AHRS

is converted from Magnetic North-referenced to True North-referenced using a magnetic variation database. When AHRS is in Free/"DG" mode, heading from the AHRS is used as-is and is expected to reflect True North. PFD scenes and compass rose symbols are aligned with True North, and wind is displayed referenced to True North.

NOTE:

Designating Magnetic North vs. True North mode is critical since it determines how inputs are used – i.e., the relationship between GPS Track and ADAHRS Heading. Mixing things up in Free/"DG" mode (i.e., slewing the compass rose to match Magnetic North when in True North mode and vice-versa) may result in large errors in wind calculations and GPS track/flight path marker displays.

9.5. Altitude Miscompare Threshold

The altitude miscompare threshold is based upon allowable altitude error. There are two components to allowable altitude error, instrument error and installed system error. Allowable instrument error is based upon the values of SAE AS8002A Table 1 as follows.

Table 9-1: Allowable Instrument Error

Altitude	Allowed Error
Sea Level	25'
1,000'	25'
2,000'	25'
3,000'	25'
4,000'	25'
5,000'	25'
8,000'	30'
11,000'	35'
14,000'	40'
17,000'	45'
20,000'	50'
30,000'	75'
40,000'	100'
50,000'	125'

Allowable installed system error is added on top of instrument error and these values are derived from the regulations as follows.

Table 9-2: Regulatory Reference

Regulation	Allowed Error
14 CFR § 23.1325	At sea level, the greater of 30' or 30% of the calibrated airspeed in knots. This increases proportionally to SAE AS8002A Table 1 at higher altitudes.
14 CFR § 25.1325	
14 CFR § 27.1325	
14 CFR § 29.1325	

An allowable altitude error is computed for each compared value and added together to create the altitude miscompare threshold. This accommodates for the values deviating in different directions.

Worked example for a calibrated airspeed of 100 knots and comparing a first altitude of 3,490' with a second altitude of 3,510':

1) Calculate allowable instrument error based upon altitudes:
   Allowable Instrument Error #1 = 50'
   Allowable Instrument Error #2 = 50'

2) Calculate allowable installed system error based upon altitudes and calibrated airspeed:
   Allowable Installed System Error #1 = 30'
   Allowable Installed System Error #2 = 30'

3) Calculate altitude miscompare threshold based upon sum of above allowable errors:
   Altitude Miscompare Threshold = 160'

9.6. Airspeed Miscompare Threshold

The airspeed miscompare threshold is based upon allowable airspeed error. There are two components to allowable airspeed error, instrument error and installed system error. Allowable instrument error is based upon the values of SAE AS8002A Table 3 as follows.

Table 9-3: Airspeed Error

Calibrated Airspeed	Allowed Error
50 knots	5 knots
80 knots	3 knots
100 knots	2 knots
120 knots	2 knots

Table 9-3: Airspeed Error	
Calibrated Airspeed	**Allowed Error**
150 knots	2 knots
200 knots	2 knots
250 knots	2.4 knots
300 knots	2.8 knots
350 knots	3.2 knots
400 knots	3.6 knots
450 knots	4 knots

Allowable installed system error is added on top of instrument. Error and these values are derived from the regulations as follows.

Table 9-4: Airspeed Regulatory Reference	
Regulation	**Allowed Error**
14 CFR § 23.1323	Starting from (1.3 x $\mathbf{V_{S1}}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.3 x $\mathbf{V_{S1}}$).
14 CFR § 25.1323	Starting from (1.23 x $\mathbf{V_{SR1}}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (1.23 x $\mathbf{V_{SR1}}$). Note: System uses $\mathbf{V_{S1}}$ as a substitute for $\mathbf{V_{SR1}}$.
14 CFR § 27.1323	Starting from (0.8 x $\mathbf{V_{CLIMB}}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (0.8 x $\mathbf{V_{CLIMB}}$).
14 CFR § 29.1323	For Climbing Flight (VSI > 250 feet per minute): Starting from ($\mathbf{V_{TOS}}$ – 10): 10 knots Do not perform a comparison if either value is below ($\mathbf{V_{TOS}}$ – 10) For Other Flight Regimes:

Table 9-4: Airspeed Regulatory Reference

Regulation	Allowed Error
	Starting from (0.8 x $\mathbf{V}_{TOS}$): Greater of 5 knots or 3%. Do not perform a comparison if either value is below (0.8 x $\mathbf{V}_{TOS}$). Note: System uses $\mathbf{V}_{CLIMB}$ as a substitute for $\mathbf{V}_{TOS}$.

An allowable airspeed error is computed for each compared value and added together to create the airspeed miscompare threshold and accommodates for the values deviating in different directions.

9.7. Jeppesen NavData Chart Compatibility

As GPS navigation, flight management systems, computer flight maps, and computer flight planning systems have gained acceptance, avionics companies and software developers have added more features. Even with the many systems available today, paper enroute, departure, arrival, and approach charts are still required and necessary for flight. Avionics systems, flight planning, computer mapping systems, and associated databases *do not* provide all of the navigation information needed to conduct a legal and safe flight. They are not a substitute for current aeronautical charts.

See www.Jeppesen.com for the latest information on coding instrument procedures, naming conventions, altitudes within the database, and aeronautical information compatibility.

9.8. ARINC-424 Path-Terminator Leg Types

Table 9-5: Path Terminators

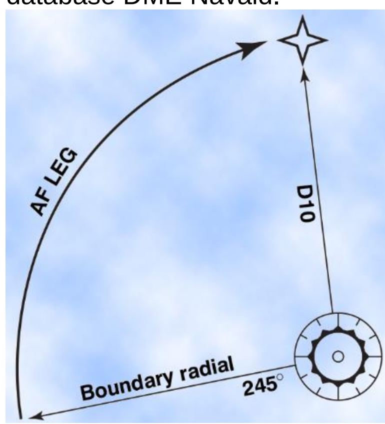
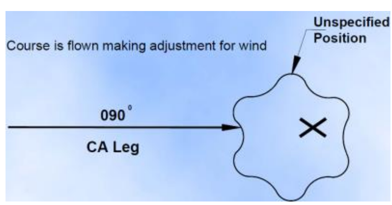
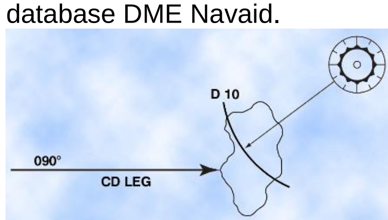
Type ARINC-424 Leg	Abbreviation	Example
DME Arc	**AF**	Arc to a Fix or defines a track over ground a specified constant distance from a database DME Navaid. 
Course to Altitude (Course is flown making adjustment for wind)	**CA**	
Course to DME Distance	**CD**	Leg defines a specified course to a specific DM Distance, which is from a specific database DME Navaid. 

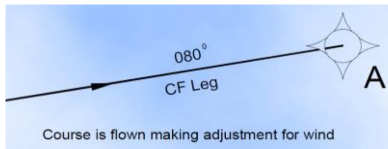
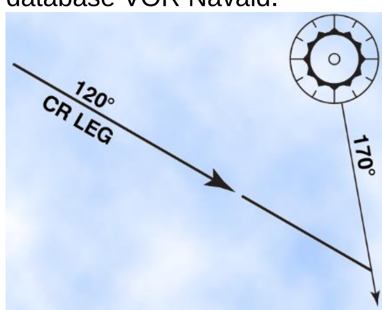
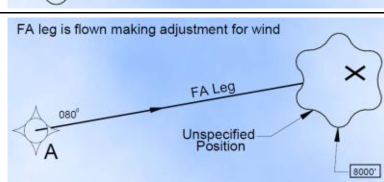
Table 9-5: Path Terminators		
Type ARINC-424 Leg	**Abbreviation**	**Example**
Course to Fix	**CF**	
Course to Intercept	**CI**	Leg defines a specified course to intercept a subsequent leg. 
Course to Radial	**CR**	Leg defines a course to a specified radial from a specific database VOR Navaid. 
Direct to Fix	**DF**	
Course from Fix to Altitude	**FA**	

Table 9-5: Path Terminators

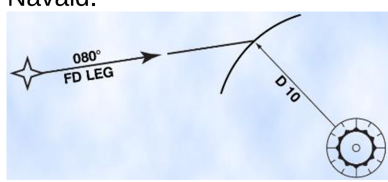
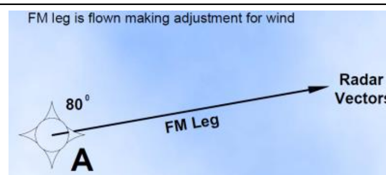
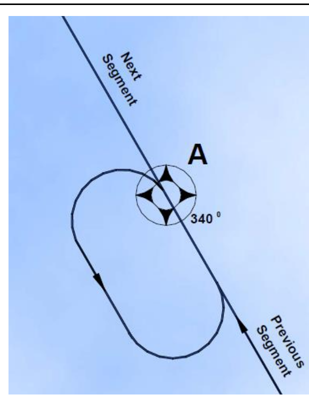
Type ARINC-424 Leg	Abbreviation	Example
Course Fix to along Track Distance	**FC**	Leg defines a specified track over ground from a database fix for a specific distance. 
Course from Fix to DME Distance (Different Fix)	**FD**	Leg defines a specific track from a database fix to a specific DME Distance from a DME Navaid. 
Course from Fix to Manual termination	**FM**	
Terminates at an altitude Terminates at the fix after one orbit Manual termination	**HA** **HF** **HM**	

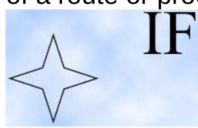
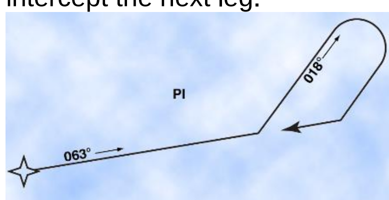
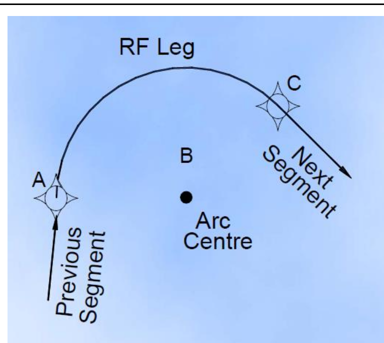
Table 9-5: Path Terminators		
Type ARINC-424 Leg	**Abbreviation**	**Example**
Initial Fix leg	**IF**	Leg defines a database fix as a point in space. It is only required to define the beginning of a route or procedure. 
Procedure Turn	**PI**	Leg defines a course reversal starting at a specific fix, includes Outbound Leg followed by 180 degree turn to intercept the next leg. 
Precision Arc to Fix	**RF**	

Table 9-5: Path Terminators

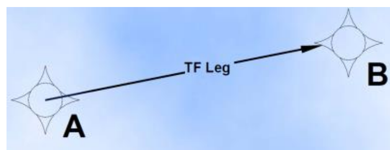
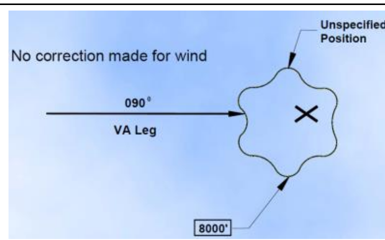
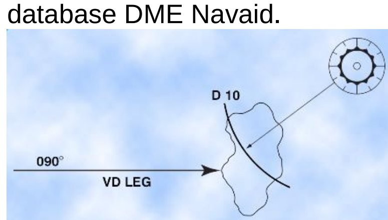
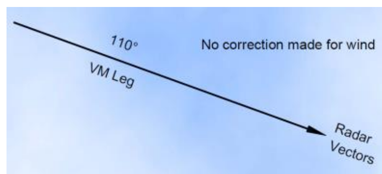
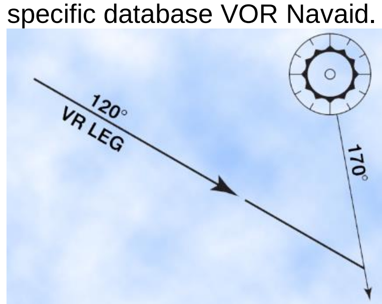
Type ARINC-424 Leg	Abbreviation	Example
Track from Fix to New Fix	**TF**	Defines a great circle track over ground between two known database fixes. Preferred type for straight legs. 
Track to a Fix	**TF**	
Heading to Altitude	**VA**	
Heading to DME Distance	**VD**	Leg defines a specified heading terminating at a specified DME Distance from a specific database DME Navaid. 

Table 9-5: Path Terminators		
Type ARINC-424 Leg	**Abbreviation**	**Example**
Heading to Intercept	**VI**	Leg defines a specified heading to intercept the subsequent leg at an unspecified position. 
Heading to Manual Termination	**VM**	
Heading to Radial	**VR**	Leg defines a specified heading to a specified radial from a specific database VOR Navaid. 

9.9. Data Logging and Retrieval

The Genesys Aerosystems EFIS logs all data associated with a flight, including all flight instrument and navigation data. This data may be downloaded for review after flight. Data from the last five flights or 20 hours are logged at a one-second interval.

Selecting “Download LOG Files” on the IDU creates a “\log” directory on the USB Memory and copies the data logging files into the“\log” directory. The data logging files contain recordings of flight and engine parameters of up to five hours each from the previous five operations of the system. During system operation, flight and engine parameters are recorded every one second. Each time the parameters are recorded, a Zulu time stamp followed by three lines of comma delimited ASCII text data are written where the first line contains flight parameters, the second line contains engine parameters.

9.10. Delete LOG Files

1) Select “Delete LOG Files” option to delete all log files contained in the log directory. This option may be performed if there are problems updating a navigation database or application software due to an excessively large log file.

2) The files deleted are named “LOG00.dat” thru “LOG04.DAT” and “MSGLOG.DAT.” Performing this option does not affect operations of the EFIS, as the EFIS automatically generates new “LOG00.DAT” and “MSGLOG.DAT” files once a flight has started.

3) Press any button on the IDU or push ❶ to return to the Ground Maintenance menu.

9.10.1. Downloading Screen Capture from Ground Maintenance Pages

1) With IDU powered off, open USB door and insert USB.

2) Power up IDU and gain access to GMF desired page.

3) Press **(R4)** to capture view of the page. The files are written to the user\log\ subdirectory and named either “GROUNDdd.BMP” or “LIMEDTdd.BMP,” so they may be copied with "Download LOG files."

4) Exit GMF copied page and return to GMF abbreviated Ground Maintenance Functions.

5) Scroll ❶ to Download Log Files and push to enter.

6) Remove USB. Insert into computer and view list (20 maximum) of files including “GROUNDdd.BMP” or “LIMEDTdd.BMP.”

9.11. Routes and Waypoints

9.11.1. VFR Flight Planning

The navigation database includes VFR waypoints, which consist of five digits beginning with the letters "VP." These may be found on VFR charts and should be loaded in the FMS prior to flight to ensure they are available in the database, and the INFO checked for proper location.

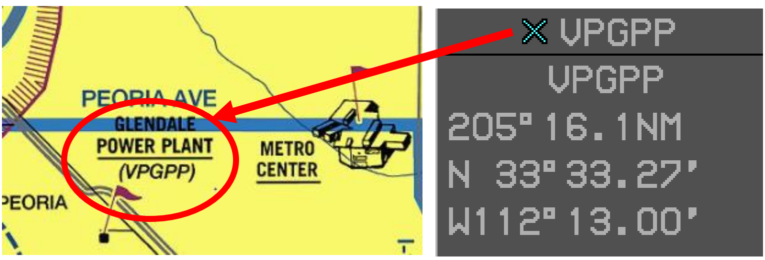


Figure 9-2: VFR Waypoint

9.11.2. Download Routes and User Waypoints

1) To download all routes and user waypoints stored in the IDU to the USB External Memory Drive, selecting "Download Routes and User Waypoints" option from the Ground Maintenance Page. This option is useful for fleet operations where multiple aircraft fly the same routes.

2) Routes are stored on the USB Memory external drive as NAME1-NAME2.RTE where NAME1 is the 1 to 5 character designation of the origin waypoint and NAME2 is the 1 to 5 character designation of the destination waypoint. User waypoints are stored on the USB External Memory Drive as USER.DAT.

9.11.3. Upload Routes and User Waypoints

To copy all routes and user waypoints from a USB to the IDU, select "Upload Routes and User Waypoints" on the Ground Maintenance page. This option used in conjunction with the "Download Routes and User Waypoints" option enables the pilot to store the same routes and user waypoints in multiple aircraft.

9.11.4. Delete Routes/User Waypoints

Select "Delete Routes" on the Ground Maintenance page to remove all routes and the user waypoint file USER.DAT from the IDU. Use this option to delete the contents of the route directory when corrupted routes cause the IDU to continually reboot.

9.12. EFIS Training Tool (ETT)

NOTE:

See the Installation and User Guide distributed with the ETT install files for directions to install and use the EFIS Training Tool.

9.13. USB External Drive Memory Limitations

NOTE:

Maximum USB memory is not a factor, but the following should be considered:

USB must be formatted as FAT.

FAT-16 for USB Drives 2 GB or smaller

FAT-32 for any larger sized drive. If the drive is not recognized, try another source.

When powering up the IDU with a USB inserted and the following message displays, the USB external drive is likely too large and or not acceptable for loading or transferring data.

1) Error: No updater files found on USB drive.
2) Ensure the USB with required files is properly connected.
3) Try again after reboot.
4) Press any button to continue.
5) Try a different USB external drive.

9.14. Service Difficulty Report

Print, complete, then fax to 940-325-3904

Name:	Phone:
Flight No:	Date:
Aircraft:	Registration#:
Software Version:	Error Code:
Route:	Duration of Flight:
Conditions:	
Remarks: (Include time, altimeter Setting, OAT, ALT, TAS, GS, Heading, track, position, flight segment, pilot action, system response, is problem repeatable?).	

9.15. Certification Basis

The following TSOs are considered applicable to the IDU-450 (depending upon the features of the installed software).

Document Number	Document Title	
ARINC 429-16	Mark 33 Digital Information Transfer System (DITS)	
ARINC 735A-1	Traffic Alert and Collision Avoidance System	
EIA-232D	Interface between Data Terminal Equipment and Data	
EIA-422A	Electrical Characteristics of Balanced Voltage Digital Interface Circuits	
FAA AC 23.1311-1B	Installation of Electronic Display in Part 23 Airplanes	
RTCA/DO-155	Minimum Performance Standards - Airborne Low-Range Radio Altimeters	
RTCA/DO-229D	Minimum Operational Performance Standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment	
RTCA/DO-283A	Minimum Operational Performance Standards for Required Navigation Performance for Area Navigation	
SAE AS396B	Bank and Pitch Instruments (Indicating Stabilized Type)	
SAE AS8002A	Air Data Computer - Minimum Performance Standard	
TSO-C4c	Bank and Pitch Instruments	
TSO-C87	Airborne Low-Range Radio Altimeter	
TSO-C106	Air Data Computer	
TSO-C194	Terrain Awareness and Warning System	
TSO-C113	Airborne Multipurpose Electronic Displays	SAE AS8034
TSO-C52b	Flight Director Equipment	SAE AS8008
TSO-C146a	Stand-Alone airborne navigation equipment using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)	
N/A	Airplane Aerodynamics and Performance, Lan and Roskam, 1981.	

9.16. Environmental Requirements

The IDU-450 meets the requirements of RTCA/DO-160F as defined.

Sec.	Condition	Cat.	Test Category Description	Notes
4.0	Temperature and Altitude	F2	Equipment intended for installation in non-pressurized and non-controlled temperature location in an aircraft that is operated at altitudes up to 55,000 ft. (16,800 m) MSL. Operating Low Temp: -55 deg C Operating High temp: +70 deg C Ground Survival Low Temp: -55 deg C Ground Survival High Temp: +85 deg C Altitude: +55,000 feet	+75°C for Short-Time Operating High Temp. Cat. V (30 minutes) for loss of cooling.
5.0	Temperature Variation	B	Equipment in a non-temperature-controlled or partially temperature controlled internal section of the aircraft.	
6.0	Humidity	B	Equipment intended for installation in civil aircraft, non-civil transport aircraft and other classes, installed under conditions in which a more severe humidity environment than standard conditions may be encountered.	
7.0	Operational Shocks & Crash Safety	B	Equipment generally installed in fixed-wing aircraft or helicopters and tested for standard operational shock and crash safety.	Aircraft Type 5, Test Type R for Crash Safety Sustained Test

Sec.	Condition	Cat.	Test Category Description	Notes
8.0	Vibration	H + R + U	H – Demonstrates performance at high-level, short duration transient vibration levels R - (Fixed-Wing) Demonstrates performance at higher, robust vibration levels and after long term vibration exposure. U - (Helicopter w/Unknown Frequencies) Demonstrates performance at higher vibration levels and after long term vibration exposure for fuselage and instrument panel equipment when the specific rotor frequencies are unknown.	Cat. H, curve R Cat. R, curves B, B1 Cat. U, curve G
9.0	Explosive Atmosphere	X	Not Applicable	
10.0	Waterproofness	W	Equipment is installed in locations where it may be subjected to falling water, such as condensation.	Drip proof test
11.0	Fluids Susceptibility	X	Not Applicable	
12.0	Sand and Dust	S	Equipment is installed in locations subject to blowing sand and dust.	
13.0	Fungus Resistance	F	Demonstrate whether equipment material is adversely affected by fungi growth.	By Analysis
14.0	Salt Fog	S	Equipment is subjected to a corrosive atmosphere	
15.0	Magnetic Effect	Z	Magnetic deflection distance less than 0.3m.	

Sec.	Condition	Cat.	Test Category Description	Notes
16.0	Power Input	Z	Equipment intended for use on aircraft DC electrical systems where the DC supply has a battery whose capacity is small compared with the capacity of the DC generators.	200 ms power interruption capacity
17.0	Voltage Spike	A	Equipment intended primarily for installation where a high degree of protection against damage by voltage spikes is required.	
18.0	Audio Frequency Conducted Susceptibility-Power Inputs	Z	Equipment intended for use on aircraft DC electrical systems where the DC supply may not have a battery of significant capacity floating on the dc bus at all times.	
19.0	Induced Signal Susceptibility	ZC	Equipment intended primarily for operation in systems where interference-free operation is required on aircraft whose primary power is constant frequency or DC.	
20.0	Radio Frequency Susceptibility (Radiated and Conducted)	Y	Equipment and interconnecting wiring installed in severe electromagnetic environments and to show compliance with the interim HIRF rules.	Radiated: K Minimum level at all frequencies to be 100V/m
21.0	Emission of Radio Frequency Energy	M	Equipment in areas where apertures are EM significant but not in direct view of aircraft antennas,	

Sec.	Condition	Cat.	Test Category Description	Notes
			such as passenger cabin or cockpit.	
22.0	Lightning Induced Transient Susceptibility	A3J33	Equipment interconnected with wiring installed within any airframe or airframe section when structural resistance is also a significant source of induced transients, (i.e., carbon fiber composite structures). Level 3 designates equipment and interconnecting wiring installed in a moderately exposed environment.	Level 4 for MSU and OAT Probe pins.
23.0	Lightning Direct Effects	X	Not Applicable	
24.0	Icing	X	Not Applicable	
25.0	Electrostatic Discharge (ESD)	A	Electronic equipment that is installed, repaired, or operated in an aerospace environment.	
26.0	Fire, Flammability	C	Non-metallic equipment, component parts, sub-assemblies installed in pressurized or non-pressurized zones and non-fire zones with largest dimension greater than 50 mm.	By Analysis

Traffic

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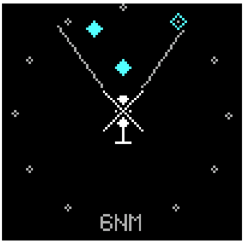
List of Figures and Tables

T 1. Traffic Thumbnail



When selected from declutter options, the traffic thumbnail has clock face markings 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 multiples of two NM (2 NM, 4NM, or 6NM), to optimally display the traffic. While the traffic thumbnail is mutually exclusive with the Mini-map, it too disappears in the Unusual Attitude Mode.

Figure T-1: Traffic Thumbnail

T 2. Traffic Display Definitions

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

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

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

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

T 2.1. Traffic Rendering Rules

Traffic thumbnail and PFD traffic are rendered as follows.

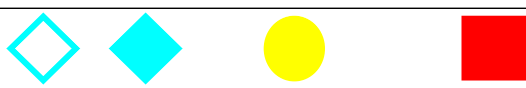
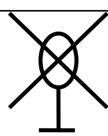
Table T-1: Traffic Rendering Rules

Type Traffic	**Distance**	**Results**
OT and PA Traffic	Beyond 6 NM	Not displayed
TCAS-I, TCAS-II, TAS, or TIS-A Sensor	Within 200’ of ground	Not displayed

Table T-2: Pilot Selected OT and PA Traffic Altitude-Filter

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

Table T-3: Traffic Symbology

Type Traffic	Symbology
TCAS-I, TCAS-II and TIS-A	 Other Traffic; Proximate Advisory; Traffic Advisory (Flashing); Resolution Advisory (Flashing)
Ownship symbol	

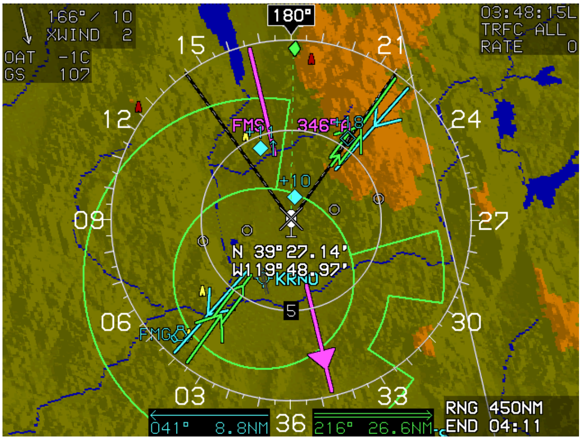


Figure T-2: Traffic Symbology

T 3. Dedicated Traffic Screen

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

T 3.1. Ownship Symbol

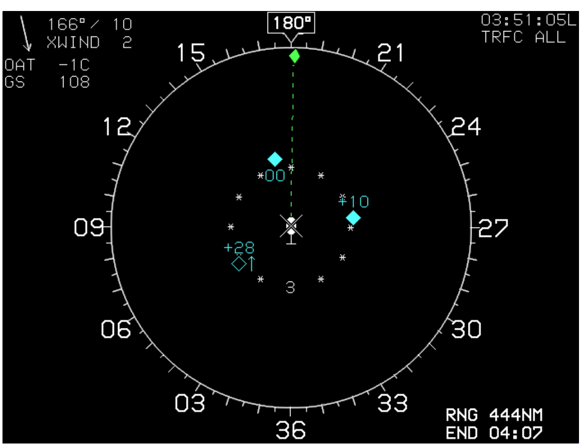


Figure T-3: Traffic Display Format

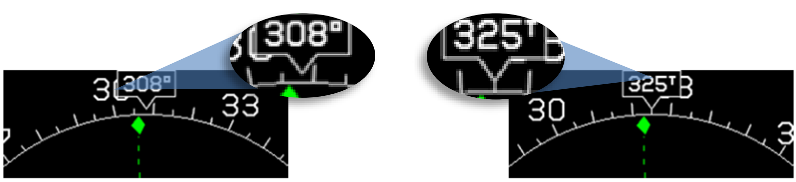
The traffic display uses a centered display format with the ownship symbol centered in the traffic screen with data displayed out to an equal distance in all directions. The compass rose is aligned with either magnetic North or True North depending upon the status of the True North discrete input. When the AHRS is in DG Mode, “DG” appears to the right of the ownship symbol.

T 3.2. 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, has a radius of half the range in 20NM, 50NM, and 100NM ranges, and is presented on the TCAS range ring (e.g., 3NM, 10NM, 25NM, or 50NM).

T 3.3. Compass Rose Symbols



Normal Mode **True North Mode**

Figure T-4: Traffic Screen Range Compass Rose Symbols

A digital heading readout and pointer aligned with the longitudinal axis of the ownship symbol appears on the compass rose boundary circle. Compass rose symbols are as specified in Section 3 Display Symbology. A green dashed lubber line connects the center of the aircraft symbol and the track pointer.

If a target altitude is set and not captured, an altitude capture predictor arc is displayed on the lubber line at a point corresponding with predicted climb or descent distance (based upon current VSI). A top of descent symbol is shown at the point where a VNAV descent is predicted to commence. The track pointer, lubber line, altitude capture predictor arc, and top of descent symbol are not displayed when groundspeed is less than 30 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the compass rose. A magenta, star-shaped waypoint pointer is displayed on the heading scale at a point corresponding with the active waypoint and turns amber (yellow) in the event of GPS Loss of Navigation caution.

T 3.4. Active Flight Plan Path/Manual Course/Runways

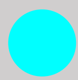
When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path, when selected, is shown on the traffic screen in correct relationship to the ownship symbol. The active flight plan path depiction meets all the requirements of GPS/SBAS path definition and matches the lateral navigation guidance given on the PFD (GPS/SBAS CDI in automatic OBS mode, skyway boxes, and mini-map). Active flight plan path waypoint symbols for fly-over waypoints are distinct from fly-by waypoints and consist of the waypoint symbol within a circle. When there is a parallel offset, the active flight plan path depicts the parallel offset path, and the original flight plan path is shown with haloed gray dashed lines.

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

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

The traffic screen displays airport runways in correct relationship and scale to the ownship symbol.

When the source of traffic is ADS-B, traffic vectors, and aircraft identification data are shown. The traffic vector is a line connecting the traffic's current position with the traffic's predicted position based upon the traffic's current track and groundspeed. The prediction time period, in minutes, is pilot-selectable. Aircraft identification is simple text located near the traffic symbol. The color of the aircraft identification data matches the color of the traffic symbol. Traffic identification data usually reflects aircraft registration number or scheduled airline flight number.

Table T-4: ADS-B and TIS-B Traffic Symbols			
	Other Traffic	**Proximate Advisory**	**Traffic Advisory (Flashing)**
High-Integrity Traffic with Track Information			
High-Integrity Traffic without Track Information			
Degraded Position Traffic with Track Information			
Degraded Position Traffic without Track Information			

T 3.5. Clock and Options

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

1) **Zulu Time or LCL Time**: As specified in Table T-5.

2) **Timer**: As specified in Table T-5.

3) **Traffic Status**: As specified in Table T-5. When traffic is enabled, status of traffic altitude filtering is displayed as follows:

   a) AUTO = "**TRFC AUTO**"

   b) ABOVE = "**TRFC ABV**"

   c) BELOW = "**TRFC BLW**"

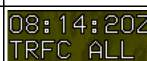
   d) NORMAL = "**TRFC NORM**"

   e) ALL = "**TRFC ALL**"

   See T 3.4 for traffic rendering rules.

4) **ADS-B Traffic Vector Length**: When display of ADS-B traffic vector symbols is selected, the length of the traffic vector is annunciated as "**VECT ##**" where "##" is the traffic vector length in minutes.

Table T-5: Clock/Timers/Options

Feature	Options	Notes
Zulu Time or Local Offset	Zulu or Local	Shown in **hh:mm:ss** and synchronized with the GPS/SBAS constellation.
Timer	**COUNT UP COUNT DN.. FLT TIME**	Countdown or count-up timer is displayed when selected and matches timer shown on the PFD.
Declutter Mode	**DCLTR A DCLTR M**	= Automatic declutter mode = Manual declutter mode
Traffic Status	Enabled or Disabled	 Status annunciated disabled if manually deselected. In the event of a traffic warning (TA or RA), traffic thumbnail is enabled while traffic warning is active and aircraft is above 500'AGL. If traffic is disabled, the "X" is red.

T 3.6. Fuel Totalizer/Waypoint Bearing and Distance Functions

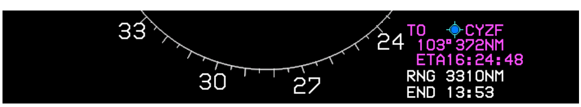


Figure T-5: Fuel Totalizer/Waypoint Bearing and Distance Functions

T 3.7. MFD Traffic Format (FORMAT) Menu

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

1) **ROUTE ON/ROUTE OFF**: Toggles showing the active flight plan route on the Traffic page.

2) **IDENT OFF/IDENT ON**: When the TCAS flag is TIS-B, toggles showing traffic identifier/squawk information.

3) **ALT FILTER**: Sets the traffic altitude filter to either AUTO, ABOVE, BELOW, NORMAL, or ALL.

4) **TCAD TEST**: When the TCAS flag is Ryan/Avidyne TCAD, activates the TCAD pilot initiated test function.

5) **TREND VECTOR**: When the TCAS flag is TIS-B, used to select the traffic trend vector length in minutes. **OFF (R4)** appears at this level to quickly turn off the traffic trend vector.

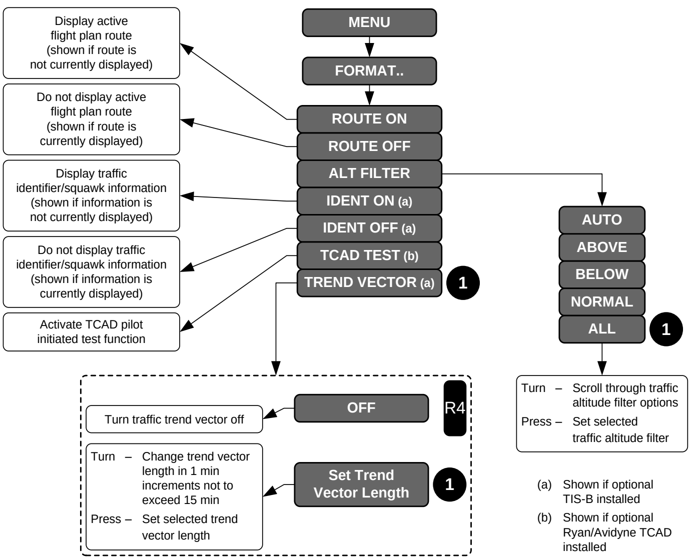


Figure T-6: MFD Traffic Format (FORMAT) Menu

Table T-6: Menu Synchronization	
Menu Parameter	**Notes**
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Countdown Timer Start Time	
Countdown Timer Default Value	
Heading Bug	
VLOC OBS Settings	

Table T-6: Menu Synchronization

Menu Parameter	Notes
Timer Starting Signal	
Traffic Filter Setting	
UTC Offset	
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Navigation Source	
PFD Traffic Thumbnail Show Flag	
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.
MFD Map Function Declutter Settings	
MFD Show ETA Flag	
MFD Traffic Page Settings	

T 4. MFD Fault Display (FAULTS) Menu

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

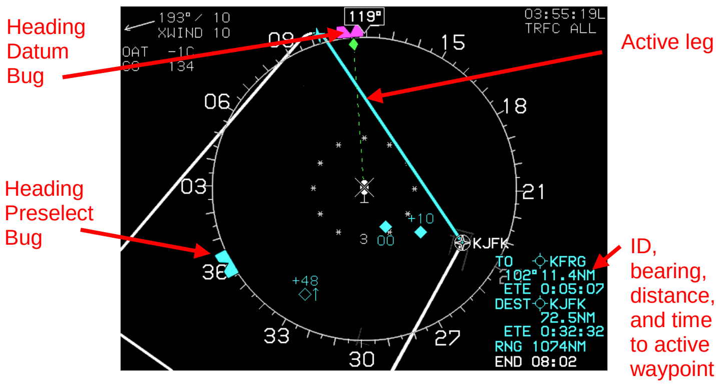


Figure T-7: Dedicated Traffic Screen (AW-109SP)

T 4.1. Compass Rose Symbols (AW-109SP)

The Compass Rose has a Heading Datum Bug and a Heading Preselect Bug shaped to geometrically interact with the present heading pointer symbol. The Heading Datum Bug is filled-magenta, and the Heading Preselect Bug is filled-cyan. When the two bugs overlap, the Heading Datum Bug is drawn on top of the Heading Preselect Bug. The AFCS communicates the Heading Preselect and Datum Bug values to the EFIS. The color of the star-shaped active waypoint pointer is determined using Lateral Naviagtion Color Logic table in Section 3 Display Symbology.

T 4.2. Active Leg of Active Flight Plan Path (AW-109SP)

Active leg color in the flight plan path is determined by Lateral Naviagtion Color Logic table in Section 3 Display Symbology.

NOTE:

When a MOT flight pattern is displayed, the active leg includes all legs between the “From” and “To” waypoints.

T 4.3. Identifier, Bearing, Distance, and Time to Active Waypoint (AW-109SP)

The color for rendering the identifier, bearing, distance, and time to the active waypoint is determined using Lateral Naviagtion Color Logic table in Section 3 Display Symbology.

Figure T-8: Identifier, Bearing, Distance, and Time to Active Waypoint (AW-109SP)

NOTE:

When a MOT flight pattern is displayed, these values are derived from the AFCS.

Remote Bugs Panel (RBP)

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RBP 1. Remote BUGs Panel

The Remote Bugs Panel (RBP) provides dedicated controls for frequently needed bugs and additional controls for setting IDU parameters such as defined in Table RBP-1.

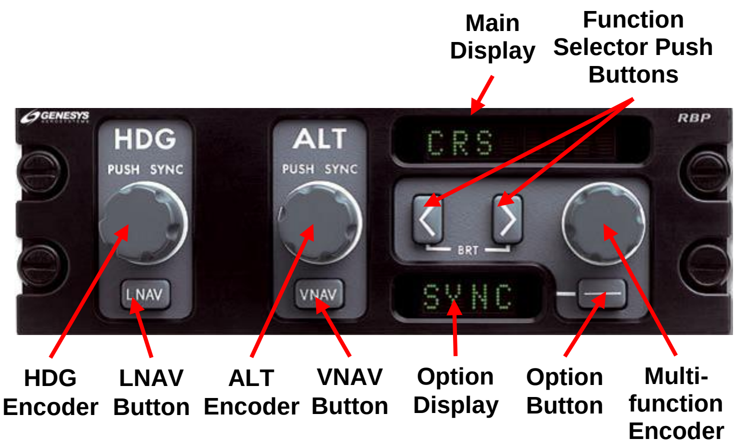

Figure RBP-1: Remote Bugs Panel

The RBP has an internal dimming control functionality, which allows it to control its own backlighting and display brightness with an internal light sensor to adjust the initial display and backlight brightness. Press the two arrow buttons simultaneously to gain access for brightness control while the multifunction encoder is used to make the brightness adjustments. Press the Option button to exit the brightness control program return the RBP to normal operation.

The design of this RBP promotes the ease of operation while minimizing pilot workload complexity. The HDG and ALT control encoders behave exactly as the encoder on the IDU-450 where they appear during most screen configurations. During initialization, the RBP always begins with the GENESYS RBP displayed on the Main and Option display screens.

Table RBP-1: Remote Bugs Panel (RBP)

Button/Encoder	Function	Scroll	Press/Push
Heading Encoder	Heading Bug	Increment or decrement heading bug	Synchronize heading bug to current heading
Altitude Encoder	Altitude Bug	Increment or decrement target altitude bug	Synchronize target altitude bug to current altitude
Multifunction Encoder	GPS Course	Increment or decrement GPS course setting	Synchronize GPS course to current bearing to active waypoint
Multifunction Encoder	VOR 1 Course	Increment or decrement VOR 1 course setting	Synchronize VOR 1 course to current bearing to the station
Multifunction Encoder	VOR 2 Course	Increment or decrement VOR 2 course setting	Synchronize VOR 2 course to current bearing to the station
Multifunction Encoder	Airspeed Bug	Increment or decrement Airspeed Bug setting	Synchronize Airspeed Bug to current airspeed
Multifunction Encoder	Vertical Speed Bug	Increment or decrement Vertical Speed Bug setting	Synchronize Vertical Speed Bug to current VSI
Multifunction Encoder	Climb Angle Set	Increment or decrement Climb Angle setting	Set Climb Angle Setting to 3º
Multifunction Encoder	Descent Angle Set	Increment or decrement Descent	Set Descent Angle Setting to 3º

Table RBP-1: Remote Bugs Panel (RBP)			
Button/Encoder	**Function**	**Scroll**	**Press/Push**
		Angle setting	
Multifunction Encoder	Decision Height Bug	Increment or decrement Decision Height Bug	Set Decision Height Bug to 200’ AGL
Multifunction Encoder	Minimum Altitude Bug	Increment or decrement Minimum Altitude Bug	Set Minimum Altitude to current altitude
Option “---“ Button	GPS Course	N/A	Change OBS mode (Manual or Automatic)
Option “---“ Button	VOR 1 Course	N/A	No Function
Option “---“ Button	VOR 2 Course	N/A	No Function
Option “---“ Button	Airspeed Bug	N/A	Toggle Airspeed Bug (On or Off)
Option “---“ Button	Vertical Speed Bug	N/A	Toggle Vertical Speed Bug (on or off)
Option “---“ Button	Climb Angle Setting	N/A	No Function
Option “---“ Button	Descent Angle Setting	N/A	No Function
Option “---“ Button	Decision Height Bug	N/A	Toggle Decision Height Bug (on or off)
Option “---“ Button	Minimum Altitude Bug	N/A	Toggle Decision Height Bug (on or off)
Arrow Buttons	Function Scroll	N/A	Scroll through possible “set” Multi-Function Encoder functions. Press

Table RBP-1: Remote Bugs Panel (RBP)			
Button/Encoder	**Function**	**Scroll**	**Press/Push**
			both arrow buttons simultaneously to place RBP into dimming mode
VNAV Button	VNAV	N/A	Switch EFIS autopilot pitch steering and commanded VSI between VNAV sub-mode and target altitude sub-mode
LNAV Button	LNAV	N/A	Switch EFIS autopilot roll steering between LNAV sub-mode and heading sub-mode

RBP 1.1. Remote Bugs Panel (AW-109SP)

The RBP is used to select heading and altitude, transition into and out of FMS LNAV and VNAV Submodes, and to perform other miscellaneous functions as follows.

RBP 1.2. Heading Encoder

When pushed or scrolled, the heading encoder communicates with the AFCS. When the AFCS is in NAV mode and the EFIS is in FMS Heading Submode:

1) Push the heading encoder to synchronize the Heading Datum to the AFCS-controlled Heading Preselect;

2) Scroll the heading encoder while pushed to directly change the Heading Datum; and

3) Changing the Heading Datum causes the Heading Datum readout to be displayed on the PFD for five seconds.

The Heading Datum value is communicated to the AFCS.

RBP 1.3. Altitude Encoder (AW-109SP)

When pushed or scrolled, altitude encoder communicates with the AFCS. When the AFCS is in VNAV mode and the EFIS is in ALTA Submode:

1) Push the altitude encoder to synchronize the ALTA Datum to the AFCS-controlled Altitude Preselect; and

2) Scroll the altitude encoder while pushed to directly change the ALTA Datum.

The ALTA Datum value is communicated to the AFCS.

RBP 1.4. Multifunction Encoder

FMS OBS function is available:

1) On the Side in Command; OR

2) When Side in Command cannot be determined; OR

3) If not cross-linked; OR

4) When Side in Command is not using FMS as its NAV source.

VOR1 OBS function is available:

1) On the Side in Command; OR

2) When Side in Command cannot be determined; OR

3) When Side in Command is not using VOR1 as its NAV source.

VOR2 OBS function is available:

1) On the Side in Command; OR

2) When Side in Command cannot be determined; OR

3) When Side in Command is not using VOR2 as its NAV source.

The SPD bug function is disabled (it is driven by a control on the AFCS panel).

VSI bug function is available when the AFCS is in VNAV mode with a VSI climb or VSI descent as the current vertical control law and:

1) On the Side in Command; OR

2) When Side in Command cannot be determined.

The Climb Angle function is available:

1) On the Side in Command; OR

2) When Side in Command cannot be determined.

The Descent Angle function is available:

1) On the Side in Command; OR

2) When Side in Command cannot be determined.

Otherwise, there are no changes to the Multifunction Encoder functions.

RBP 1.5. LNAV Button (AW-109SP)

When the AW-109SP AFCS is in NAV mode, press the LNAV button to toggle the EFIS between LNAV Submode and HDG Submode. The EFIS toggles to LNAV Submode by turning OFF the heading bug. The EFIS toggles to HDG Submode by initializing the heading bug to either the AFCS-controlled Heading Preselect value (if valid) or aircraft heading. Upon engagement of HDG Submode, the Heading Datum readout is displayed on the PFD for five seconds.

RBP 1.6. VNAV Button (AW-109SP)

When the AW-109SP AFCS is in VNAV mode, press the VNAV button to toggle the EFIS between VNAV Submode and ALTA Submode. The EFIS toggles to VNAV Submode by turning off the ALTA bug. The EFIS toggles to ALTA Submode by initializing the ALTA bug to either ALTA preselect value (if valid) or VNAV altitude.

Table RBP-2: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	

Table RBP-2: Menu Synchronization	
Menu Parameter	**Notes**
AHRS 1 and 2 mode and slewing values	
VNAV Climb Angle	
VNAV Descent Angle	
Decision Height Setting	Used when "Dual Decision Height Flag" is false.
Heading Bug	
Minimum Altitude Bug Value	
VLOC OBS Settings	
Airspeed Bug Setting	
Target Altitude Bug Setting	
Settable V-Speeds	
VSI Bug Setting	
Crosslink Synchronization Status	
For menue synchronization. The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
Transition Altitude	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Decision Height Setting	Used when "Dual Decision Height Flag" is true.
Navigation Source	
PFD Analog AGL	
PFD Altitude (meters) Show Flag	

Table RBP-2: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.
MFD Map and HSI Page Pointer Settings	
MFD Map Function Declutter Settings	
MFD Show ETA Flag	
MFD Map NavData Symbol Declutter Settings	

WX-500 Lightning Strikes

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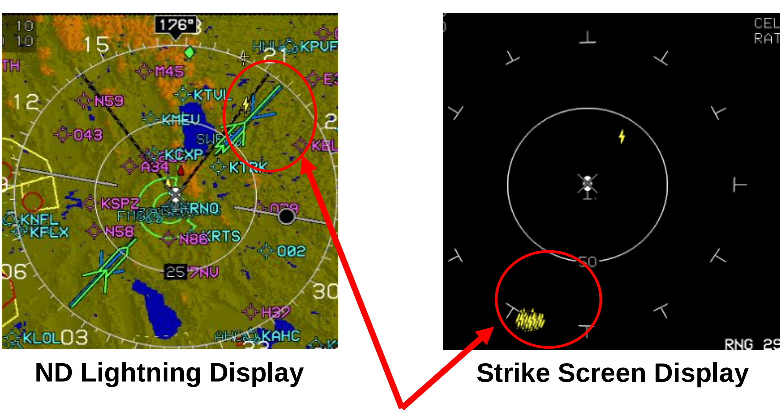
S 1. WX-500 Data

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

Table S-1: Lightning Strikes

View	Time or Distance Limit
Strikes not shown	Display scale less than 25 NM
Strikes not shown	More than 3 minutes old
Strikes less than 20 seconds old	Shown with lightning symbol
Strikes between 20 seconds and 2 minutes old	Shown with large cross symbol
Strikes between 2 minutes and 3 minutes old	Shown with small cross symbol

The pilot may select either an arced or centered display format with the ownship displaced toward the bottom of the screen so strike data are displayed in a larger scale while displaying all data within range ahead of the aircraft. The strike screen has “Strikefinder” markings aligned with either magnetic North or True North depending upon the status of the True North discrete input. When the AHRS is in the DG mode, a “DG” indication appears to the right of the ownship symbol.



ND Lightning Display **Strike Screen Display**

Figure S-1: Lightning Symbols

S 2. Strike Screen Range

The following strike screen ranges may be selected with all distances representing the distance from the ownship symbol to the "Strikefinder" markings: 12.5 NM, 25 NM, 50 NM, 100 NM, and 200 NM. The range ring is centered upon the ownship symbol to help judge range to displayed symbols. The range ring has half the radius of the "Strikefinder" markings displayed indicating the range corresponding to the radius of the range ring such as (1.5 NM, 25 NM, 50 NM, and 10 NM.) The range ring is completely visible in arced display format to ascertain the current strike screen setting.

S 2.1. Air Data and Groundspeed

Figure S-2: Air Data and Groundspeed in Upper Left Corner

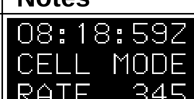
S 2.2. Clock and Options

Clock with Local Offset Time

Clock with Zulu Time

Figure S-3: Clock and Options

Table S-2: Clock/Timers/Options

Feature	Options	Notes
WX-500 Status	Enabled or Disabled	 When selected, ND displays Cell Mode lightning strikes in correct relationship to the ownship symbol with the limits found in Table S-3.

S 2.3. Active Flight Plan Path/Manual Course/Runways

When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path is shown on the strike screen in correct relationship to the ownship symbol.

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

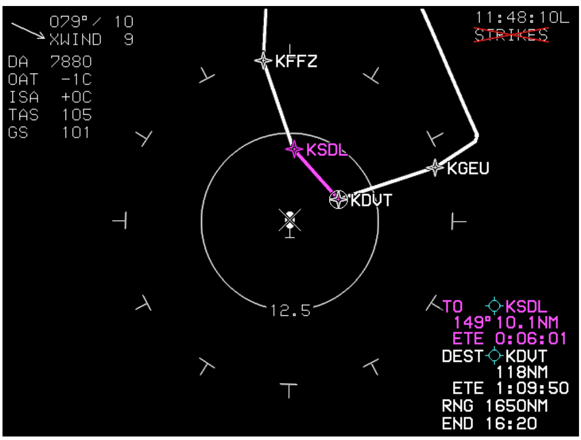


Figure S-4: Active Flight Plan Path/Manual Course/Runways

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

The strike screen displays airport runways in correct relationship and scale to the ownship symbol.

Table S-3: WX-500 Status

Condition	**Annunciation**
System Normal, Strikes Selected	**RATE ###** depicts current strike rate Strike symbols shown

Table S-3: WX-500 Status

Condition	Annunciation
System Normal, Strikes De-selected "Show Full Sensor Status Flag" in EFIS Limits.	**STRIKES** overlaid with green "X" Strike symbols removed
System Normal, Strikes De-selected "Show Full Sensor Status Flag" in EFIS Limits.	**STRIKES** overlaid with red "X" Strike symbols removed
System Failed, "Show Full Sensor Status Flag" in EFIS Limits.	**STRK TST** shown Strike symbols removed

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

S 2.4. Fuel Totalizer/Waypoint Bearing and Distance Functions

Figure S-5: Fuel Totalizer, Waypoint Bearing/Distance in Lower Right Corner

S 2.5. MFD Strike Format (FORMAT) Menu

Upon selecting the MFD format menu when in the Strike page, the following option list appears:

1) **CENTER/ARC**: Toggles between a centered and arced Strike page display format.

2) **ROUTE ON/ROUTE OFF**: Toggles showing the active flight plan route on the Strike page.

3) **STRK MODE/CELL MODE**: Toggles between strike mode strikes and cell mode strikes on the Strike page.

4) **STRK TEST:** Activates the WX-500 pilot initiated test function.

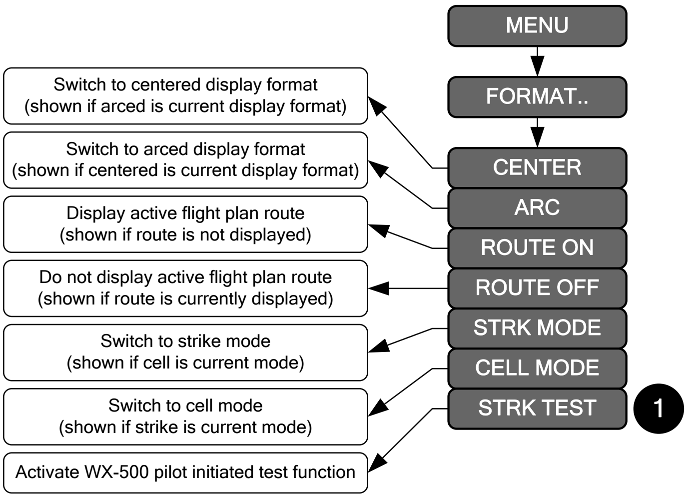


Figure S-6: MFD Strike Format (FORMAT) Menu

Table S-4: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Countdown Timer Start Time	
Countdown Timer Default Value	
Heading Bug	
VLOC OBS Settings	
Timer Starting Signal	
Traffic Filter Setting	
True North Mode	
UTC Offset	
Crosslink Synchronization Status	
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters	

Table S-4: Menu Synchronization	
Menu Parameter	**Notes**
and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
Navigation Source	
PFD Altitude (meters) Show Flag	
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.
MFD Map and HSI Page Pointer Settings	
MFD Map NavData Symbol Declutter Settings	
MFD Strike (WX-500) Page Settings	

S 3. MFD Page First-Level Option Descriptions

CLR STRKS (L6) or **WX LGND (L6)**: On ND page or Strike page with WX-500 option enabled, **CLR STRKS** activates the strike clear option. On Datalink page, **WX LGND** activates the datalink weather legend.

S 4. MFD Page (PAGE) Menu

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

STRIKES: Shows the Strike page.

S 5. MFD Fault Display (FAULTS) Menu

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

S 6. Dedicated Strike (WX-500) Screen (AW-109SP)

Figure S-7: Dedicated Strike (WX-500) Screen (AW-109SP)

Datalink

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D 1. Datalink Symbology

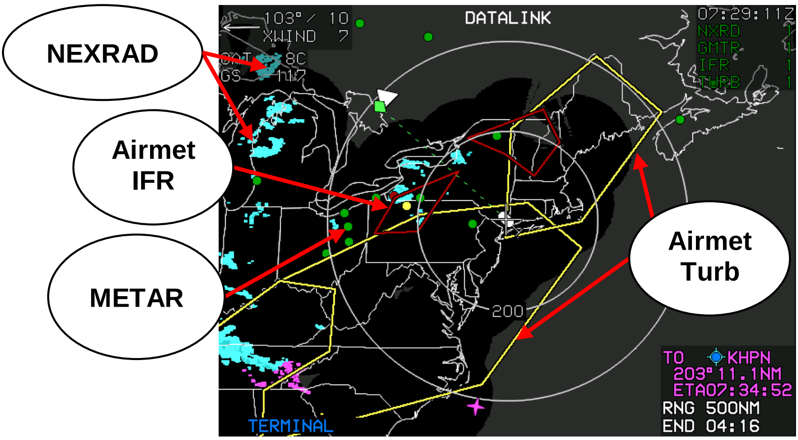


Figure D-1: Datalink Symbology

When individually selected, the ND displays and indicates status for Temporary Flight Restriction, NEXRAD radar, graphical METAR, and lightning ground strike data. When Temporary Flight Restriction data have not been completely downlinked, status is annunciated as the word “TFR” with an overlying red “X.” Only the following products received are supported and displayed.

Table D-1: WSI Inflight™ Data Products	
Temporary Flight Restriction Data	Available if included in user subscription
NEXRAD Radar Data	
Lightning Ground Strike Data	
Graphical METAR Data	Available if Textual METAR data is included in user subscription. Derived from Textual METAR data using EFIS algorithm.

NOTE:

Up to 300 Temporary Flight Restrictions may be displayed.

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

Table D-2: Datalink NEXRAD Radar Data

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

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

Table D-3: Datalink NEXRAD Echo Tops

Severe Weather Condition	**Color**	**Amplifying Text**
Possible hail	Light Cyan	“HAIL”
Confirmed hail	Light Cyan	“HAIL+”
Mesocyclonic (Rotation Detected)	Red	“MESO”
Tornadic	Magenta	“TRNDO”

Minor echo tops are displayed as a small white circle with the height of the minor echo top, in hundreds of feet, being textually displayed to the left of the minor echo top symbol. The text size for the minor echo top symbol is smaller than for the major echo top symbol.

Graphical METARs are displayed on the datalink screen in correct relationship to the ownship symbol as a large color-filled circle in accordance with the following convention.

Table D-4: Datalink Graphical METARs

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

Table D-5: Graphical METARS (GMETARS) Screen Range

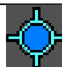
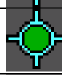
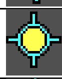
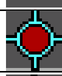
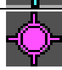
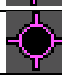
Screen Range	Display
50 NM	All GMETARS with airport symbol and ID
100 NM	All GMETARS with airport symbol only
200 NM	All GMETARS
400 NM	VFR GMETARS are decluttered
800NM and 1,600 NM	VFR and MVFR GMETARS are decluttered

Graphical METARs are also displayed in the menu system “nearest airport,” “nearest weather,” and “info” functions.

Figure D-2: NRST Airport INFO

If the airport has an available datalinked METAR, the circular part of the airport symbol is colored-fill with the following coloring convention.

Table D-6: Graphical METAR Symbols

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

Graphical weather conditions data are displayed in the menu system "info" function as large colored squares per the following convention.

Table D-7: Datalink Graphical METAR Precipitation

Color	Meaning
Sky blue	No significant precipitation
Green	Rain
White	Snow
Red	Hazardous weather
Right half gray	Obscuration to visibility
Small black square centered in large square	High wind
Black	No data

The following may be displayed on the datalink screen:

1) **Lightning ground strikes**: In correct relationship to the ownship symbol as an amber (yellow), small cross symbols.

2) **Convective SIGMET**: As magenta line segments showing the boundary of the area in correct relationship to the ownship

symbol. The pilot may view the text of individual convective SIGMETs. When viewing text, the associated symbol flashes.

3) **Icing AIRMET and SIGMET**: As cyan line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual icing AIRMETs and SIGMETs. When viewing such text, the associated symbol flashes.

4) **IFR AIRMET and SIGMET**: As red line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual IFR AIRMETs and SIGMETs. When viewing such text, the associated symbol flashes.

5) **Turbulence AIRMET and SIGMET**: As amber (yellow) line segments showing the boundary of the area in correct relationship to the ownship symbol. The pilot may view the text of individual turbulence AIRMETs and SIGMETs. When viewing text, the associated turbulence AIRMET or SIGMET symbol flashes.

Winds and temperature aloft data are displayed on the datalink screen in correct relationship to the ownship symbol as a grid of black squares containing textual readouts of wind speed and temperature (in units determined by the Temp Units EFIS Limits setting) and a graphical arrow indicating wind direction. When winds and temperature aloft data are being displayed, soft tiles are present to allow the pilot to change the data altitude.

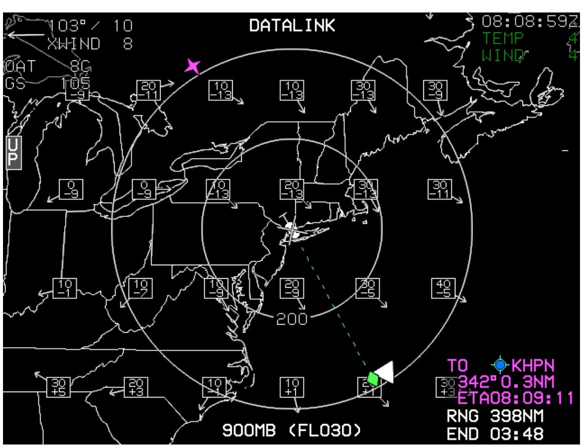
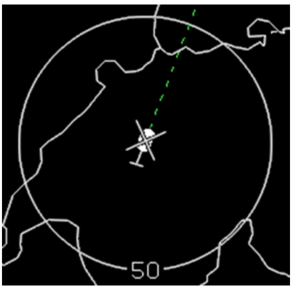


Figure D-3: Datalink Winds and Temperature Aloft

Textual METAR and TAF data are displayed when appropriate in the menu system "info" function. Time of observation and forecast are contained within the text.

D 1.1. Ownship Symbol



When not panning with the AHRS is in the DG mode, a "DG" indication appears to the right of the ownship symbol. The datalink screen is always displayed in a North-up orientation with a boundary circle in place of the compass rose. If not in the pan mode, the ownship symbol is aligned with the aircraft heading.

Figure D-4: Rotorcraft FAR Part 27/29

D 1.2. Datalink Screen Legend

When selected, the datalink screen legend depicts symbology used for Graphical METARs, AIRMETs, SIGMETs, NEXRAD Radar with winter colors, Echo Tops, Temperatures Aloft, and Winds Aloft.

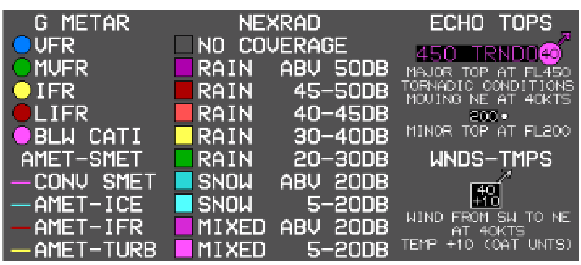


Figure D-5: WSI Datalink Screen Legend

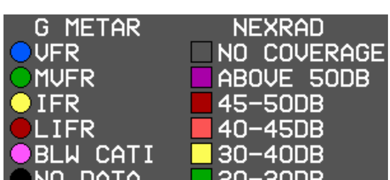


Figure D-6: ADS-B Datalink Screen Legend

D 1.3. Air Data and Groundspeed

Air data and groundspeed are displayed in the upper left corner of the datalink screen as specified in Section 3 Display Symbology.

D 1.4. Clock/Timers/Options

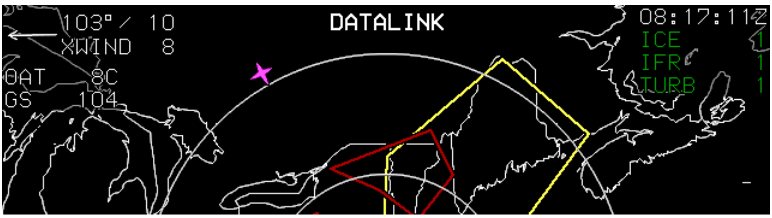


Figure D-7: Clock/Timers/Options

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

1) **Zulu Time or LCL Time**: As specified in Section 3 Display Symbology.

2) **Timer**: As specified in Section 3 Display Symbology.

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

4) **Datalink Weather Status**: When status of NEXRAD radar, graphical METARs and lightning ground strike data is displayed as follows.

Table D-8: Datalink NEXRAD Radar Status

Condition	Annunciation
NEXRAD Radar Status:	
NEXRAD never completely downlinked	No Annunciation
NEXRAD downlinked within last 5 minutes and selected for display (weather radar, if installed, deselected from	“NXRD ##” drawn in green where ## is age in minutes. NEXRAD Radar shown on display.

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
display). “Show Full Sensor Status Flag” enabled.	
NEXRAD downlinked within last 5 minutes and deselected from display or weather radar, if installed, has been selected for display. “Show Full Sensor Status Flag” enabled.	“NXRD ##” drawn in green where ## is age in minutes. “NXRD ##” overlaid with green “X” NEXRAD Radar not shown on display.
NEXRAD not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display (weather radar, if installed, deselected from display). “Show Full Sensor Status Flag” enabled.	“NXRD ##” drawn in amber (yellow) where ## is age in minutes. NEXRAD Radar shown on display.
NEXRAD not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display or weather radar, if installed, has been selected for display. “Show Full Sensor Status Flag” enabled.	“NXRD ##” drawn in amber (yellow) where ## is age in minutes. “NXRD ##” overlaid with green “X” NEXRAD Radar not shown on display.
NEXRAD not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display (weather radar, if installed, deselected from display).	“NXRD ##” drawn in red where ## is age in minutes. NEXRAD Radar shown on display.
NEXRAD not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display or weather radar, if installed, has been selected for display.	“NXRD ##” drawn in red where ## is age in minutes. “NXRD ##” overlaid with green “X”

Table D-8: Datalink NEXRAD Radar Status

Condition	Annunciation
	NEXRAD Radar not shown on display.
NEXRAD not downlinked within last 75 minutes (timed-out)	“NXRD XX” drawn in red “NXRD XX” overlaid with red “X” NEXRAD Radar not shown on display.
Graphical METAR Status:	
METARS never completely downlinked	No Annunciation
METARS downlinked within last 5 minutes and selected for display. “Show Full Sensor Status Flag” enabled.	“GMTR ##” drawn in green where ## is age in minutes. Graphical METARs shown on display.
METARS downlinked within last 5 minutes and deselected from display. “Show Full Sensor Status Flag” enabled. “Show Full Sensor Status Flag” enabled.	“GMTR ##” drawn in green where ## is age in minutes. “GMTR ##” overlaid with green “X” Graphical METARs not shown on display.
METARS not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display. “Show Full Sensor Status Flag” enabled.	“GMTR ##” drawn in amber (yellow) where ## is age in minutes. Graphical METARs shown on display.
METARS not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display. “Show Full Sensor Status Flag” enabled. “Show Full Sensor Status Flag” enabled.	“GMTR ##” drawn in amber (yellow) where ## is age in minutes. “GMTR ##” overlaid with green “X” Graphical METARs not shown on display.
METARS not downlinked within last 10 minutes but	“GMTR ##” drawn in red where ## is age in minutes.

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
downlinked within last 75 minutes and selected for display	Graphical METARs shown on display.
METARS not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display. “Show Full Sensor Status Flag” enabled.	“GMTR ##” drawn in red where ## is age in minutes. “GMTR ##” overlaid with green “X” Graphical METARs not shown on display.
METARS not downlinked within last 75 minutes (timed-out) “Show Full Sensor Status Flag” enabled.	“GMTR XX” drawn in red “GMTR XX” overlaid with red “X” Graphical METARs not shown on display.
Lightning Ground Strike Status:	
Lightning Ground Strikes never completely downlinked.	No Annunciation
Lightning Ground Strikes downlinked within last 5 minutes and selected for display.	“LTNG ##” drawn in green where ## is age in minutes. Lightning Ground Strikes shown on display.
Lightning Ground Strikes downlinked within last 5 minutes and deselected from display. “Show Full Sensor Status Flag” enabled.	“LTNG ##” drawn in green where ## is age in minutes. “LTNG ##” overlaid with green “X” Lightning Ground Strikes not shown on display.
Lightning Ground Strikes not downlinked within last 5 minutes but downlinked within last 10 minutes and selected for display. “Show Full Sensor Status Flag” enabled.	“LTNG ##” drawn in amber (yellow) where ## is age in minutes. Lightning Ground Strikes shown on display.

Table D-8: Datalink NEXRAD Radar Status	
Condition	**Annunciation**
Lightning Ground Strikes not downlinked within last 5 minutes but downlinked within last 10 minutes and deselected from display	"LTNG ##" drawn in amber (yellow) where ## is age in minutes. "LTNG ##" overlaid with green "X" Lightning Ground Strikes not shown on display.
Lightning Ground Strikes not downlinked within last 10 minutes but downlinked within last 75 minutes and selected for display. "Show Full Sensor Status Flag" enabled.	"LTNG ##" drawn in red where ## is age in minutes. Lightning Ground Strikes shown on display.
Lightning Ground Strikes not downlinked within last 10 minutes but downlinked within last 75 minutes and deselected from display. "Show Full Sensor Status Flag" enabled.	"LTNG ##" drawn in red where ## is age in minutes. "LTNG ##" overlaid with green "X" Lightning Ground Strikes not shown on display.
Lightning Ground Strikes not downlinked within last 75 minutes (timed-out). "Show Full Sensor Status Flag" enabled.	"LTNG XX" drawn in red "LTNG XX" overlaid with red "X" Lightning Ground Strikes not shown on display.

D 1.5. Datalink Screen Range

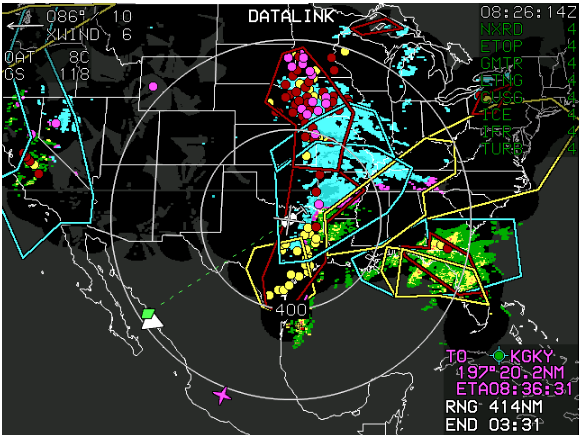


Figure D-8: Datalink

When selected, the following datalink screen ranges are available.

Table D-9: Datalink Screen Range Values

Distance from Ownship to the Boundary Circle	Radius Range Values
50 NM	25 NM
100 NM	50 NM
200 NM	100 NM
400 NM	200 NM
800 NM	400 NM
1,600 NM	800 NM

D 1.6. Boundary Circle Symbols

Figure D-9: Boundary Circle Symbol

A white triangular heading pointer aligned with the longitudinal axis of the ownship symbol appears on the boundary circle with a green diamond-shaped track pointer aligned with the aircraft's track across the earth. A green dashed lubber line connects the center of the aircraft symbol and the track pointer.

If a target or VNAV altitude is set and not captured, an altitude capture predictor arc is displayed on the lubber line at a point corresponding with predicted climb or descent distance (based upon current VSI). A top of descent symbol is shown except when groundspeed is less than 30 knots. A pilot-settable heading bug geometrically interacting with the heading pointer appears on the boundary circle. A magenta, star-shaped waypoint pointer is displayed on the boundary circle at a point corresponding with the active waypoint. The waypoint pointer turns amber (yellow) in the event of GPS Loss of Navigation caution. Boundary circle symbols are not drawn if the datalink screen is in pan mode.

D 1.7. Active Flight Plan Path/Manual Course/Runways

When there is an active flight plan and the GPS/SBAS OBS setting is automatic, the flight plan path, if selected, shows on the datalink screen in correct relationship to the ownship symbol. The active flight plan path depiction meets all the requirements of GPS/SBAS path definition and matches the lateral navigation guidance given on the PFD (GPS/SBAS CDI in automatic OBS mode, skyway boxes, and mini-map). Active flight plan path waypoint symbols for fly-over waypoints are distinct from fly-by waypoints and consist of the waypoint symbol within a circle. When there is a parallel offset, the active flight plan path depicts the parallel offset path and the original flight plan path with haloed gray dashed lines.

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

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

The datalink screen displays airport runways in correct relationship and scale to the ownship symbol.

D 1.8. Borders

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

D 1.9. Pan Mode

The datalink screen has a pan mode to change the location of the center of the screen away from current location and view weather conditions along the route of flight and at the intended destination or alternate destination. When pan mode is active, scroll ❶ (or ❷ as applicable) to pan north, south, east, and west. When pan mode is active, a line from the map center to the aircraft's current position is drawn, and bearing and distance to the map center is always displayed above the ownship symbol when the aircraft is more than 0.5 NM away. If referenced to magnetic North, (as specified in Section 3 Display Symbology). When panning, the nearest displayed graphical METAR symbol within the inner range ring is highlighted with a flashing circle. When such a point is highlighted, dedicated buttons are present to allow the pilot to view and hide the waypoint information (including datalink weather information) associated with that point

D 2. MFD Datalink Format (FORMAT) Menu

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

1) **ROUTE ON/ROUTE OFF**: Toggles showing the active flight plan route on the Datalink page.

2) **PAN ON/PAN OFF**: Toggles Datalink page Pan Mode.

3) **AMET-SMET**: Only available when an AIRMET or SIGMET is within the Datalink page viewable area. Allows the pilot to view the text for the displayed AIRMETs and SIGMETs. While viewing the text for a particular AIRMET or SIGMENT, the border associated with the AIRMET or SIGMET flashes on the page.

4) **DCLTR**: Only available when datalink weather products are available for display. Allows the pilot to select individual datalink weather products for display. Only those datalink weather products available for display appear in the selection box.

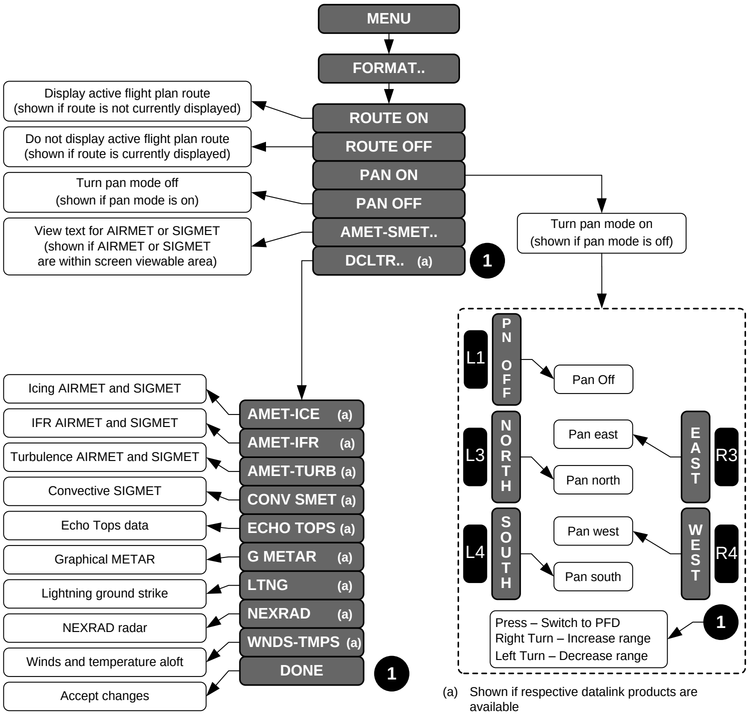


Figure D-10: MFD Datalink Format (FORMAT) Menu

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

1) **ROUTE ON/ROUTE OFF**: Toggles active flight plan route on the Datalink page.

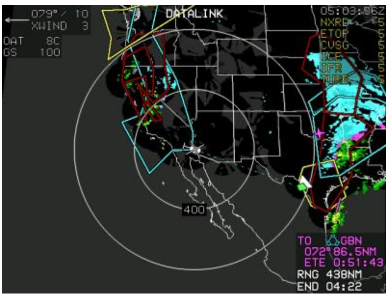
2) **PAN ON/PAN OFF**: Toggles Datalink page Pan mode.

3) **AMET-SMET**: Only available when an AIRMET or SIGMET is within the Datalink page viewable area. Allows the pilot to view text for the displayed AIRMETs and SIGMETs. While viewing text for a particular AIRMET or SIGMENT, the border associated with AIRMET or SIGMET flashes on the page.

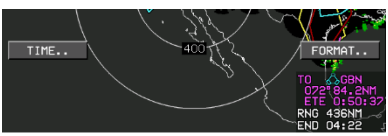
4) **DCLTR**: Only available when datalink weather products are available for display. Allows the pilot to select individual datalink weather products for display. Only datalink weather products available for display appear in the selection box.

D 2.1. MFD DATALINK Page (Step-By-Step)

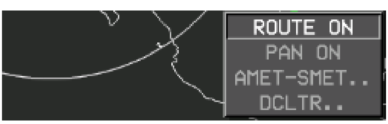
1) Push ❶ and scroll to **DATALINK**. Push to enter.



2) Example shows MFD with DATALINK.



3) Press **MENU (R1)** then **FORMAT (R4)** to format DATALINK page.



4) Scroll ❶ to **ROUTE ON**, **PAN ON**, **AMET-SMET..**, or **DCLTR..** Push to enter.

Table D-7: Menu Synchronization

Menu Parameter	Notes
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
Heading Bug	
True North Mode	
UTC Offset	
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters	

Table D-7: Menu Synchronization

Menu Parameter	Notes
and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Barometric Setting Units	
Barometric Setting Value	
Barometric Setting Mode	
PFD Zoom Mode	
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Datalink Page Settings	
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.

Table D-8: Top-Level Auto Pop-Up Function Descriptions

FPL (L1)	When showing Datalink Page with Pan Mode enabled, **PN OFF** appears. Press to disable Pan Mode. **RESET** has precedence over **PN OFF**.
ACTV (L2)	1) When showing Datalink Page with Winds and Temperatures Aloft enabled, **UP** appears. Press to increase the Winds and Temperatures Aloft grid level. **UP** does not appear when the highest grid level is displayed.

Table D-8: Top-Level Auto Pop-Up Function Descriptions

	2) When showing Datalink Page with: (a) pan mode enabled; (b) information for the nearest highlighted waypoint being shown; and (c) airport weather information present in the information block; **WX** appears to allow the display of textual METAR and TAF data for the airport. **UP** has precedence over **WX**. 3) When showing ND Page with: (a) pan mode enabled; (b) information for the nearest highlighted waypoint being shown; and (c) airport weather information present in the information block; **WX** allows the display of textual METAR and TAF data for the airport.
INFO (L3)	When showing Datalink Page with Pan Mode enabled, **NORTH** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.
OBS (L4)	When showing Datalink Page with Pan Mode enabled, **SOUTH** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.
BARO (R2)	1) When showing Datalink Page with Winds and Temperatures Aloft enabled, **DOWN** appears. Press to decrease the Winds and Temperatures Aloft grid level. **DOWN** does not appear when the lowest grid level is displayed. 2) When showing the Datalink Page with Pan Mode enabled, **INFO** or **HIDE** appears. Press to toggle the display of information for the nearest highlighted waypoint. Refer to the INFO Menu requirements for the amount and type of information presented. **DOWN** has precedence over **INFO/HIDE**.
NRST (R3)	When showing the Datalink Page with Pan Mode, **EAST** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.
 **(Direct-To) (R4)**	When showing the Datalink Page with Pan Mode enabled, **WEST** appears. Press to shift the center of the Pan Mode Datalink Page in the specified direction.

D 3. Active Flight Plan (ACTV) Menu Options

NRST APT (L2): With optional datalink, **WX LGND** and **EXPND WX** tiles are available at this level to show a weather symbol legend and highlighted result METAR and TAF text respectively.

Identifier Entry Box: Highlighted result information includes datalinked weather information when available. With optional datalink, **WX LGND (L2)** and **EXPND WX (L3)** are available at this level to show a weather symbol legend and highlighted result METAR and TAF text respectively.

D 4. MFD Fault Display Menu

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.

If ADS-B datalink is enabled, an indication of ADS-B position validity (ADSB POSN), an indication of whether maintenance of the ADS-B receiver is required (ADSB MAINT) and an indication of whether the Conflict Situational Awareness algorithm is working (ADSB CSA). ADS-B datalink is mutually exclusive with WSI datalink.

D 5. MFD Page (PAGE) Menu

DATALINK: Shows the Datalink page.

Weather Radar

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WX 1. Weather Radar

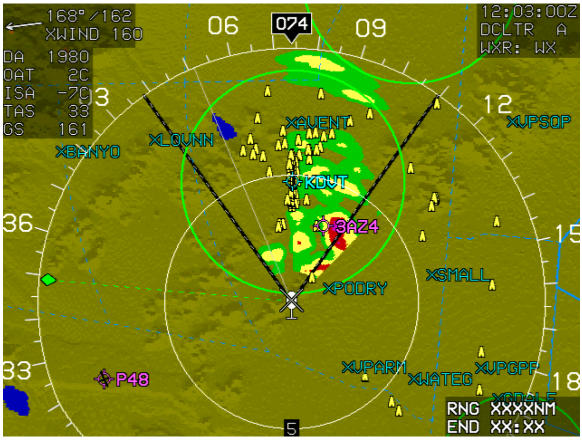

Figure WX-1: Weather Radar Image on ND

Weather Radar automatically declutters when weather radar returns are selected for display on the ND map screen in correct relationship to the ownship symbol unless inhibited during active FLTA alerts. When Weather Radar is selected, datalink NEXRAD is automatically deselected. Table WX-1 defines all inhibited factors with display.

Table WX-1: Weather Radar Inhibited Conditions
During Active FLTA alerts
ND Moving Map Panning Mode
When North Up orientation is selected
When RDR-2100 is in vertical profile mode
When screen range is too small to effectively show the weather returns (defined as when the length of the weather radar scan line is longer than 512 pixels given current weather radar scale setting, screen range, and screen mode)

WX 2. Weather Screen Format

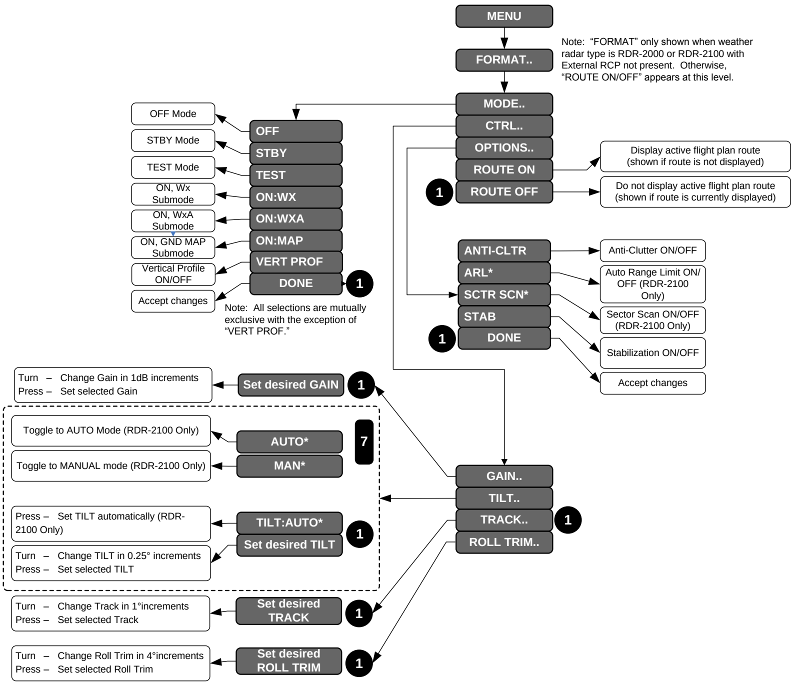

Figure WX-2: MFD WX RDR Format Menu

Upon selecting the MFD format menu in the WX RDR page when weather radar type is RDR-2000 or RDR-2100 with external RCP not installed, an option list appears with the following options:

MODE: Sets the weather radar mode to either OFF, STBY, TEST, ON: WX, ON: WXA, ON: MAP or VERT PROF. The weather radar modes are mutually exclusive, therefore selecting one turns off the other modes with the exception of Vertical profile. Vertical Profile option appears in the selection box only when the selected weather radar mode is not OFF or STBY.

CTRL: Activates an option list to control the weather radar to GAIN, TILT, TRACK, or ROLL TRIM. The control options are as follows and these options are live parameters:

GAIN: Changes the gain in increments of 1dB.

TILT: Changes the tilt in units of 0.25 degrees if tilt mode is manual for both weather radar type RDR-2000 and RDR-2100. **TILT:AUTO** is set when TILT is automatic only when the weather radar is RDR-2100. When weather radar type is RDR-2100, toggles **AUTO/MAN** tilt mode.

TRACK: Changes the track in increments of 1 degree.

ROLL TRIM: Changes the roll trim in increments of 4 degree.

OPITIONS: Select or deselect the available options of weather radar to either **ANTI-CLTR**, **ARL** (only for RDR-2100), **SCTR SCN** (only for RDR-2100), or **STAB**.

ROUTE ON/ROUTE OFF: Toggles showing the active flight plan route on the WX RDR page.

In horizontal depiction, the weather screen uses an arced format with the ownship symbol centered in the bottom of the display with the weather area depicted as an arc ahead of the ownship symbol.

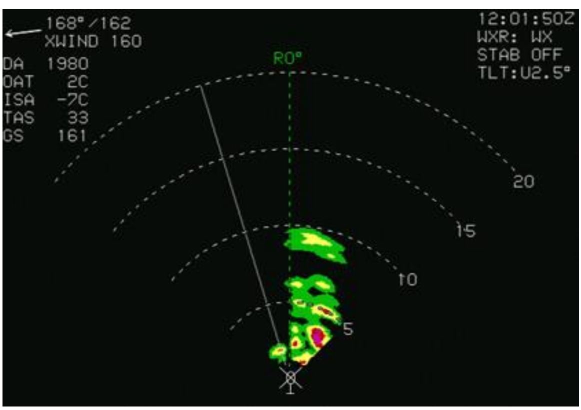

Figure WX-3: Radar Image in Arced Format

In profile depiction, the weather screen uses an arced format with the ownship symbol centered on the left side of the display and the weather area depicted as an arc to the right of the ownship symbol.

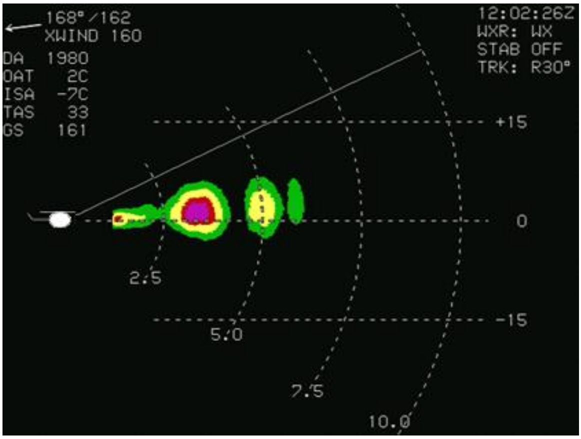

Figure WX-4: Radar Image in Profile Depiction

To select profile depiction, use the separate Weather Radar Control Panel connected to the IDU. The IDU ensures at least one weather radar-enabled screen is showing the weather radar page prior to entering into profile depiction and disables profile depiction if the pilot sets the screens for no weather radar page on any weather radar-enabled screen. The purpose is to maximize the availability of weather radar information on the ND screen. The ND screen only shows a horizontal depiction and disables profile depiction if the weather radar mode is set to off or standby via Radar Control Panel.

WX 2.1. Weather Screen Range

Weather screen range is pilot-selectable with either ❶ (RDR-2000 and RDR-2100 weather radar types) or a control panel directly attached to the weather radar receiver-transmitter. Weather screen range is displayed as a series of equidistant dashed arcs centered upon the ownship symbol to help the pilot judge range to the displayed weather radar returns. All distances represent the distance from the ownship symbol to the outer dashed arc: 5NM, 10NM, 20NM, 40NM, 80NM, 160NM, 240NM, and 320NM.

For most screen ranges, there are four equidistant dashed arcs. When in 2.5NM range, there are five equidistant dashed arcs. Each arc is labeled with distance in nautical miles at its right-most point (horizontal depiction) or bottom-most point (profile depiction). In profile depiction, there are also three horizontal altitude lines drawn relative to the aircraft's altitude to help judge the vertical distance to the displayed weather radar returns. The center line is level with the ownship symbol to represent the aircraft's altitude. The other two lines are equally spaced above and below the center line to represent altitude differences above and below the aircraft. The number of feet above and below the aircraft varies with the selected range to compensate for the radar scan width at the different ranges.

WX 2.2. Track Line

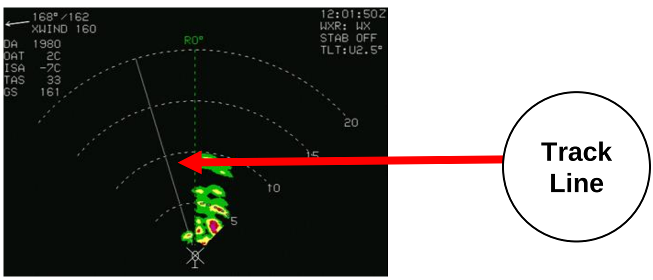

Figure WX-5: Radar Track Line

When the weather radar type is RDR-2000 or RDR-2100 and in horizontal depiction, a dashed track line emanates from the ownship symbol to the outer dashed arc. The value of the track line in whole degrees left or right of aircraft heading is displayed adjacent to the outer end of the track line.

WX 2.3. Active Flight Plan Path/Manual Course/Runways

The active flight plan path (when selected), waypoints, and manual course appear when the weather radar screen is in horizontal depiction. The weather radar screen displays airport runways, when the weather radar screen is in horizontal depiction.

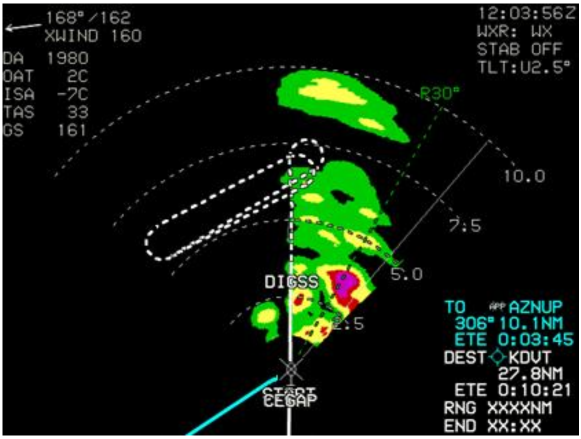

Figure WX-6: Radar Active Flight Plan

WX 2.4. Weather Radar Return Data

Weather radar return data are displayed on the weather radar screen in correct relationship to the ownship symbol as colored regions according to the value of the ARINC 453 3-bit range bins.

Table WX-2: Weather Radar Return Data

ARINC 453 3-Bit Range Bin	Color	Meaning
000b	Black	No Returns
001b	Green	Low-Level Weather or Low-Level Ground Returns
010b	Amber (Yellow)	Mid-Level Weather or Mid-Level Ground Returns
011b	Red	Third-Level Weather Returns. Color is replaced with black when in MAP mode. MAP mode is encoded in ARINC 453 label 055 and 171 bits 27-29 as 010b.
100b	Magenta	Fourth-Level Weather or Third-Level Ground Returns. With RDR-2000 or RDR-2100 weather radar type, color alternates between

Table WX-2: Weather Radar Return Data		
ARINC 453 3-Bit Range Bin	**Color**	**Meaning**
		magenta and black at 1Hz when internal submode is WXA.
101b	Cyan	Automatic Range Limit Returns. Indicates areas of unreliable returns due to radar power absorption.
110b	Light Gray	Moderate Turbulence Returns
111b	White	Severe Turbulence Returns

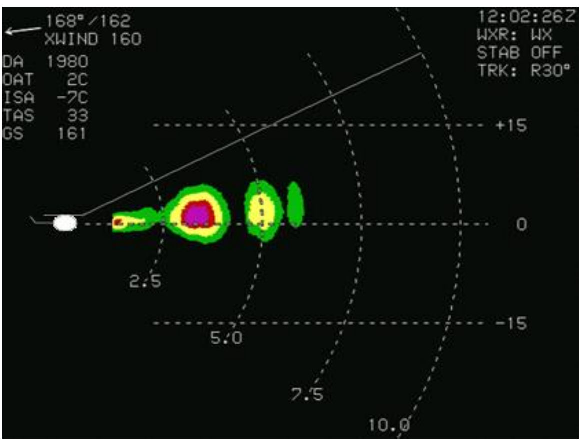

Figure WX-7: Radar Return Data

The following weather radar-specific warnings appear in a conspicuous area adjacent to the weather radar return data so they do not conflict with the weather radar return data. Only one weather radar-specific warning appears at any given time, with the following order of precedence:

1) **WX ALRT**: Shown when a weather alert condition is active.

2) **TURB ALRT**: Shown when a turbulence alert condition is active. A turbulence alert condition is indicated by ARINC 453 label 055 Bit 14.

3) **STAB LIMIT**: Shown when the aircraft attitude has moved to a point where the weather radar antenna can no longer be effectively stabilized.

4) **ANT FAULT**: Shown when the weather radar antenna is temporarily dislodged by turbulence.

WX 2.5. Air Data and Groundspeed

Air data and groundspeed are displayed in the upper left corner of the weather radar screen as specified in Section 3 Display Symbology.

WX 2.6. Clock/Timers/Options

Figure WX-8: Radar Clock/Timer/Options

1) **Zulu Time or LCL Time**: Displayed as in Section 3 Display Symbology;

2) **Timer**: As in Section 3 Display Symbology;

3) **Weather Radar Mode Annunciation**: As in Table WX-3.

Table WX-3: RDR 2100 Applicability

Mode	Annunciation
Off	**WXR:OFF**
Standby	**WXR:STBY**
Weather only	**WXR:WX**
Weather alert	**WXR:WXA**
Ground map	**WXR:GMAP**
Contour	**WXR:CONT**
Test	**WXR:TEST**
Not defined	**WXR:----**

Table WX-4: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
Overlaid with Red X	Weather radar mode is off or not defined. Cooling fault condition exists. Attitude or range fault condition exists. T/R fault condition exists.
STAB OFF (Stabilization)	Weather radar mode annunciation is not overlaid with a red “X”; Weather radar mode is not standby or forced standby; and Weather radar indicates stabilization is off.
TGT ALERT (Target Alert)	Weather radar mode annunciation is not overlaid with a red “X”; Weather radar mode is not standby or forced standby; Weather radar is in horizontal depiction.
“TLT:UXX.X” or “TLT:AUTO” (TILT)	U = Up or Down (either U or D, but not both, may appear – use “U” for 0°); XX.X represents absolute value of the tilt angle in degrees truncated to the nearest tenth; “TLT:AUTO” is used where weather radar reports a value of -16°, representing automatic tilt. Weather radar tilt annunciation only appears when all following conditions are true: 1) Mode annunciation is not overlaid with a red “X”; 2) Mode is not standby or forced standby; and 3) Radar is not in vertical profile submode.
TRK:LXX (TRACK)	L = Left or Right (either L or R, but not both, may appear – use “R” for 0°); and

Table WX-4: RDR 2100 Mode Annunciation	
Annunciation	**Conditions**
	XX represents absolute value of the track angle in degrees. Weather radar track annunciation only appears when all following conditions are true: 1) Mode annunciation is not overlaid with a red "X"; 2) Mode is not standby or forced standby; and 3) Radar is in vertical profile submode (profile depiction).
"GN:SXXDB," "GN:CAL," or "GN:MAX" (GAIN)	S = Sign (either "+" or "-," but not both, may appear – use "+" for 0°); and XXDB represents the manual gain setting in decibels. "GN:CAL" represents the calibrated condition "GN:MAX" represents maximum manual gain Weather radar manual gain annunciation only appears when all following weather radar mode conditions are true: 1) Mode annunciation is not overlaid with a red "X"; 2) Mode is not standby or forced standby; and 3) Mode is ground map.

WX 2.7. Fuel Totalizer/Waypoint Bearing and Distance Functions

Fuel totalizer, waypoint bearing, and waypoint distance are displayed in the lower right corner of the weather radar screen as specified in Section 3 Display Symbology.

Table WX-5: Menu Synchronization	
Menu Parameter	**Notes**
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
Runway Display Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means that individual pilots can still adjust their PFD settings to their preference.	
Sensor Selections	
Navigation Source	
PFD Altitude (meters) Show Flag	
Weather Radar Scale	Onside because range is controlled by the weather radar.
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.
MFD Map Function Declutter Settings	
MFD Show ETA Flag	

WX 3. MFD Fault Display (FAULTS) Menu

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

Weather radar power/communication status failed (WXR PWR X) reflects any one of the following conditions is true:

a) Loss of weather radar communication.

b) Weather radar mode is OFF.

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

a) A Cooling Fault Condition exists.

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

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

d) An Attitude or Range Fault Condition exists.

e) A Control Fault Condition exists.

f) A T/R Fault Condition exists.

3) If weather radar is enabled and the weather radar type is RDR-2000 or RDR-2100, an indication of radar control panel status (WXR RCP X or WXR RCP OK). Radar control panel status failed (WXR RCP X) indicates either loss of communication or a failure status using the same test as invalid data SSM for output labels 270, 271, 273, or 275.

Video

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V 1. Video Input Screen

The video input screen is an image of 640 by 480 pixels and accepts video input signals in the RS-170 composite format. The system is configurable to the NTSC, PAL (including the PAL-m and PAL-nc variants), or SECAM versions of RS-170 separately for each video input. In addition, an auto-detection mode, which programs the video input chip to process most standard RS-170 formats, is configurable for each video input.

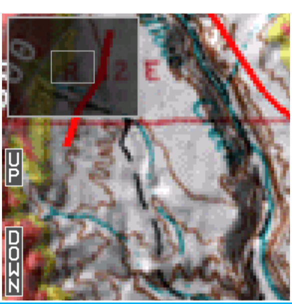
NO VIDEO IMAGE AVAILABLE: Displayed in white centered on the screen when no video signal is detected; the video input screen is black with the annunciation. To aid in diagnosing problems with undetected video signals, the following annunciations are displayed below this annunciation in white centered on the screen:

1) **NO INTERLACED SIGNAL**: No interlaced signal detected.
2) **NO HORIZ OR VERT SYNC**: No horizontal or vertical synchronization detected.
3) **NO COLOR SIGNAL**: No video chroma signal detected.
4) **LOAD ERROR DETECTED**: Video chip reports a load error.
5) **TRIGGER ERROR DETECTED**: Video chip reports a trigger error.
6) **PROGRAMMING ERROR DETECTED**: Video chip reports a programming error.

V 1.1. ZOOM Level

The pilot may set desired zoom levels from 1 (no pixel replication) to 10 in increments of 1.

V 1.2. Pan Mode



When the ZOOM level is greater than 1, the Video Input screen has a pan mode for selecting the portion of the video image displayed by replicating pixels. When pan mode is active, controls are present to allow moving the portion displayed up, down, left, and right.

Figure V-1: Video Pan View

A mini-map of the displayed image's position in the full video image is displayed for 10 seconds after:

1) Entering Pan Mode;

2) Changing the ZOOM level to a value greater than 1;

3) Panning the zoomed image.

Exiting Pan Mode removes pan mode controls and mini-map, if any.

V 1.3. Video Input Status Display

When selected, the following are optionally displayed in the upper right corner of the Video Input display:

1) **Label**: Identifies video input source and is configurable to one of a set of predefined labels. If no label is configured, the label is **VIDEO-n** where **n** is the video input source number.

2) **ZOOM**: Amount of pixel expansion is displayed as **ZOOM nnX** where **nn** is the ZOOM level.

3) **Brightness**: Displayed as **BRT nnn%** where **nnn** is the brightness setting as a percentage of the maximum value.

4) **Contrast**: Displayed as **CTRST nnn%** where **nnn** is the contrast setting as a percentage of the maximum value.

5) **Saturation**: Chroma saturation is displayed as **SAT nnn%** where **nnn** is the saturation setting as a percentage of the maximum value.

6) **Hue**: Chroma hue is displayed as **HUE nnn%** where **nnn** is the hue setting as a percentage of the maximum value.

Figure V-2: Video Status

V 2. MFD Video Input Format (FORMAT) Menu

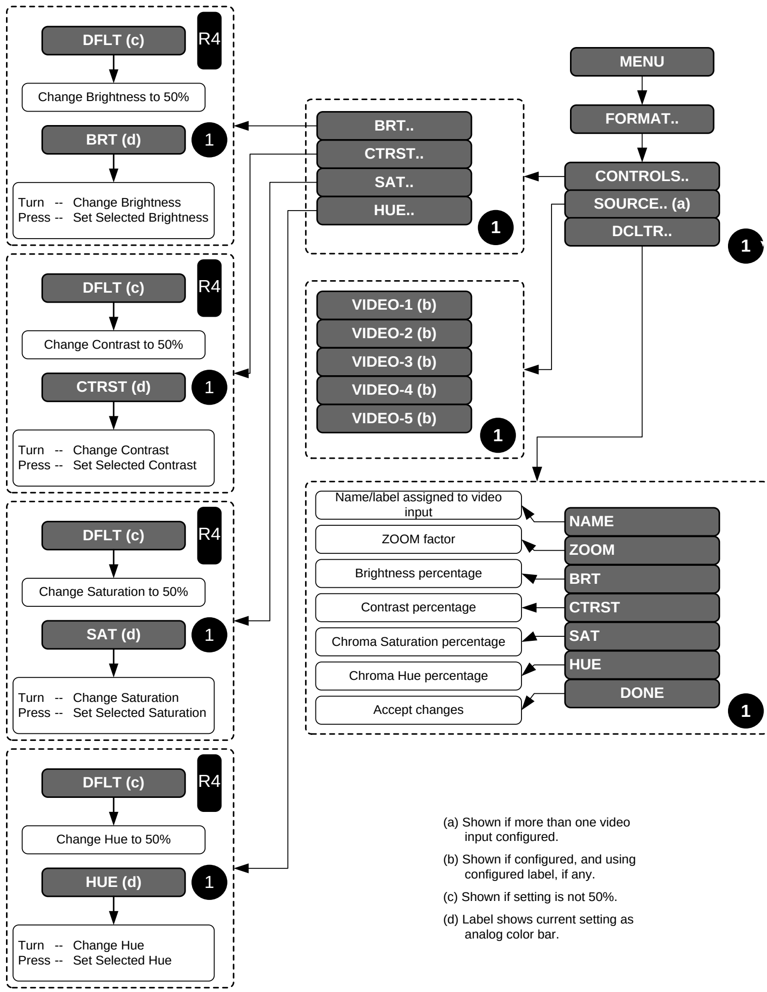


Figure V-3: MFD Video Input Format (FORMAT) Menu

Upon selecting the MFD format menu when in the Video Input page, an option list appears with the following options.

Table V-1: Video Input Controls

Controls Settings	Definition	Notes
BRT	Adjust brightness setting for the current video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting brightness to nominal default.
CTRST	Adjust contrast setting for current video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting contrast to nominal default.
SAT	Adjust chroma saturation (color intensity) setting for current video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting to nominal default value.
HUE	Adjust chroma hue (red-green balance) settings for current video input.	When not at the nominal default (50%) value, **DFLT (R4)** appears for resetting to nominal default value.
SOURCE	Selection of optional video source.	Only available if more than one video input is enabled. Allows selected video input to be displayed.
DCLTR	Activates an option list to select video input status settings.	a) NAME: (Video input label) b) ZOOM: (Current amount of image expansion) c) BRT: (Current brightness setting) d) CTRST: (Current contrast setting) e) SAT: (Current chroma saturation setting) f) HUE: (Current chroma hue setting)

Table V-2: Menu Synchronization	
Menu Parameter	**Notes**
The following menu parameters are synchronized across all displays at all times. These are bugs and fundamental aircraft values that should never have independence.	
AHRS 1 and 2 mode and slewing values	
Countdown Timer Start Time	
Countdown Timer Default Value	
Emergency and Minimum Fuel Settings	
Heading Bug	
VLOC OBS Settings	
Target Altitude Bug Setting	
Timer Starting Signal	
Traffic Filter Setting	
True North Mode	
UTC Offset	
Crosslink Synchronization Status	
The following menu parameters are synchronized across all displays when crosslink is enabled. Otherwise, they are only synchronized onside. These parameters are FMS parameters and allow the pilot and co-pilot FMSs to be operated independently when crosslink is inhibited.	
Active Flight Plan Parameters	
The following menu parameters are only synchronized onside. These parameters are usually sensor selections or PFD options used to keep the appearance of any pilot's PFD consistent in the case of PFD reversion. The onside characteristic means individual pilots can still adjust PFD settings to their preference.	
Sensor Selections	
The following menu parameters are independent between displays. These are used to support non-PFD display options to give the pilot maximum MFD operating flexibility.	
MFD Selected Page	This parameter is transmitted to all other IDUs to support weather radar vertical profile mode selection.

Table V-2: Menu Synchronization

Menu Parameter	Notes
MFD Map Page Settings	Map scale is transmitted onside to support weather radar range selection.
MFD Map Function Declutter Settings	
MFD Video Page Settings	• Selected Input • Brightness • Contrast • Saturation • Hue (The above are video hardware settings.)

Table V-3: Top-Level Auto Pop-Up Function Descriptions

ACTV (L2)	Showing Video Input Page with pan mode enabled, **UP** appears. Press to move up the section of the video image displayed in the full video image.
INFO (L3)	Showing Video Input Page with pan mode enabled, **DOWN** appears. Press to move down the section of the video image displayed in the full video image.
BARO (R2)	Showing Video Input Page with pan mode enabled, **LEFT** appears. Press to move left the section of the video image displayed in the full video image.
NRST (R3)	Showing the Video Input Page with pan mode enabled, **RIGHT** appears. Press to move right the section of the video image displayed in the full video image.

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Glossary

AGL Indication (Rad Alt, GPS Alt, Baro Alt) – Display of altitude above the ground, with designation of the altitude source as R (radio altitude), G (GPS WAAS geodetic altitude less local ground elevation), or B (barometric altitude less local ground elevation).

Air Data and Groundspeed – Display of density altitude, outside air temperature, ISA temperature deviation, true airspeed, and ground speed.

Airspeed Information – Display of airspeed is the indicated airspeed tape and airspeed readout with associated data. The airspeed function includes color-coded caution bands for minimum and maximum speeds based on V-speeds set in the EFIS limits.

Altitude Information – Display of altitude information is the altitude tape and altitude readout.

Approach Mode Signal Output – Conventional autopilot approach mode signals are course error output, the left/right deviation signal (localizer output) and the up/down deviation signal (glideslope output). Signals are based on the selected ILS source.

Attitude Information – Display of attitude information includes pitch and roll. The bank angle scale may be set to auto-declutter by the pilot when the bank angle is less than 2.8°. The pitch ladder is limited to ±10° from the flight path marker or aircraft waterline, whichever is greater. The unusual attitude display appears when the aircraft pitch exceeds ± 30° or bank angle exceeds 65° (fixed wing) or 50° (rotorcraft).

Autoset – Automatically selects features or settings.

Azimuth – Angle between the north vector and the perpendicular projection of the star down onto the horizon. Usually measured in degrees (°).

Barometric Altimetry – Measurement of altitude based on the atmosphere (pressure and temperature).

Barometric Correction – Display and altitude correction for local barometric pressure.

Bezel – Faceplate of the IDU comprised of pushbuttons along the pushbuttons along the sides and rotary encoders along the bottom.

Chroma – Colorfulness relative to the brightness.

Conformally – Angle-preserving. Example: Traffic appears conformally on the PFD.

Course Deviation Indicator – Display of course deviation from selected course, including a To-From indicator.

Critical Flight Phase – Phase(s) of flight where the failure mode would result in a hazard condition using flight phases. For example, failure of ILS would only be a hazard condition during approach and landing.

Crossfill – Transfer of data and information between IDUs in a dual system with two PFDs configured.

Cross-linked – Synchronized across both EFIS systems.

Datalinked – Display of received data such as weather or traffic from peripheral systems such as WSI or ADS-B.

dBZ – Decibel relative to radar reflectivity (Z). Composite reflectivity shows the highest dBZ (strongest reflected energy) at all elevations. Unlike base reflectivity, which only shows reflected energy at a single elevation scan of the radar, composite reflectivity displays the highest reflectivity of ALL elevations scans. If there is heavier precipitation in the atmosphere over an area of lighter precipitation (i.e. rain has yet to reach the ground), the composite reflectivity displays the stronger dBZ level.

Deadband – Neutral zone where no action or changes are made.

Directional Scale (Compass Rose or Arc) and Ownship Symbol – Display of general directional information. All MFD pages include a form of the compass rose with current heading pointer and aircraft “ownship” symbol.

Discrete – A logic input or output that identifies a condition or status of or for an ancillary system. Discretes are defined by the operating software or settings programmed specifically for the aircraft.

Display of ADF – Display of single ADF bearing information in the form of an RMI needle.

Display of Glideslope – Display of Glideslope 1 or Glideslope 2 in the form of vertical deviation dots and deviation on PFD or MFD HSI page.

Display of Lightning Cell Information – Display of lightning information from a WX-500 system and shown in the form of lightning cells. The pilot may show individual lightning strike data by selecting the dedicated WX-500 page.

Display of Localizer – Display of Localizer 1 or Localizer 2 in the form of horizontal deviation dots and deviation.

Display of Marker Beacon – Display of outer, middle, and inner marker beacons in the form of a color-coded circle with the corresponding letter (O, M, I).

Display of Traffic Information – When integrated with an appropriate traffic system, the PFD and MFD display traffic information in two formats. One format is via traffic symbols as shown on the PFD and MFD Map page and Traffic page. The second format is with the traffic pop-up thumbnail display showing traffic position in a full 360° format on the PFD.

Display of VOR RMI – Display of VOR1 and VOR2 bearing in the form of RMI needles.

Dot – (CDI scale referenced) represents an additional 2° for VOR and 1.25° for Localizer.

EFIS-Coupled – The EFIS is coupled to an autopilot and controls the lateral and vertical modes of the autopilot.

Failure Condition Hazard Description – A description of the failure mode to be analyzed.

Flight Director (Selectable Function) – Display of flight director in a single or dual cue format when selected for display on the PFD.

Flight Path Marker (Velocity Vector) – Display of aircraft's actual flight path, showing where the aircraft is going as opposed to where the aircraft is pointed.

Flight Plan and Navigation Display – Display of the active GPS WAAS/SBAS-based flight plan, including course line, waypoints, ground track, glide range, projected path, altitude capture predictor, approach procedure, missed approach procedure, and the aircraft present position on the active leg.

Geodetic – Set of reference points used to locate places on the earth.

Geoid – Global mean sea level.

G-Force and Fast/Slow Indicator – Indications to show the G-force on the aircraft or, for aircraft equipped with a compatible angle of attack computer, the deviation from the reference speed while in the landing configuration.

Glideslope Sidelobes – False glideslope signals.

GPS WAAS Course Deviation Indicator (CDI) – Display of CDI relative to selected course, either automatic based on active flight plan or manual based on pilot-selected OBS.

GPS WAAS Functions – The EFIS meets the GPS WAAS navigation and flight planning/management requirements of TSO-C146a (RTCA/DO-229D) for Class Gamma 3 equipment. These functions include navigation, flight planning (function select, flight plan generation and editing, selected waypoints, user waypoints, etc.), path definition including approach and departure paths, GPS altitude, dead reckoning, navigation modes with automatic mode switching, loss of navigation monitoring, loss of integrity monitoring, etc. The database used with the GPS WAAS functions meets the integrity requirements of RTCA/DO-200A.

Heading Bug – Display and control of selected heading using a bug. May be used to drive heading bug output to autopilot for HSI-based heading mode.

Heading Display – Display of heading with directional scale is provided at the top of the PFD. This is the same heading information provided on the MFD.

Heading Mode Signal Output – Conventional autopilot heading mode signal is a heading error output based on the difference between the EFIS desired heading and the actual aircraft heading. The EFIS desired heading is either the pilot-selected heading bug or a heading designed to achieve and maintain the active GPS-based flight plan.

Hectopascal (hPa) – International System of Units (SI) unit measure of pressure, equals one millibar (mbar).

HeliSAS – Genesys Aerosystems' helicopter autopilot and stability augmentation system.

Horizontal Situation Indicator (Selectable Function) – Display of VOR or localizer and glideslope deviation when selected for display on the PFD.

Hover Vector Display (Rotorcraft Only) – Display of hover drift in a rotorcraft installation when the helicopter is traveling less than 30 knots airspeed.

Inches of Mercury (inHg) – Unit of atmospheric pressure used in the United States. Named for the use of mercurial barometers which equate height of a column of mercury with air pressure.

Inhibit – Prevention of activity or occurrence. Examples are:

XFILL INHBT, TAWS INHBT, and TAS INHBT.

Integrated Peripherals – Internal devices of the essential unit.

Intelliflight – Genesys Aerosystems' digital autopilot.

Ionosphere – Region of the atmosphere between the stratosphere and exosphere, 50 to 250 miles (80 to 400 km) above the surface of the earth.

International Standard Atmosphere (ISA) – Standard model of the change of pressure, temperature, density, and viscosity over a wide range of altitudes or elevations.

Landing Gear Indication – When enabled on retractable landing gear aircraft, PFD shows indication of landing gear extended.

Lubber Line – Line marked on the compass showing the direction straight ahead.

Mach Display – Display of Mach number when the aircraft is traveling at or above 0.35 Mach. This function may be deselected by a setting in the IDU configuration (limits) file.

Magnetic Declination (MAGVAR) – Sometimes called magnetic variation; the angle between magnetic north and true north.

Map Data – Display of map data, including airspace, VFR/IFR airports, VHF navaids such as VOR/NDB/DME, jet/victor airways, and display range rings.

Menu Functions – The EFIS includes menus to access functions on both the PFD and the MFD.

Mesocyclonic – Contains a vortex of air within a convective; air rises and rotates around a vertical axis, often in the same direction as low pressure systems.

Millibar (mbar) – Metric (not SI) unit of pressure, one thousandth of a bar (which is about equal to the atmospheric pressure on Earth at sea level - 1013 millibars).

Miscompare – Disparity of data or information. Examples are:

ALT MISCOMP, ATT MISCOMP, GPS MISCOMP, GS MISCOMP, HDG MISCOMP, IAS MISCOMP, LOC MISCOMP, PLT MISCOMP, RALT MISCOMP, CPLT MISCOMP, and BARO MISCOMP.

NavData – Jeppesen's aeronautical database to navigate the global airspace system.

Navigation Data Display – Display of active waypoint, bearing to waypoint, and ground track based on active flight plan. The pilot may also select flight plan information as a mini-map (thumbnail map). These functions are analyzed as part of the GPS WAAS functions not the PFD functions.

Navigation Log – Display of navigation information based on active flight plan, including next waypoint, destination, estimated time remaining, and fuel totalizer-based range and endurance. This function may be deselected by a setting in the IDU configuration (limits) file. These functions are analyzed as part of the GPS WAAS functions not the MFD functions.

Navigation Mode Signal Output – Conventional autopilot Navigation mode signals are the course error output and the left-right deviation signals. Course error output is based on the difference between the EFIS selected course (OBS) and the actual aircraft heading. These signals are based on the selected navigation signal (VOR, GPS).

Nondirectional – Functions in all directions.

Noodle – Navigation Display (ND) Projected path; curving path based upon the aircraft bank angle and ground speed used effectively to assist in course interception and making small adjustments to bank angle for proper roll out.

Nanoteslas (nT) – A unit of measurement of the strength of the magnetic field. Earth's strongest magnetic field is located at the poles, and the weakest field is near the equator.

Obstructions Display – Display of obstructions identified in the embedded obstruction database which are within 8.5 NM of the aircraft present position. Non-threatening obstructions are displayed by color to identify altitude relative to the aircraft's current altitude (amber [yellow] < 2000' below, light red < 500' below, bright red = at or above aircraft). Threatening obstructions, defined as those that pierce the TAWS envelope, are identified by highlight when producing a caution and identified by flashing highlight when producing a warning. The database used with the obstruction functions meets the integrity requirements of RTCA/DO-200A.

Omnibearing – Magnetic bearing of an omni-range station.

Ownship – Principal eye-point; referring to icon of aircraft represented on display.

Pitch Limit Indicator – Appears when the aircraft (fixed wing only) is within 10 knots of stall speed, based on the VSI setting in the EFIS limits. The intent is to notify the pilot of a possible stall condition so corrective action is taken before the stall occurs. This function may be deselected by a setting in the IDU configuration (limits) file.

Q-Routes – Published RNAV routes, including Q-Routes and T-Routes, can be flight planned for use by the Genesys EFIS, subject to any limitations or requirements noted on enroute charts, in applicable Advisory Circulars, or by NOTAM. RNAV routes are depicted in blue on aeronautical charts and are identified by the letter "Q" or "T" followed by the airway number. E.g., Q35, T-205. Published RNAV routes are RNAV-2 except when specifically charted as RNAV-1.

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

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

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

Recency – State of occurrence, appearance, or origin.

Selection and Display of Selected Course – Omni-Bearing Select (OBS) function for the pilot to select the course for navigation. Selected course is displayed for reference.

Settable V-Speeds, Targets – The pilot may set certain V-speeds for reference during flight. In addition, the pilot may set certain information at any time for reference during flight, including target airspeed (with corresponding bug) and target altitude (with corresponding bug).

Side in Command – Side of aircraft control responsible for its operation.

Skipped Waypoint – A skipped waypoint is a waypoint associated with a dynamic termination leg with a zero length. These are either:

1) An altitude termination leg when current aircraft altitude is above the termination altitude; or

2) System-created (i.e., not NavData specified) intercept to a “Course to a Fix” leg where there is insufficient distance to calculate an intercept heading.

Skyway VNAV/LNAV Guidance (Synthetic Vision) – Display of GPS-based active navigation route, flight plan, procedure, or OBS course in a three-dimensional series of skyway boxes. Also known as Highway in the Sky and HITS.

Slip Indicator – Display of aircraft lateral accelerations via an integral slip/skid indicator function. The slip indicator is a rectangle just below the heading pointer that moves left and right to indicate the lateral acceleration sensed by the AHRS in the same manner as the ball in a mechanical slip indicator.

Strikefinder – Lightning detector system (WX-500) connected to EFIS and enabled through Factory Program settings.

Suppressed Waypoint – A suppressed waypoint (designated by brackets) is an airport associated with an IFR or VFR approach procedure.

Symbology – Use of symbols.

T-Routes – T-Routes are available for use by GPS or GPS/SBAS equipped aircraft from 1,200 feet above the surface (or in some instances higher) up to but not including 18.000 feet MSL. T-Routes are depicted on Enroute Low Altitude Charts and considered to include the same attributes of Low Altitude Airways in the Genesys Aerosystems EFIS Declutter menus.

Talker – IDU providing data to external sensors and generating aural alerts. IDUs depend upon intra-system communications to determine which IDU on a side takes over "Talker" responsibilities. Only one talker (transmit enabled) per side, two talkers in a two sided system, and a master talker PFD when considering aircraft limits. Any IDU may become a talker through auto reversionary means in the event of the PFD failing.

Terrain Display (PFD Artificial Horizon) – Conformal display of surrounding terrain presented with the artificial horizon, shown in the correct scale and perspective for the aircraft's current position and altitude. Includes conformal display of known runway locations, direction, scale, and perspective based on aircraft's current position and altitude.

Terrain Display and TAWS/HTAWS – Display of terrain, including identification and annunciation of threatening terrain in accordance with Terrain Awareness Warning System (TAWS) requirements. Coloring scheme for SVS-TAWS PFD and MAP has been simplified as follows:

Non-alerting Terrain below aircraft – Olive Shades

Non-alerting terrain above aircraft – Brown Shades

TAWS FLTA Caution Terrain – Amber (Yellow)

TAWS FLTA Warning Terrain – Red

Obstacles Below aircraft – Amber (Yellow)

Obstacles above aircraft – Red

When over water – Deep Blue

Threatening terrain is determined by the requirements of TAWS TSO-C151b (fixed wing) and TSO-C194 HTAWS (rotorcraft). Threatening terrain is shaded amber (yellow) for caution situations or shaded red for warning situations per TSO-C151b and TSO-C194. TAWS cautions and warnings are accompanied by an amber (yellow) or red flag and an aural annunciation. TAWS Class A, TAWS Class B, TAWS Class C, Enhanced HTAWS, or HTAWS functions may be activated in the system prior to installation. The database used with the TAWS functions meets the integrity requirements of RTCA/DO-200A.

Timer Indication – Pilot-selected function for a count-up or count-down timer.

Traffic Display – When integrated with an appropriate traffic system, traffic is shown using standard TCAS symbology showing relative position, altitude, climb/decent, and color. The pilot may also show traffic information by selecting the dedicated traffic display page.

Vertical Speed Display – Display of altitude rate of change (vertical speed or climb rate).

V_{PROC} (Procedure Speed) – The aircraft's normal speed (in Airspeed Units and configured in EFIS Limits) for flying instrument approaches (DPs, IAPs, STARs). This value is used for calculating the turn radius used for instrument procedure legs. This speed is not seen on the airspeed tape and only found in the aircraft speed settings inside the limits.

Warning, Caution, and Advisory Flags – Display of, warning, caution, and advisory indications accompanied by aural indications. The flags are stacked in the lower left corner of the PFD. Warnings are always shown at the top of the flag stack, followed by cautions and then advisories. These flags remain in view for as long as the situation exists.

Waterline – Indication of the aircraft's longitudinal axis or waterline (attitude).

Wide Area Augmentation System (WAAS) – Developed by Federal Aviation Administration to provide accurate positioning part of the Satellite Based Augmentation System (SBAS). Other countries have similar systems: Europe: European Geostationary Overlay System (EGNOS); Japan: MTSAT Satellite-based Augmentation System (MSAS); India: GPS Aided GEO Augmented Navigation system (GAGAN).

Wind Information – Display of wind direction, wind speed, and cross wind component.

Zulu Clock, Timers – Display of Zulu time (based on GPS data) and pilot-selected timer.

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64-000102-080E

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