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TO: HOLDERS OF THE KSN 765/770 INTEGRATED COMMUNICATION NAVIGATION DISPLAY PILOT'S GUIDE, HONEYWELL PUB. NO. D200802000009

REVISION NO. 4 DATE FEBRUARY 2016

HIGHLIGHTS

This revision is a full replacement. This guide has been revised to reflect changes and added information. Pages that have been revised are outlined below. The List of Effective Pages (LEP) identifies the current revision to each page in this guide.

Page No.	Description of Change
T-1, T-2	Updated to reflect Revision 4.
RR-1	Updated to reflect Revision 4.
LEP-1 thru LEP-6	Updated to reflect Revision 4.
15-89	Added sentence in regards to a KI 209A indicator.

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KSN 765/770 Pilot's Guide

Integrated Communication Navigation Display

Advanced technologies. Proven performance. Enhanced safety.

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KSN 765/770 Integrated Communication Navigation Display

Pilot's Guide

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For each revision, put the changed pages in your guide and discard the replaced pages. Write the revision number and date, and the date put in the guide. Put your initials in the applicable columns on the Record of Revisions. The initial H shows that Honeywell put the changed pages in the guide.

Revision Number	Revision Date	Insertion Date	By
1	Dec 2013	Dec 2013	H
2	Jun 2014	Jun 2014	H
3	Nov 2014	Nov 2014	H
4	Feb 2016	Feb 2016	H

Blank Page

List of Effective Pages

Subheading and Page		Date
Title		
T-1	■	Feb 2016
T-2	■	Feb 2016
Record of Revisions		
RR-1	■	Feb 2016
RR-2		Jun 2014
List of Effective Pages		
LEP-1	■	Feb 2016
LEP-2	■	Feb 2016
LEP-3	■	Feb 2016
LEP-4	■	Feb 2016
LEP-5	■	Feb 2016
LEP-6	■	Feb 2016
D LEP-7		Feb 2016
D LEP-8		Feb 2016
Table of Contents		
TC-1		Jun 2014
TC-2		Jun 2014
TC-3		Jun 2014
TC-4		Jun 2014
TC-5		Jun 2014
TC-6		Jun 2014
TC-7		Jun 2014
TC-8		Jun 2014
TC-9		Jun 2014
TC-10		Jun 2014
TC-11		Jun 2014
TC-12		Jun 2014
TC-13		Jun 2014
TC-14		Jun 2014
TC-15		Jun 2014
TC-16		Jun 2014
TC-17		Jun 2014
TC-18		Jun 2014
Introduction		
1-1		Jun 2014
1-2		Jun 2014
1-3		Nov 2014
1-4		Jun 2014
User Interface and System Overview		
2-1		Jun 2014
2-2		Jun 2014
F 2-3/2-4		Jun 2014
2-5		Jun 2014
2-6		Jun 2014
2-7		Jun 2014
2-8		Jun 2014
2-9		Jun 2014
2-10		Jun 2014
2-11		Jun 2014
2-12		Jun 2014
2-13		Jun 2014
2-14		Jun 2014
2-15		Jun 2014
2-16		Jun 2014
2-17		Jun 2014
2-18		Jun 2014
2-19		Jun 2014
2-20		Jun 2014
Display States and Mode Control		
3-1		Jun 2014
3-2		Jun 2014
3-3		Jun 2014
3-4		Jun 2014
3-5		Jun 2014
3-6		Jun 2014
3-7		Jun 2014
3-8		Jun 2014
3-9		Jun 2014
3-10		Jun 2014
3-11		Jun 2014
3-12		Nov 2014
3-13		Jun 2014
3-14		Jun 2014
3-15		Jun 2014
3-16		Jun 2014

■ indicates a changed page
D indicates a deleted page
F indicates a foldout page

■ indicates a changed page
F indicates a foldout page
D indicates a deleted page

Subheading and Page	Date
Charts View	
7-1	Jun 2014
7-2	Jun 2014
7-3	Jun 2014
7-4	Jun 2014
7-5	Jun 2014
7-6	Jun 2014
7-7	Jun 2014
7-8	Jun 2014
7-9	Jun 2014
7-10	Jun 2014
7-11	Jun 2014
7-12	Jun 2014
7-13	Jun 2014
7-14	Jun 2014
7-15	Jun 2014
7-16	Jun 2014
7-17	Jun 2014
7-18	Jun 2014
Terrain View	
8-1	Jun 2014
8-2	Jun 2014
8-3	Jun 2014
8-4	Jun 2014
8-5	Jun 2014
8-6	Jun 2014
8-7	Jun 2014
8-8	Jun 2014
8-9	Jun 2014
8-10	Jun 2014
Traffic View	
9-1	Jun 2014
9-2	Jun 2014
9-3	Jun 2014
9-4	Jun 2014
9-5	Jun 2014
9-6	Jun 2014
9-7	Jun 2014
9-8	Jun 2014
Datalink Weather View	
10-1	Jun 2014
10-2	Jun 2014
10-3	Jun 2014
10-4	Jun 2014
10-5	Jun 2014
10-6	Jun 2014
10-7	Jun 2014
10-8	Jun 2014
10-9	Jun 2014
10-10	Jun 2014
10-11	Jun 2014
10-12	Jun 2014
10-13	Jun 2014
10-14	Jun 2014
10-15	Jun 2014
10-16	Jun 2014
10-17	Jun 2014
10-18	Jun 2014
10-19	Jun 2014
10-20	Jun 2014
10-21	Jun 2014
10-22	Jun 2014
10-23	Jun 2014
10-24	Jun 2014
10-25	Jun 2014
10-26	Jun 2014
10-27	Jun 2014
10-28	Jun 2014
10-29	Jun 2014
10-30	Jun 2014
10-31	Jun 2014
10-32	Jun 2014
10-33	Jun 2014
10-34	Jun 2014
10-35	Jun 2014
10-36	Jun 2014
10-37	Jun 2014
10-38	Jun 2014
10-39	Jun 2014
10-40	Jun 2014
10-41	Jun 2014
10-42	Jun 2014
10-43	Jun 2014
10-44	Jun 2014

■ indicates a changed page
F indicates a foldout page
D indicates a deleted page

■ indicates a changed page
D indicates a deleted page
F indicates a foldout page

Subheading and Page	Date
Flight Management System (FMS) (cont)	
15-37	Jun 2014
15-38	Jun 2014
15-39	Jun 2014
15-40	Jun 2014
15-41	Jun 2014
15-42	Jun 2014
15-43	Jun 2014
15-44	Jun 2014
15-45	Jun 2014
15-46	Jun 2014
15-47	Jun 2014
15-48	Jun 2014
15-49	Jun 2014
15-50	Jun 2014
15-51	Jun 2014
15-52	Jun 2014
15-53	Jun 2014
15-54	Jun 2014
15-55	Jun 2014
15-56	Jun 2014
15-57	Jun 2014
15-58	Jun 2014
15-59	Jun 2014
15-60	Jun 2014
15-61	Jun 2014
15-62	Jun 2014
15-63	Jun 2014
15-64	Jun 2014
15-65	Jun 2014
15-66	Jun 2014
15-67	Jun 2014
15-68	Jun 2014
15-69	Jun 2014
15-70	Jun 2014
15-71	Jun 2014
15-72	Jun 2014
15-73	Jun 2014
15-74	Jun 2014
15-75	Jun 2014
15-76	Jun 2014
15-77	Jun 2014
15-78	Jun 2014
15-79	Jun 2014
15-80	Jun 2014
15-81	Jun 2014
15-82	Nov 2014
15-83	Jun 2014
15-84	Jun 2014
15-85	Nov 2014
15-86	Jun 2014
15-87	Jun 2014
15-88	Jun 2014
15-89	■ Feb 2016
15-90	Jun 2014
15-91	Jun 2014
15-92	Jun 2014
15-93	Jun 2014
15-94	Jun 2014
15-95	Jun 2014
15-96	Jun 2014
15-97	Jun 2014
15-98	Jun 2014
15-99	Jun 2014
15-100	Jun 2014
15-101	Jun 2014
15-102	Jun 2014
15-103	Jun 2014
15-104	Jun 2014
15-105	Jun 2014
15-106	Jun 2014
15-107	Jun 2014
15-108	Jun 2014
15-109	Jun 2014
15-110	Jun 2014
15-111	Jun 2014
15-112	Jun 2014
15-113	Jun 2014
15-114	Jun 2014
15-115	Jun 2014
15-116	Jun 2014
15-117	Jun 2014
15-118	Jun 2014
15-119	Jun 2014
15-120	Jun 2014
15-121	Jun 2014

■ indicates a changed page
D indicates a deleted page
F indicates a foldout page

■ indicates a changed page
D indicates a deleted page
F indicates a foldout page

Table of Contents

Table of Contents (cont)

Table of Contents (cont)

Table of Contents (cont)

Section **Page**

Table of Contents (cont)

Table of Contents (cont)

Section **Page**

15. FLIGHT MANAGEMENT SYSTEM (FMS) (CONT)

Table of Contents (cont)

Table of Contents (cont)

List of Figures

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Figures (cont)

Table of Contents (cont)

List of Tables

Table of Contents (cont)

List of Tables (cont)

Blank Page

1. Introduction

This guide describes the components, operation, typical flight applications, and operating procedures of the KSN 765 and KSN 770 integrated communication navigation display.

The KSN 765/770 features a 5.7-inch multifunction display (***MFD***) and flight management system (FMS). The KSN 765/770 incorporates a moving map display with the relative location of the aircraft with respect to the surrounding area. The moving map gives a view of cartographic as well as topographic features and navigation data.

This publication is intended to be used as a guide and is written for system familiarization only. This guide does not supersede any Federal Aviation Administration (FAA) or original equipment manufacturer (OEM)-approved procedures.

NOTE: Figures presented in this guide are intended for illustration purposes only. While the figures are representative of the display definition, they are not necessarily representative of real flight conditions.

Important terms used in this guide to describe the KSN 765/770 are contained in the glossary near the end of the guide and displayed as ***bold italicized cyan*** text.

NOTE: Only the first use of glossary terms in each section are displayed in ***bold italicized cyan*** text.

STRUCTURE OF THIS GUIDE

This guide is divided into the following sections:

- **Section 1 - Introduction** - This section describes the structure of this guide and gives the product support and publications ordering information.
- **Section 2 - User Interface and System Overview** - This section describes the terminology used in this guide to describe the KSN 765/770. User controls, color conventions, ***pop-up alerts***, and the acknowledgement page are also described in this section
- **Section 3 - Display States and Mode Control** - This section describes the display states and the modes to control the interactive display of the KSN 765/770.

- **Section 4 - Menu** – This section describes the modes and operation of the menu.

- **Section 5 - KSN 770 Radio** – This section describes the internal navigation and communication radio function of the KSN 770.

- **Section 6 - Navigation Map View** – This section describes the various navigation functions featured in the KSN 765/770.

- **Section 7 - Charts View** – This section describes viewing National Aeronautical Charting Office (NACO) terminal charts.

- **Section 8 - Terrain View** – This section describes the terrain awareness function which uses an internal terrain database to provide terrain and obstacle awareness.

- **Section 9 - Traffic View** – This section describes the traffic awareness display of the KSN 765/770.

- **Section 10 - Datalink Weather View** – This section describes the graphical and textual descriptions of weather-related information received from XM WX Satellite weather.

- **Section 11 - Weather Radar View** – This section describes the airborne weather radar and the various external weather radar sensor that can be installed.

- **Section 12 - Lightning Detection View** – This section describes the lightning detection display and control function which gives the ability to control and display the WX-500 Stormscope® Series II weather mapping sensor.

- **Section 13 - Terrain Awareness and Warning System (TAWS) View** – This section describes the TAWS function which displays the Honeywell enhanced ground proximity warning system (EGPWS).

- **Section 14 - Course Deviation Indicator (CDI) and Switching View** – This section describes the ***CDI*** page view which indicates lateral deviation from the centerline of a selected GPS course.

- **Section 15 - Flight Management System (FMS)** – This section describes the FMS functionality which provides flight planning capability and navigation information to the flight crew.

- **Section 16 - Database Loading Procedures** – This section describes how to update the various databases installed on the KSN 765/770.

CUSTOMER SUPPORT

Contact BendixKing customer support at the follow numbers:

- 1-855-250-7027 (Toll Free U.S.A./Canada)
- 1-602-365-7027 (International Direct)

Website: www.bendixking.com/support

KSN 765/770 operation training is available online at the following URL:

http://ksn.app.bendixking.com/training/

BENDIXKING TECHNICAL PUBLICATIONS

Updates to this pilot guide will be posted on the BendixKing website (www.bendixking.com).

Questions about this publication can be sent to

- techsupport@bendixking.com

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2. User Interface and System Overview

INTRODUCTION

The KSN 765/770 is a Multifunction Display with an internal GPS receiver, NAV/Comm Radio, and a Flight Management System (FMS) that manages flight data from departure to arrival. This section provides a user interface and system overview of the KSN 765/770.

TERMINOLOGY AND DESCRIPTIONS

The KSN 765/770 has two functions; the ***MFD function*** and the ***FMS function***. The MFD function displays a variety of navigation, weather, terrain, obstacle, and traffic information. The FMS function allows the flight crew to establish a specific routing for the aircraft from the departure airport to destination airport.

When the MFD function or FMS function is selected, a ***page*** is displayed. The MFD function and FMS function both contain three pages. Each page is segmented into ***windows***. A window represents the physical location on the screen within which a ***view*** is presented.

A physical arrangement of windows on a page is called the ***layout***. Each layout is predefined and cannot be changed. However, the content of the view displayed within the windows can be customized. Figures 2–1 and 2–2 show the possible MFD and FMS layouts.

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The MFD layout is shown in Figure 2-1.

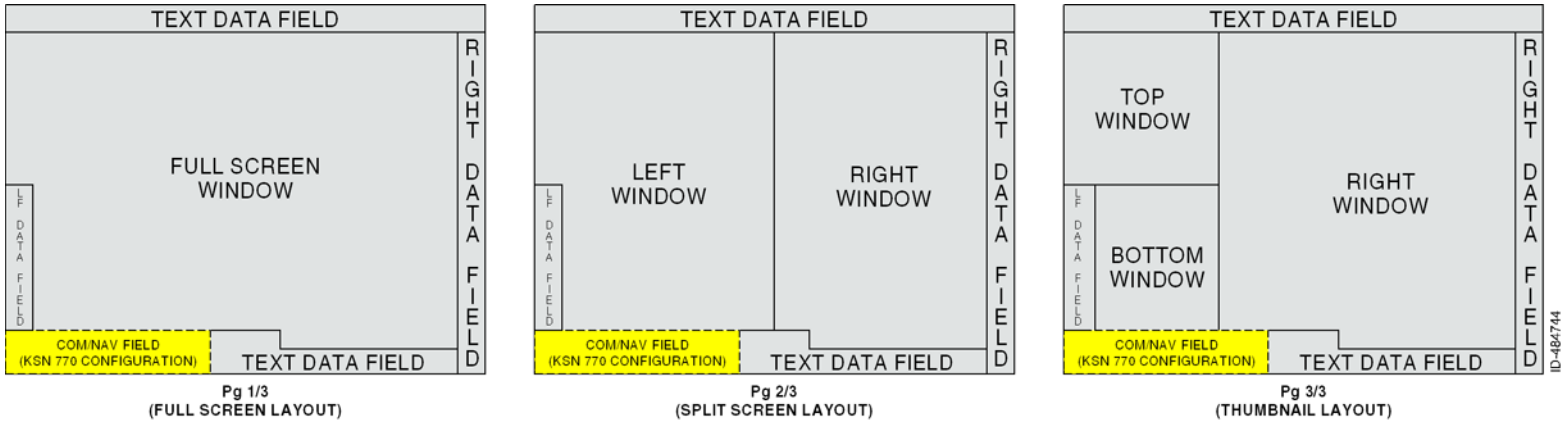


Figure 2-1
MFD Layouts

The FMS layout is shown in Figure 2-2.

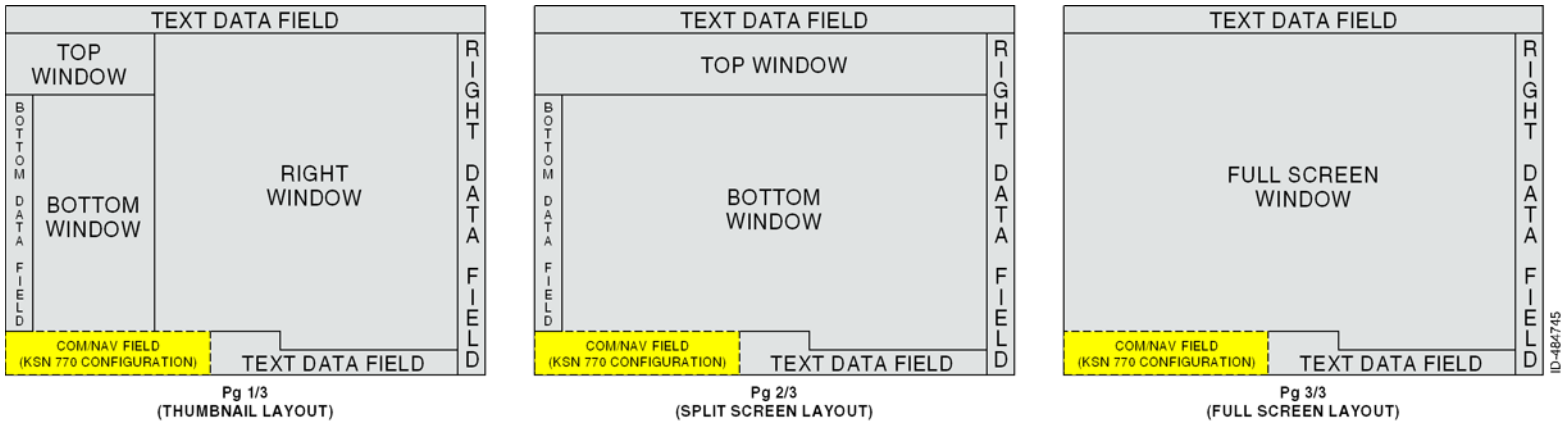


Figure 2-2
FMS Layouts

NOTE: The differences between the KSN 765 layouts and the KSN 770 layouts is the KSN 765 does not contain a COM/NAV field.

All windows contain a view. A view presents specific information within a window. The view name is displayed in the upper-left corner of the window. In the MFD function, multiple views can be selected within a window. The MFD function can display the following views.

- ***Navigation Map View***
- ***Terrain View***
- ***Traffic View*** [1]
- ***Datalink Weather View*** [1]
- ***Lightning View*** [1]
- ***Weather Radar View*** [1]
- ***Terrain Awareness and Warning System (TAWS) View*** [1]
- ***Charts View***
- ***GPS Course Deviation Indicator View***.

NOTE: [1] indicates an optional feature which requires an external sensor or subscription

In the FMS function, the view within a window is predefined and cannot be changed but the content within the view is still customizable.

NOTE: The FMS function is described in detail in Section 15, Flight Management System (FMS).

To change the view within a window, the window needs to have ***focus***. A focused window is visually represented by a magenta border outline, as shown in the upper-left corner of Figure 2-3. When the focus is on a window, context-sensitive controls apply to the window and view.

NOTE: Focus and controls are described in detail in Section 3, Display States and Mode Control.

Figure 2-3
FOCUS

USER CONTROLS

The KSN 765/770 is controlled through a combination of various knobs, ***dedicated bezel keys***, ***bezel softkeys***, ***touchscreen buttons***, an interactive touchscreen, and keypads. This section provides an introduction to the controls of the KSN 765/770. The individual functionalities are described in detail later in the guide. The KSN 770 is shown in Figure 2–4.

Figure 2–4
KSN 770 User Controls

The KSN 770 features the following controls:

- ***Volume Knob***
- ***Radio Control Knob***
- ***Joystick Knob***
- ***Dedicated Bezel Keys***
  - — ***Zoom-In/+ Bezel Key***
  - — ***Zoom-Out/- Bezel Key***

  - — ***Frequency Swap Bezel Key***
  - — ***Direct-To Bezel Key***
  - — ***FMS Bezel Key***
  - — ***MFD Bezel Key***
  - — ***MENU Bezel Key***
  - — ***PAGE Bezel Key***
  - — ***VIEW Bezel Key***
- ***Bezel Softkeys***
- ***Touchscreen Buttons***
- ***Volume Overlay Control***
- ***Keypads***.

NOTES:
1. The KSN 765 shares all of the previously mentioned controls of the KSN 770, with the exception of the Volume Knob and the Radio Control Knob.
2. The KSN 765/770 does not have a power button. The unit powers–on with the aircraft avionics.

Volume Knob (KSN 770 Only)

Clockwise rotation of the volume knob increases the volume and counterclockwise rotation decreases the volume of the selected radio. Pushing the knob turns the squelch/ID on or off. The ID function decodes NAV radio Morse code to display the identifier.

Radio Control Knob

Rotating the outer knob of the radio control knob tunes the selected radio standby megahertz (MHz) frequency (the digits to the left of the decimal point). Rotating the inner knob tunes the selected radio standby kilohertz (kHz) frequency (the digits to the right of the decimal point). Pushing the knob toggles the COM and NAV frequencies.

Joystick Knob

The joystick knob provides a rotation control, push function, and a toggle function. This control can be used for panning, scrolling, data input, and selecting items.

Dedicated Bezel Keys

Dedicated bezel keys have only one function. The following paragraphs describe the dedicated bezel keys on the KSN 765/770.

ZOOM-IN/+ AND ZOOM-OUT/- BEZEL KEY

When the view within a selected window contains an adjustable range, the range is increased by pushing the zoom-out/- bezel key and decreased by pushing the zoom-in/+ bezel key. When the menu is displayed, the zoom-in/+ and zoom-out/- bezel keys are used to increase and decrease the screen brightness.

FREQUENCY SWAP BEZEL KEY

Pushing the frequency swap bezel key changes the standby frequency to the active frequency and the active frequency to the standby frequency. On the KSN 765, the bezel key exists but has no function.

DIRECT-TO BEZEL KEY

Pushing the Direct-To bezel key displays the **DIRECT TO** pop-up window where the pilot can enter direct routes to flight plan waypoints, airports, NAVAIDs, intersections, and user waypoints.

FMS BEZEL KEY

Pushing the FMS bezel key selects the FMS function and returns the FMS function to page 1/3 with focus on the window titled HOME.

MFD BEZEL KEY

Pushing the MFD bezel key selects the MFD function.

MENU BEZEL KEY

Pushing the MENU bezel key activates the menu and displays a context-sensitive list of MFD functions and FMS function options.

PAGE BEZEL KEY

Pushing the PAGE bezel key toggles the layouts in the selected function (MFD or FMS).

VIEW BEZEL KEY

When the MFD function is selected, pushing the VIEW bezel key changes the view within the selected window. The view content is the data that is displayed in each window (for example, terrain, traffic, stormscope, etc.). When the FMS function is selected, pushing the VIEW bezel key has no control function and the annunciation **No VIEW control in FMS function** is displayed.

The view selection state is described in detail in Section 3, Display States and Mode Control.

Bezel Softkeys

Bezel softkeys are software configurable keys that perform context-sensitive functions based on the focused window. The KSN 765/770 has five right bezel softkeys and two left bezel softkeys, as shown in Figure 2-4. When a bezel softkey performs an action, a ***bezel softkey label*** is displayed adjacent to the bezel softkey. When no label is displayed, no action is performed when the adjacent bezel softkey is pushed.

Bezel softkeys are described in detail in Section 3, Display States and Mode Control.

Interactive Touchscreen Interface

The KSN 765/770 features an integrated resistive touchscreen display. The touchscreen functionality is used for various tasks including (but not limited to) touchscreen button selection, map panning, data input using the appropriate on-screen keypad, and scrolling (by touching and dragging a scroll bar when displayed).

Resistive touchscreen displays respond to pressure put on the surface and have proven reliability. Contact can be made with a finger or any other pointing device. The KSN 765/770 units work well with both gloved fingers and bare fingers.

The touchscreen becomes active when pressed. After 5 seconds of no touchscreen activity, the touchscreen becomes inactive. This is to prevent inadvertent activations.

Keypads

The KSN 765/770 contains a ***QWERTY keypad*** and a ***numeric keypad***, as shown in Figure 2-5. Data is entered into the QWERTY keypad by toggling the joystick knob or using the touchscreen display. The left and right toggle function of the joystick knob advances to the next available character in the pilot-selected identifier field. Rotating the joystick knob changes the selection of letters and numbers of the identifier field.

Figure 2-5
QWERTY Keypad

As data is entered into the QWERTY keypad, characters on the keypad are filtered to show valid remaining selections. Valid selections stand out as brighter keys, such as OK shown in Figure 2-5, and invalid selections are shown as dimmer keys, such as M shown in Figure 2-5.

To accept the data entry, push in the joystick knob (as indicated by PUSH FOR OK• in the lower-right corner) or use the touchscreen to push OK .

NOTE: When the identifier field is selected and no character is highlighted, the lower segment of the display is blank.

Scroll Bars

When the amount of text displayed exceeds the displayable limits of the window, a scroll bar is displayed to the right of the list, as shown in Figure 2-6.

Figure 2-6
Scroll Bars

When the scroll bar is displayed, the text can be scrolled by dragging the scroll bar using the touchscreen display. The text can also be scrolled using the joystick.

COLOR CONVENTION

Color is used to highlight key information and to help aid the pilot in determining editable and non-editable states of the KSN 765/770. Table 2-1 provides an overview of the KSN 765/770 color convention.

Table 2-1
Color Convention

Color	Purpose
RED	Used to indicate temporary flight restrictions (TFRs), weather areas, terrain, obstructions, and warning annunciations that require immediate pilot recognition. Also used as the strike through color for datalink weather age annunciations and WX-500 rate annunciators when failures occur.
AMBER	Used to indicate weather, traffic, terrain, obstructions, caution annunciations and failure annunciations that require immediate pilot awareness.

Table 2-1 (cont)
Color Convention

Color	Purpose
MAGENTA	Used to identify the selected window, active control functions, depicting navigation map features, the active GPS navigation leg, weather, and terrain data.
CYAN	Used to indicate inactive control functions and for depicting the track line, terrain data, traffic data, and weather data.
GREEN	Used for navigation maps features, weather data, terrain and obstruction data, navigation information and mode data related to or provided by the navigation source (i.e., navigation deviations or equipment operating modes).
DARK BLUE	Used with saturated green to show the status of softkeys.
SATURATED GREEN	Used with dark blue to show the status of softkeys and declutter level. Also used to show some primary navigation information, NAV ID, and GPS modes (black background) and the active COM or NAV frequency (gray background).
WHITE	Used to indicate terrain data and general information and menu items that are selectable for editing.
GRAY	Used to show menu items that are not selectable for editing.
BLUE	Used to indicate weather data and navigation map features.
BROWN	Used to indicate navigation map features.

The following paragraphs describe of Warnings, Cautions, and Notes used throughout the guide.

WARNING

INDICATES A CRUCIAL OPERATING PROCEDURE THAT, IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY TO, OR DEATH OF, PERSONNEL OR LONG TERM HEALTH HAZARDS. INDICATES THE POSSIBLE NEED FOR IMMEDIATE CORRECTIVE ACTION.

CAUTION

INDICATES AN ESSENTIAL OPERATING PROCEDURE THAT, IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF, EQUIPMENT. INDICATES THE POSSIBLE NEED FOR FUTURE CORRECTIVE ACTION.

Notes are used to highlight an important operating procedure, condition, or statement.

POP-UP ALERTS

Pop-up alerts are displayed to prompt the pilot for a decision and/or an acknowledgement. Pop-up alerts, shown in Figure 2-7, require a response before the system can continue to be used.

NOTE: All pop-up alerts continue to allow control of the ***CDI***, radios (through dedicated knobs and bezel softkeys), volume, and menu (for brightness).

Figure 2-7
Pop-Up Alert

Pop-up alerts are prioritized in the following order:

- Traffic advisory
- Missed approach
- Airport diagram
- Manual sequence of altitude legs.

Table 2-2 lists the pop-up alert label colors.

Table 2-2
Pop-Up Alert Label Colors

Color	Definition
RED TEXT ON BLACK BACKGROUND	Key is active for selection and the alert condition requires immediate pilot recognition.
AMBER TEXT ON BLACK BACKGROUND	Key is active for selection and the alert condition requires immediate pilot awareness.
WHITE TEXT ON GRAY BACKGROUND	Key is active for selection.

Each pop-up alert is described in detail within its respective section.

TEXT DATA BAR

The text data bar, shown in Figure 2-8, is always displayed at the top of the screen and displays the following:

- Radio control (KSN 770 only)
- Wind speed and direction relative to the nose of the aircraft
- From, To, and Next waypoint
- Suspend annunciation (when active)
- Distance-to-go (DTG) along the path displayed to next waypoint
- Desired track (DTK)
- Actual Track (TRK)
- Groundspeed (GS).

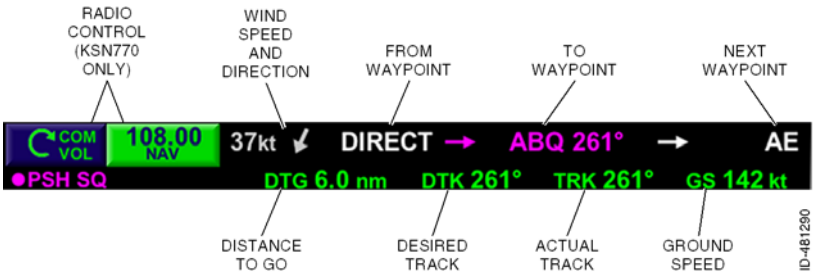


Figure 2-8
Text Data Bar

Wind speed is displayed in knots and the wind direction arrow is displayed graphically relative to the nose of the aircraft. When the true airspeed is below 40 knots or the aircraft is on the ground, the wind speed and direction arrow are removed from display (showing a blank on the display). The wind speed and direction arrow are also removed from display when the wind speed is less than 10 knots or greater than 99 knots. When the wind parameter is set to On, **WIND** is displayed in place of the wind speed and direction arrow if any of the following failure annunciations/conditions are detected:

- **GPS FAIL**
- **TAS FAIL**
- **HDG FAIL**
- Track fail
- Groundspeed invalid.

WIND is also displayed when in the polar regions when magnetic variation is not available.

The active TO waypoint is displayed in magenta when guidance to the waypoint is active, and green when guidance to the waypoint is available but not active. If **LOSS OF NAV** is displayed, the active TO waypoint is displayed in white.

The From and Next waypoints are always displayed in white. The DTG, DTK, TRK, and GS are always displayed in green.

NOTE: When a discontinuity is active, the TO waypoint, DTG, and DTK fields are displayed as dashes.

When a message condition is triggered, the message field is displayed in the upper-line of the text data bar and is prioritized in the following order:

- TAWS messages
- FMS messages - Alerting
- FMS messages - Advisory.

TAWS and Alerting messages are persistent and must be manually cleared using the joystick knob. Advisory messages are displayed for 5 seconds and then automatically removed.

LOW ALT is displayed over the groundspeed field in the text databar as black text in a yellow background box and indicates the low altitude alert has been reached. This is only available when TAWS is not interfaced with the KSN 765/770.

An FMS message condition is shown in Figure 2-9. FMS messages are described in Section 15, Flight Management System (FMS).

Figure 2-9
FMS Message

When a flight plan offset is active, the direction and distance of the offset is displayed in the text data bar next to **PSH SQ** . Flight plan offsets are described in detail in Section 15, Flight Management System (FMS).

The **SUSPEND** annunciation, shown in Figure 2-10, replaces the next waypoint when in Suspend. Suspend is described in detail in Section 15, Flight Management System (FMS).

Figure 2-10
SUSPEND Annunciation

Invalid States

When the active flight plan is not available, dashes are displayed in place of the following:

- The FROM waypoint
- The TO waypoint
- The next waypoint.

When the distance, desired track, track, or groundspeed is not available or is invalid, the numerical value on the text data bar is displayed in green dashes (---).

Distance and actual track are dashed when in dead reckoning mode.

If a loss of navigation condition exists and the GPS position is invalid, the distance, actual track, and groundspeed are dashed.

AIRCRAFT SYMBOL (OWNSHIP)

The ownship symbol provides a visual representation of the present position in relation to geography and the active flight plan.

NOTE: When heading is not available or invalid, and GPS ground track is available, the ownship is displayed using GPS track data. When both heading and GPS track are not available or invalid, the ownship symbol is removed from display.

TRUE NORTH ORIENTATION INDICATOR SYMBOL

The true north orientation indicator symbol is displayed in the upper-left corner of the navigation map display, charts display, and datalink weather display. The orientation indicator is turned on or off via the menu.

ACKNOWLEDGEMENT CONFIRMATION PAGE

When the KSN 765/770 is powered up, an acknowledgement confirmation page is displayed. Databases installed on the unit are displayed along with the expiration date of each database, as shown in Figure 2-11.

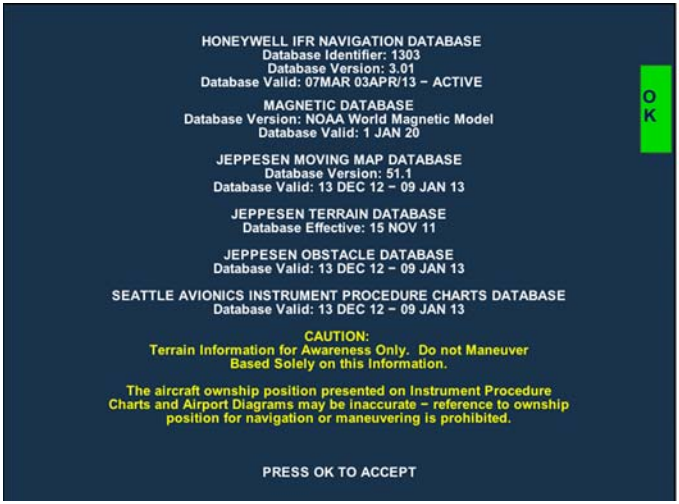


Figure 2-11
Acknowledgement Confirmation Page

The power-up display lists the six databases installed. The following is a list of the installed databases and the associated functions:

- Honeywell IFR Navigation Database - Contains navigation database information and is described in detail in Section 15, Flight Management System (FMS).
- Magnetic Database - Contains magnetic variation data derived from an NOAA World Magnetic Model.
- Jeppesen Moving Map Database - Contains feature data displayed on the moving map and is described in detail in Section 6, Navigation Map View.
- Jeppesen Terrain Database - Contains terrain data and is described in detail in Section 8, Terrain View.
- Jeppesen Obstacle Database - Contains obstacle data and is described in detail in Section 8, Terrain View.

- Seattle Avionics Instrument Procedure Charts Database – Contains National Aeronautical Charting Office (NACO) charts displayed using the charts function and is described in detail in Section 7, Charts View.

Terrain and ownship caution messages are also displayed. The **OK** bezel softkey must be pushed to accept responsibility for all databases installed as well as caution messages, before access to the functions of the KSN unit is permitted.

NOTE: The KSN 765/770 may display Database Init or Loading momentarily after the **OK** bezel softkey is pushed. The system is ready when the message is no longer displayed.

Expired databases are displayed in amber text with a black background as **Database Expired** below the database version. Also, **One or more Databases are expired** is displayed at the bottom of the power-up display when any of the databases are expired, as shown in Figure 2-12.

Figure 2-12
Database Expired and Not Yet Valid

Databases that are not yet valid are displayed in amber text with a black background as **Database Not Yet Valid** below the database version.

3. Display States and Mode Control

INTRODUCTION

This section describes the display states and the modes to control the interactive display of the KSN 765/770.

PAGE LAYOUT

The ***MFD function*** and ***FMS function*** are segmented into three predefined ***layouts*** that the pilot can select from. Layouts are changed by pushing the ***PAGE bezel key***.

Pushing the PAGE bezel key toggles through the three predefined ***page*** layouts in the following order:

- **Pg 1/3 → Pg 2/3 → Pg 3/3 → Repeat**

NOTE: The previously selected layout is displayed after a power cycle of the unit.

The MFD function and FMS function have different predefined layouts. The following paragraphs describe the MFD and FMS layouts.

MFD Layouts

The MFD layouts are displayed by pushing the ***MFD bezel key***. When a MFD layout is displayed, pushing the PAGE bezel key toggles through the following pages.

- **Full Screen Layout → Split Screen Layout → Thumbnail Layout → Repeat**

NOTE: The previously selected layout is displayed after a power cycle of the unit or when leaving the MFD function and return to it.

FULL SCREEN LAYOUT

The full screen layout uses the entire ***MFD*** to display the various selectable ***views***. Figure 3-1 shows an example of the full screen layout in the ***navigation map view***.

Figure 3-1
Full Screen Layout

The full screen layout supports the following views in the following order:

- Navigation Map (**NAV MAP**)
- Datalink Weather (**WX**) [1]
- Terrain (**TERR**)
- Traffic (**TRFC**) [1]
- Stormscope® (**STRIKES**) [1]
- Charts (**CHARTS**) [1]
- Weather Radar (**WX RADAR**) [1]
- Terrain Awareness and Warning System (**TAWS**) [1]
- GPS Course Deviation Indicator (**GPS CRS DEV**).

NOTE: [1] indicates additional equipment and/or subscription is required. When the additional equipment required for the view to function is not installed, or the view is disabled during installation, the view is not displayed and the next available view is displayed.

SPLIT SCREEN LAYOUT

The split screen layout splits the MFD display area into half and displays two views at once. Figure 3-2 shows an example of the split screen layout with the left side displaying the ***terrain view*** and the right side displaying the navigation map view.

Figure 3-2
Split Screen Layout

When the MFD function is active, the right and left ***window*** in the split screen layout supports the following views in the following order:

- Navigation Map (**NAV MAP**)
- Datalink Weather (**WX**) [1]
- Terrain (**TERR**)
- Traffic (**TRFC**) [1]
- Stormscope® (**STRIKES**) [1]
- GPS Course Deviation Indicator (**GPS CRS DEV**).

NOTE: [1] indicates additional equipment and/or subscription is required. When the additional equipment required for the view to function is not installed, or the view is disabled during installation, the view is not displayed and the next available view is displayed.

When weather view is selected on one of the split screens, the other split screen supports all other views with the exception of the following:

- Navigation Map (**NAV MAP**)
- Weather (**WX**).

When the navigation map view is selected on one of the split screens, the other split screen supports all other views with the exception of the following:

- Navigation Map (**NAV MAP**)
- Weather (**WX**).

THUMBNAIL LAYOUT

The thumbnail layout splits the MFD display area into three areas. Figure 3-3 shows an example of the thumbnail layout with the top-left thumbnail displaying the ***traffic view***, the lower-left thumbnail displaying the terrain view, and the right window displaying the navigation map view.

Figure 3-3
Thumbnail Screen Layout

The top-left window in the thumbnail layout supports the following views in the following order:

- Terrain (**TERR**)
- Traffic (**TRFC**) [1]
- Stormscope® (**STRIKES**) [1]
- GPS course deviation indicator (**GPS CRS DEV**).

The bottom-left window in the thumbnail layout supports the following views in the following order:

- Terrain (**TERR**)
- Traffic (**TRFC**) [1]
- Stormscope® (**STRIKES**) [1]
- GPS course deviation indicator (**GPS CRS DEV**).

The right window in the thumbnail layout supports the following views in the following order:

- Navigation map (**NAV MAP**)
- Datalink Weather (**WX**) [1]
- Terrain (**TERR**)
- Traffic (**TRFC**) [1]
- Stormscope® (**STRIKES**) [1]
- GPS Course Deviation Indicator (**GPS CRS DEV**).

NOTE: [1] indicates additional equipment and/or subscription is required. When the additional equipment required for the view to function is not installed, or the view is disabled during installation, the view is not displayed and the next available view is displayed.

FMS Layouts

The FMS layouts are displayed by pushing the ***FMS bezel key***. When a FMS layout is displayed, pushing the PAGE bezel key toggles through the following pages.

- **FMS Home Page → Waypoint Detail Page → Utility Page → Repeat**

Alternating views within the FMS function pages is not permitted. The FMS function is described in detail in Section 15, Flight Management System (FMS).

VIEW CONTROL MODE

The pilot can choose the displayed view in each window. To change the view within a window, the window must have focus. The window with focus is indicated by a magenta-framed **border** which differentiates the selected window from the other windows displayed. The ***bezel softkey labels*** associated with the window with focus are displayed along the right side of the display, as shown in Figure 3-4.

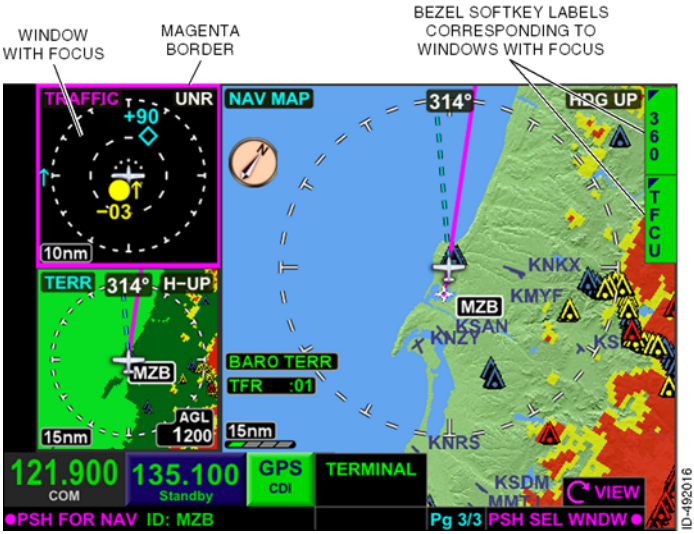


Figure 3-4
Window Selection

Focus Selection

The full screen layout always has focus and does not need to be selected. When the split screen layout is selected, pushing in the ***joystick knob*** alternates the magenta-framed **border** from the left- and right-side display. When the thumbnail screen layout is displayed, pushing in the joystick knob alternates the magenta-framed **border** from right-to-bottom, bottom-to-top, and top-to-right.

NOTE: A window can also be selected directly by using the touchscreen to select the desired window.

View Selection

Within each window, the pilot can control the displayed view. Pushing the ***VIEW bezel key*** at any time or rotating the joystick knob when the view selection state is active changes the content of the window to a new view. Pushing in the joystick knob or pushing the VIEW bezel key activates the view selection state. When the view selection state is active, the VIEW annunciator, displayed in the lower-right corner of the display, changes to VIEW , as shown in Figure 3-5.

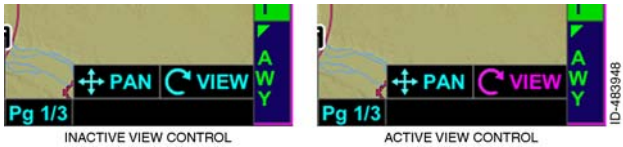


Figure 3-5
Inactive and Active View Control State

When the end of the available views is reached, continued pushes of the VIEW bezel key returns to the first available view.

The joystick knob can be turned clockwise or counterclockwise to sequence through the available views. However, once the pilot reaches the end of the available views, the view does not wrap to the first available view.

It is possible to have the same window content in the split screen or thumbnail layout. Setting two or more windows to the same window content enables the pilot to set different range scales for situational awareness.

In addition to using the joystick knob and the VIEW bezel key, the touchscreen can be used to change the displayed view. While the touchscreen is active, touching the view name ***touchscreen button***, located in the upper-left corner, displays a view selection menu where any of the available views can be selected.

For example, when the navigation map view is inactive, the NAV MAP (non-embossed) view name is displayed in the upper-left corner. When the touchscreen is activated, the embossed NAV MAP touchscreen button is displayed. Touching the NAV MAP touchscreen button displays the view selection menu, shown in Figure 3-6. A new view can be selected by using the touchscreen to select the title of the new view.

Figure 3-6
View Selection Menu

LEFT AND RIGHT BEZEL SOFTKEYS

Left- and right-side ***bezel softkeys*** are software configurable keys that perform context-sensitive functions based on the focused window. Bezel softkey labels are displayed next to the bezel softkeys that perform actions. There are five right-side bezel softkeys (referred to as R1 through R5) and two left-side bezel softkeys (referred to as L1 and L2). Bezel softkeys and bezel softkey labels are displayed in Figure 3-7.

NOTE: When a bezel softkey is pushed and no bezel softkey label is displayed beside it, nothing happens.

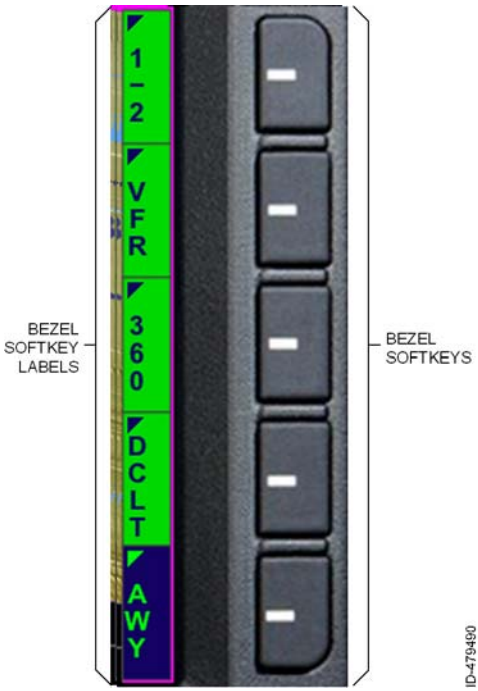


Figure 3-7
Bezel Softkeys and Bezel Softkey Labels

Bezel Softkey Labels

Bezel softkey labels are software-configurable display labels that perform context-sensitive functions based on the focused window. Bezel softkey labels are adjacent to bezel softkeys.

Active/Inactive Bezel Softkey Labels

When a bezel softkey label is displayed as **blue text on a green** background, that key is active. Opposite that, when a bezel softkey label is displayed as **green text on a blue** background, that key is inactive. For example in Figure 3-8, the 360° view is active and the legend is inactive, as indicated by the **360** and **LGND** bezel softkey labels.

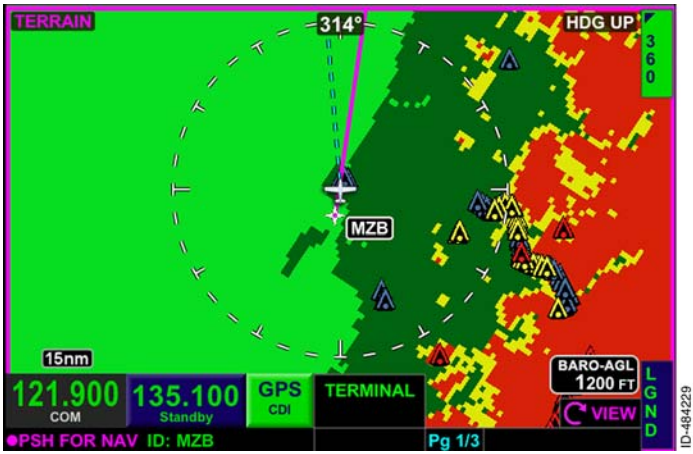


Figure 3-8
Bezel Softkey Labels

Some bezel softkey labels contain a triangular tag in the upper-left corner, which indicates the label has other options that can be toggled through when the adjacent bezel softkey is pushed. For example, pushing the bezel softkey adjacent to the **360** bezel softkey label toggles to the **ARC** bezel softkey label.

Touchscreen Buttons

Touchscreen buttons are touch sensitive and can be activated by tapping with a finger, stylus, or other pointing device. When a touchscreen button is available for selection, the touchscreen button has a raised, embossed border. The standby frequency and ***CDI*** navigation source indicator shown here are examples of touchscreen buttons.

The touchscreen is inactive until pressed. This is to prevent inadvertent activations. When the touchscreen is active, some touchscreen buttons become embossed and available for selection, such as the view name.

After 5 seconds of not being touched, the view name or associated dropdown menu becomes inactive.

PANNING

The KSN 765/770 has the capability of panning the displayed view to the left, right, up, or down for the following MFD function views:

- ***Navigation map view***
- ***Weather view***
- ***Charts view***.

Panning View Control Mode

When in navigation map view, weather view, or charts view, panning is activated by momentarily pushing the joystick knob in any direction. Panning mode is indicated by a magenta **PAN** symbol displayed in the lower-right corner of the display and **PAN MODE** displayed in the upper-center of the navigation map display, as shown in Figure 3-9.

NOTE: **PAN MODE** is displayed in the upper-right corner for charts view and weather view.

Figure 3-9
Panning Activated Navigation Map Display

When panning is activated, the navigation map, weather, and charts display freeze in the last orientation and do not move to reflect changes in aircraft heading. The ownship symbol continues to orientate with aircraft heading or track. Caution should be used when panning and maneuvering to avoid potential disorientation.

When the panning is activated, **PSH FOR BACK•** and **Zoom** are displayed in the lower-right corner to indicate zoom can be controlled by rotating the joystick knob. Also, **LOCKED** is displayed below the true north orientation indicator symbol, which reminds the pilot that when in panning mode, the display freezes in the last orientation and does not move to reflect changes in aircraft heading.

NOTE: When panning is activated, the true north orientation indicator is displayed, even when selected off in the menu.

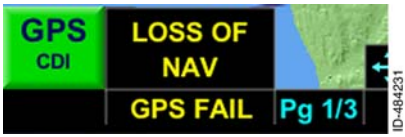
When panning is activated, the view is centered when the ***zoom-in/+*** or ***zoom-out/- bezel key*** is pushed or the joystick is rotated to zoom in and out on the location of the cursor.

When panning is active, any of the following actions disables panning:

- Pushing the PAGE bezel key
- Pushing the VIEW bezel key
- Pushing in the joystick knob.

When panning becomes inactive, the ownship symbol becomes centered within the window. When inactive, VIEW is displayed in the lower-right corner of the display.

FAILURE/STATUS ANNUNCIATIONS



Failure/status annunciations are provided in the lower-center display window (shown here as GPS FAIL). When no failure annunciations are detected, a black background box is in the lower window. When multiple failure annunciations are detected, the KSN 765/770 will alternate between all detected failure annunciations.

The following failure/status annunciations are provided in the lower-center display window of the KSN:

- GPS FAIL
- GPS ACQ (Acquisition)
- LOI (Loss of Integrity)
- FMS INOP
- INOP FAN
- OVER TEMP
- STUCK MIC
- XMIT FAIL
- ALT FAIL
- HDG FAIL
- TAS FAIL
- RAIM FAIL
- NAV DB FAIL .

NOTE: STUCK MIC and XMIT FAIL annunciations are described in detail in Section 5, KSN 770 Radio.

GPS Failure Annunciation

Within 1 second of the internal GPS sensor failing, malfunctioning, or becoming invalid, the amber failure annunciation **GPS FAIL** is displayed. If the failure persists, this condition must be checked/repaired before next flight.

All system functions relying on GPS position will be unavailable, including:

- FMS navigation, approach, and guidance capability (use an alternate navigation system)
- Terrain awareness
- Map, overlay, and sensor views based on GPS position and/or track
- Wind estimates.

GPS Acquisition Status Annunciation

When an insufficient number of GPS satellites for a valid solution cannot be tracked by the receiver, the **GPS ACQ** annunciation is displayed. If the system is in the en route phase of flight when this occurs, the FMS will transition to dead reckoning operation. All other system functions of GPS data will treat this the same as a **GPS FAIL** .

Ensure that the GPS antenna has a clear view of the sky. If the condition persists, this condition must be checked/repaired before next flight.

GPS Loss of Integrity Status Annunciation

The loss of integrity (**LOI**) annunciation indicates that satellite coverage is insufficient to pass built-in integrity monitoring tests applicable to the phase of flight. Another approach or alternate navigation system may have to be used. Monitor the GPS position using alternate sources.

FMS Failure Annunciation

An **FMS INOP** annunciation is displayed when the internal FMS fails, malfunctions, or becomes inoperative. The ownship symbol is removed and all flight plan legs are displayed in white (no active legs) when this condition exists. The KSN can no longer be used for navigation/approach and may require servicing. The GPS function is still available for other system functions.

Fan Failure Annunciation

An amber **INOP FAN** annunciation is displayed when one or both of the internal fans fails. No immediate action is required but it should be repaired before next flight.

Over Temp Status Annunciation

An amber **OVER TEMP** annunciation is displayed when the internal temperature of the unit exceeds the predefined limit. No immediate action is required but it is recommend to manually lower display brightness, and the use of KSN should be limited to 30 minutes after this message is displayed and may require servicing.

Altitude Failure Annunciation

An amber **ALT FAIL** annunciation is displayed when configured to receive baro-corrected altitude data and the altitude source is not detected or the altitude data is invalid. The following modes and information will not be available when **ALT FAIL** is annunciated:

- FMS legs with altitude terminated transitions must be manually sequenced
- Terrain awareness will annunciate use of GPS altitude.

If the condition persists, this condition must be checked/repaired before next flight.

Heading Failure Annunciation

An amber **HDG FAIL** annunciation is displayed when configured to receive heading data and the heading source is not detected or the heading data is invalid. When **HDG FAIL** is displayed, the following modes and information are not available:

- Heading Up Map views
- Flight Plan overlays on WX Radar view.

If the condition persists, this condition must be checked/repaired before next flight.

True Air Speed (TAS) Failure Annunciation

When configured to receive TAS data and the TAS source is not detected or the TAS data is invalid, the **TAS FAIL** annunciation is displayed. If TAS is not available, the estimated Wind Vector will not be shown.

If the condition persists, this condition must be checked/repaired before next flight.

Receiver Autonomous Integrity Monitoring (RAIM) Failure Annunciation

When a RAIM ranging fault is detected, the **RAIM FAIL** annunciation is displayed.

Navigation Database (NAV DB) Failure Annunciation

When a navigation database fail condition is detected, the **NAV DB FAIL** annunciation is displayed.

4. Menu

INTRODUCTION

This section describes the modes and operation of the menu.

MENU CONTROL OVERVIEW

The ***MENU bezel key*** is used to access the menu, shown in Figure 4-1, which enables the pilot to change operational preferences. The menu also provides access to status-only information. When the MENU bezel key is pushed, the last selected menu ***page*** is displayed.

Figure 4-1
Menu Overview

The menu has two modes:

- Navigation mode – Allows the pilot to navigate to different pages within the menu
- Edit mode – Allows the pilot to edit a menu option.

Navigation mode is the default menu state. In navigation mode, navigation between the six menu pages is accomplished by rotating the ***joystick knob***. Navigation mode is indicated by **Menu Page #/6** being displayed in the bottom-right corner.

NOTE: The menu cannot be operated or controlled using the touchscreen.

A menu list item becomes active for editing when the corresponding **bezel softkey** is pushed. Only one menu item can be active for editing at any time. Edit mode is indicated by **EDIT** , shown in FIgure 4-1, being displayed in the bottom-right corner in the place of **Menu Page #/6** .

In edit mode, adjusting the editable values is accomplished with the joystick knob. Also when in edit mode, scrolling between menu pages is not possible.

Pushing the MENU bezel key or pushing anywhere on the touchscreen removes the menu overlay from the display.

General Menu Operation

When edit mode is inactive, **Menu Page #/6** is displayed in the lower-right part of the display, where **#** is the menu page number and **6** is the total number of menu pages available.

When edit mode is inactive, rotating the joystick knob navigates between the menu pages. Rotating the joystick knob clockwise advances the next menu page and counterclockwise rotation returns to the prior menu page.

On reaching the end of available menu pages, continued rotation of the joystick knob does not result in the menu navigation wrapping to the beginning or end of the menu page list.

Menu items editable but not active for editing are displayed as white **text** on a blue background, as shown in Figure 4-2.

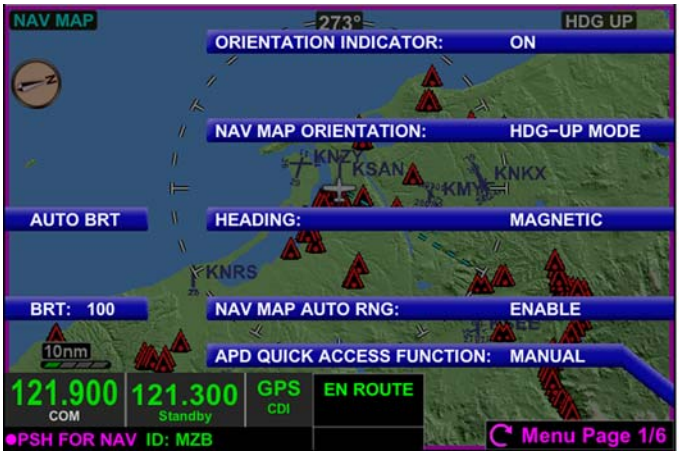


Figure 4-2
Editable Menu Item

Non-editable or status-only menu items are displayed as green **text** on a blue background, as shown in Figure 4-3.

Figure 4-3
Status Item

Menu items which have been disabled from editing are removed or display in gray **text** on a blue background, as shown in Figure 4-4.

Figure 4-4
Non-Editable Field

Edit Mode Operation

When edit mode is active, the editable value is displayed in magenta and the magenta EDIT annunciator is displayed in the lower–right corner, as shown in Figure 4–5.

Figure 4–5
Edit Mode Active

Rotating the joystick knob adjusts the editable value. Continued rotation of the joystick knob wraps through the available editable menu options.

Pushing the bezel softkey adjacent to the editable value or pushing in the joystick knob disables the field from editing and exits the edit mode. Pushing the bezel softkey adjacent to a different editable field enables that field for editing and disables the previously selected field for editing.

Menu Controls

When the MENU bezel key is pushed, six menu pages are viewable that permit control of various functions and display information that can be useful to the pilot.

Brightness control is available on the left-side of each page of the menu. Brightness control has two modes; manual (**MANUAL BRT**) and automatic (**AUTO BRT**). Toggling between the manual and automatic modes is accomplished by pushing the bezel softkey adjacent to **MANUAL BRT** or **AUTO BRT** . In manual mode, brightness can be controlled in two ways; Pushing the ***zoom-in/+ or zoom-out/- bezel keys*** or pushing the brightness level key (**BRT: 90** for example) and rotating the joystick knob to change the level. When the joystick knob can be rotated to change the brightness level, **BRT** is displayed in magenta. Manual mode has a range of 1 to 100. In automatic mode, backlight intensity is automatically adjusted based on the sensed ambient light conditions detected by the integral photocell. The power-up default is **AUTO BRT** .

Brightness control is always displayed while the menu is displayed to permit the pilot to quickly adjust the screen brightness. Also, in the event the screen becomes too dark for the pilot to view the menu, the pilot can always push the zoom-in/+ bezel key to increase the screen brightness. If not in Menu, push the ***FMS bezel key*** then push the ***MENU bezel key*** and then hold the zoom-in/+ bezel key to increase screen brightness.

NOTE: **MANUAL BRT** can also be selected by pushing the adjacent bezel softkey next to the brightness value when **AUTO BRT** is active.

Table 4-1 lists the functions available for selection in the menu.

Table 4-1
Menu Control States

Feature	Available Options/Range
Page 1/6	
Orientation Indicator	ON OFF

Table 4-1 (cont)
Menu Control States

Feature	Available Options/Range
Nav Map Orientation	N-UP MODE HDG-UP MODE TRK-UP MODE
Heading	MAGNETIC TRUE When TRUE is selected (or magnetic variation is invalid or unreliable), the TRUE values for course, heading, and track values are displayed with a T to the right of the value, as shown in Figure 4-6. When magnetic heading is not available or invalid, this option is displayed in gray and is set to TRUE.
Nav Map Auto Range	DISABLE ENABLE
Airport Diagram (APD) Quick Access Function	OFF AUTO MANUAL When charts is not enabled, this feature is displayed in gray and is disabled.
Page 2/6	
Nav Map Controlled Airspace (Class A, B,C, D, F, and G are included in this selection)	OFF AUTO
Nav Map Special Use Airspace (Prohibited and TFRs are not included in this selection as they are always ON regardless or declutter or range settings)	OFF AUTO

Table 4-1 (cont)
Menu Control States

Feature	Available Options/Range
Nav Map Flight Plan and Waypoints	OFF ON
Nav Map VORs (High, Low, Terminal – with and without the compass rose.)	OFF AUTO w/ ROSE AUTO w/o ROSE
Nav Map Intersections	OFF AUTO
Page 3/6	
Nav Map NDBs	OFF AUTO
Nav Map Hard Surface Airports	OFF AUTO
Nav Map Other Airports	OFF AUTO
Nav Map Transportation	OFF AUTO
Nav Map Boundaries	OFF AUTO
Page 4/6	
Timer Reset Condition	Air/Ground Power Up
Outside Air Temperature (OAT)	°C °F
Fuel (GAL/LB)	GAL LB
Barometric Pressure (IN/mB)	IN mB

Table 4-1 (cont)
Menu Control States

Feature	Available Options/Range
Baro Setting	28.10 to 30.99 (in increments of 0.01 when the BARO units are in IN) or 946 to 1049 (in increments of 1 when the BARO units are set to mB). This field is only displayed when the KSN 765/770 is configured to received uncorrected barometric altitude.
Page 5/6	
XM Serial Number	Status Only When XM Weather is not configured, this menu item is displayed in gray.
Signal Quality	Status Only – A detailed description is described in Section 10, Datalink Weather View. When XM Weather is not configured, this menu item is displayed in gray.
Status	Status Only – A detailed description is described in Section 10, Datalink Weather View. When XM Weather is not configured, this menu item is displayed in gray.
VHF Channel Spacing	25 kHz 8.33 kHz This menu item is removed from display for the KSN 765.

Table 4-1 (cont)
Menu Control States

Feature	Available Options/Range
Missed Approach Alert	DISABLE ENABLE Only displayed when the unit is configured for this field to be editable.
Page 6/6	
Selected Navigation Database Status	Status Only
Push To Change NAV DB Cycle	Provides Action
Hold For System Info	Pushing and holding the bezel softkey displays a SYSTEM INFO page. The SYSTEM INFO page displays detailed system information including the unit serial number and software version with part numbers. Information for the Honeywell IFR navigation database, charts database, and terrain database are displayed also.
Hold For Discrete Annunciator Test	When pushed and held, the KSN 765/770 activates the connected discrete annunciators.

When TRUE is selected (or magnetic variation is invalid or unreliable), the TRUE values for course, heading, and track are displayed with a T to the right of the value, as shown in Figure 4-6.

Figure 4-6
True Selected for NAV Map Orientation

DISCRETE ANNUNCIATOR TEST

When the **HOLD FOR DISCRETE ANNUNCIATOR TEST** menu item is held, the following remote annunciations will be lit if installed during the annunciator test:

- LNAV Approach Activate
- LNAV/VNAV Approach Activate
- LPV Approach Activate
- LP Approach Activate
- Dead Reckoning
- CDI GPS
- LOI
- Message
- Suspend
- CDI VLOC
- Waypoint.

5. KSN 770 Radio

INTRODUCTION

The ***bezel softkeys***, knobs, and touchscreen are used to control and tune the internal navigation and communication radios.

NOTE: The radio control mode is not supported by the KSN 765.

VOLUME CONTROL

The pilot controls the communication and navigation volume with the ***volume knob***, shown in Figure 5-1. When COM frequencies are displayed in the radio tuning window, rotating the volume knob controls the COM volume. When NAV frequencies are displayed in the radio tuning window, rotating the volume knob controls the NAV volume. Clockwise rotation of the volume knob increases the volume of the selected radio. Counterclockwise rotation of the volume knob decreases the volume of the selected radio.

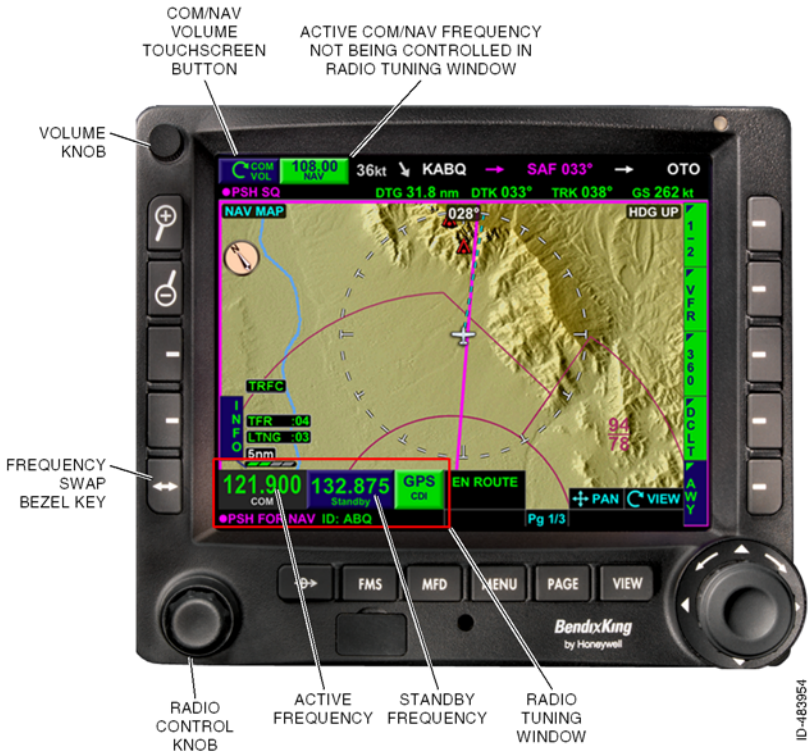


Figure 5-1
KSN 770 Radio Overview

When controlling COM volume, rotation of the volume knob or touching the COM VOL *volume touchscreen button* displays the COM radio pop-up window, as shown in Figure 5-2.

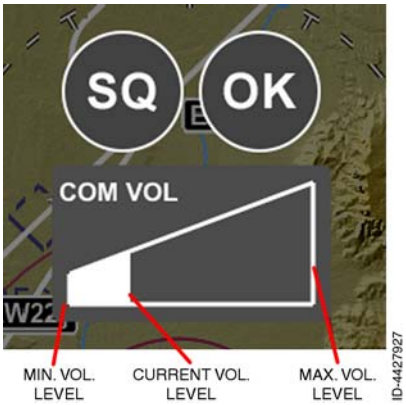


Figure 5-2
COM Radio Control Pop-Up Window

When controlling NAV volume, rotation of the volume knob or touching the NAV VOL volume touchscreen button displays the NAV radio pop-up window, as shown in Figure 5-3.

Figure 5-3
NAV Radio Control Pop-Up Window

Touching across the COM VOL or NAV VOL icon from left to right increases the volume. Touching across the COM VOL or NAV VOL icon from right to left decreases the volume.

The pop-up windows are removed from display after 5 seconds of inactivity.

COM SQUELCH AND NAV IDENTIFIER CONTROL

When the communication radio is the selected source, **•PSH SQ** is displayed in the upper-left corner of the display. Pushing the volume knob when **•PSH SQ** is displayed toggles the communication radio automatic squelch state between inactive to active, as shown in Figure 5-4.

NOTE: The squelch can also be toggled between mute and un-mute when the COM radio control pop-up window is displayed, shown in Figure 5-2.

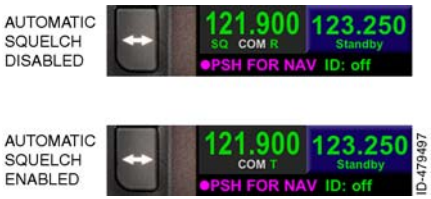


Figure 5-4
Squelch On and Off

When automatic squelch is inactive, **SQ** is displayed in the active COM frequency window. When automatic squelch is active, **SQ** is removed from display in the active COM frequency window.

When the communication system is receiving, a green **R** is displayed below the active frequency. When the system is transmitting, a green **T** is displayed below the active frequency, as shown in Figure 5-4.

When the navigation radio is the selected source, **•PSH ID** is displayed in the upper-left corner of the display. Pushing the volume knob when **•PSH ID** is displayed toggles the navigation identifier between off to on, as shown in Figure 5-5.

NOTE: The internal navigation identifier can also be toggled between on and off when the NAV radio control pop-up window is displayed, shown in Figure 5-3.

Figure 5-5
NAV Ident On and Off

When the navigation identifier is OFF, the NAVAID is not automatically tuned, as indicated by **ID: off** under the standby frequency.

When the NAVAID radio audio received from the tuned localizer or VOR is sufficient and the navigation identifier is ON, the identifier is displayed under the standby frequency next to **ID:** , as shown in Figure 5-5. When the NAVAID radio audio received from the tuned localizer or VOR is not sufficient, only **ID:** is displayed and the identifier field is blank.

The power-up default is NAV IDENT filter ON.

The COM/NAV radio control pop-up window displays the squelch and identifier states, shown in Figure 5-6. The squelch and identifier states can be controlled using the touchscreen.

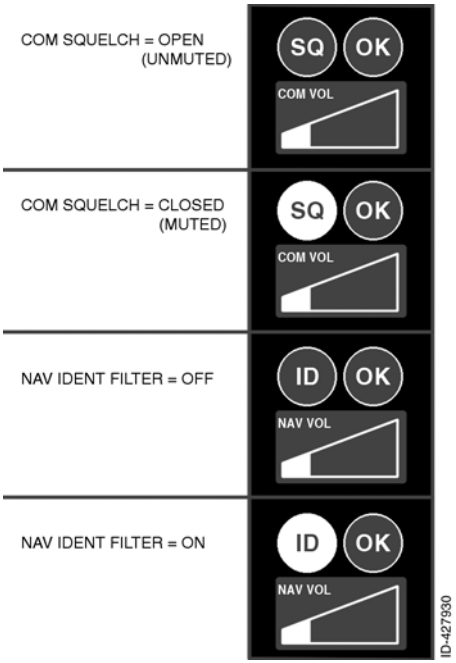


Figure 5-6
COM/NAV Pop-Up Window States

RADIO TUNING AND DISPLAY

The KSN 770 displays the standby and active frequencies of the selected internal radio in the lower–left corner of the display, shown in Figure 5–7. The active frequency is displayed in green with a gray background and the standby frequency is displayed in green with a blue background.

Figure 5–7
Standby and Active Frequencies

The standby/active frequencies are swapped by pushing the ***frequency swap bezel key*** next to the radio tuning window.

Rotating the outer knob of the ***radio control knob*** tunes the selected radio standby megahertz (MHz) frequency (the digits to the left of the decimal point). Rotating the inner knob tunes the selected radio standby kilohertz (kHz) frequency (the digits to the right of the decimal point).

When a frequency is tuned using the radio control knob, the standby frequency is displayed in magenta with a gray background, as shown in Figure 5–8, for 5 seconds. Within 5 seconds or when the frequency is made active (whichever occurs first), the standby frequency is displayed in green with a blue background.

Figure 5–8
Tuned Standby Frequency

When a COM or NAV frequency is tuned from the touchscreen (described later in this section), the standby frequency is displayed in white with a magenta background and fades away within 3 seconds to the normal display.

Switching Radio Sources

When the communication radio is the selected source, •PSH FOR NAV is displayed in the radio tuning window and the pilot can switch to the navigation radio source by pushing the radio control knob or by pushing the NAV label in the text data bar.

When the navigation radio is the selected source, •PSH FOR COM is displayed in the radio tuning window and the pilot can switch to the communication radio source by pushing in on the radio control knob or by pushing the COM label in the text data bar.

NOTE: Navigation frequencies are displayed for 30 seconds and then revert back to COM frequencies.

VHF COM

The pilot uses the menu to select the KSN 770 transceiver VHF channel spacing as either 25 kHz or 8.33 kHz.

The VHF COM operating range is 118.000 MHz to 136.990 MHz.

VHF NAV

The VHF NAV operating range is 108.00 MHz to 117.95 MHz.

NAV Radio Autotune

If configured, the KSN 770 will autotune the NAV radios for ILS and localizer approaches only. When an ILS or localizer approach is inserted into the flight plan, the standby NAV frequency is tuned to the ILS or localizer frequency.

The standby NAV frequency is automatically set to the active NAV frequency when all of the following conditions are met:

- The final approach waypoint (FAWP) has not been sequenced
- An ILS/LOC approach procedure is active in the flight plan
- Track is within 35 degrees of the inbound track as defined from the FAWP to the missed approach waypoint (MAWP).

The KSN 770 will automatically switch the ***CDI*** selected NAV source from GPS to VLOC when all of the following conditions are met:

- The FAWP has not been sequenced
- An ILS/LOC approach procedure is active in the flight plan
- Track is within 35 degrees of the inbound track as defined from the FAWP to the MAWP
- Track is within 10 degrees of the desired track.

Touchscreen Tuning

Pushing the on-screen standby COM frequency displays the radio tuning pop-up window shown in Figure 5-9.

NOTE: Pushing the on-screen standby NAV frequency displays the same pop-up window without the **CH** ***bezel softkey label***.

Figure 5-9
Radio Frequency Tuning Pop-Up Window

The radio frequency is entered by pushing the touchscreen numbers on the radio frequency pop-up window. As the frequency is selected, the remaining valid frequency values remain available for selection. The remaining invalid frequency values are grayed-out and not available for selection.

Pushing the left arrow touchscreen softkey deletes the last selected frequency value without removing the radio tuning pop-up window.

The radio tuning pop-up window is removed by pushing **OK** on the touchscreen, pushing the **BACK** bezel softkey, touching outside the pop-up window display area, or pushing the radio control knob.

Stored Frequency List

To view or edit a stored COM frequency, push the on-screen standby COM frequency field in the lower-left corner of the display, then push the **CH** bezel softkey. The stored frequency list, shown in Figure 5-10, is then displayed.

Figure 5-10
Stored Frequencies

A stored frequency can be selected from the stored frequency list by pushing in the ***joystick knob*** (as indicated by **PSH TO SELECT•** in the lower-right corner of the display) or by touching the selected frequency on the touchscreen. When this selection is made, the frequency is placed into the standby frequency field. The stored frequency window does not close when a stored frequency is entered. Pushing the **BACK** bezel softkey or touching the touchscreen outside the pop-up window display area closes the window.

The stored frequency list supports the selection of the stored communication frequencies in the range of 118.000 MHz to 136.990 MHz when 8.33 kHz VHF channel spacing is selected (by the menu) and 118.000 MHZ to 136.975 MHz when 25 kHz VHF channel spacing is selected.

NOTE: The stored frequency lists for 8.33 kHz and 25 kHz channel spacing are independent of each other. Changing the channel spacing on the menu displays a different stored frequency list.

The EMERGENCY channel has a stored frequency of 121.500, which cannot be edited.

NOTE: When the EMERGENCY channel is highlighted, the EDIT and DEL bezel softkey labels are not displayed.

When a stored frequency is highlighted (not including the EMERGENCY frequency), the EDIT and DEL bezel softkey labels are displayed. The stored frequency can be edited by pushing the EDIT bezel softkey. Pushing the EDIT bezel softkey activates edit mode and displays the EDIT and CNCL bezel softkey labels, as shown in Figure 5-11. The highlighted stored frequency can be edited using the joystick knob.

Figure 5-11
Edit Frequency

When the frequency is set as desired, pushing the EDIT bezel softkey commits the frequency to memory and exits the edit mode.

Any of the stored frequencies can be deleted by pushing the DEL bezel softkey and confirming the deletion by pushing the OK bezel softkey, shown in Figure 5-12.

NOTE: When a channel is highlighted that does not have a stored frequency (as indicated by dashes in the frequency column), the DEL bezel softkey label is not displayed.

Figure 5-12
Delete Stored Frequency

Nearest Airport Frequency Control

Pushing the **NRST** bezel softkey shown in Figure 5-9, displays the **NEAREST FREQUENCIES** window shown in Figure 5-13. When the COM radios are selected, the nearest airport frequencies are displayed by default.

NOTE: When the NAV radios are selected, the nearest VORs are displayed by default.

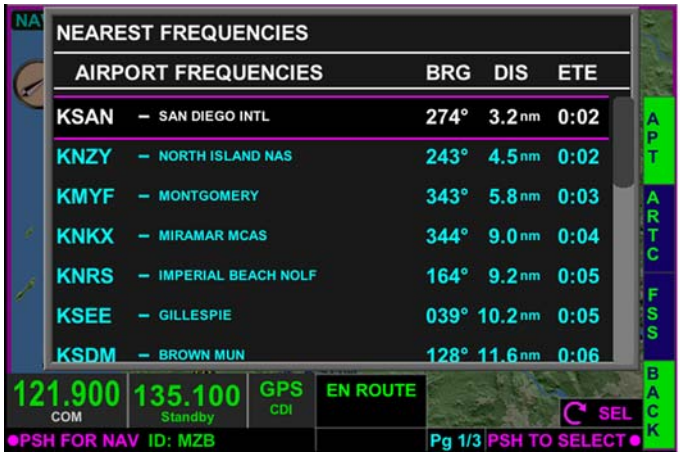


Figure 5-13
Nearest Airport Frequencies

The 20 nearest airport frequencies are displayed within 100 NM (nautical miles) from the present position, with the closest listed first and the farthest listed last. The bearing, distance, and ETE to the airport are displayed next to each of the nearest airports.

The desired airport is selected from the list of airports by rotating the joystick knob or using the touchscreen. When the desired airport is selected, pushing in the joystick knob or pushing the touchscreen twice displays a list of frequencies for the selected airport, as shown in Figure 5–14.

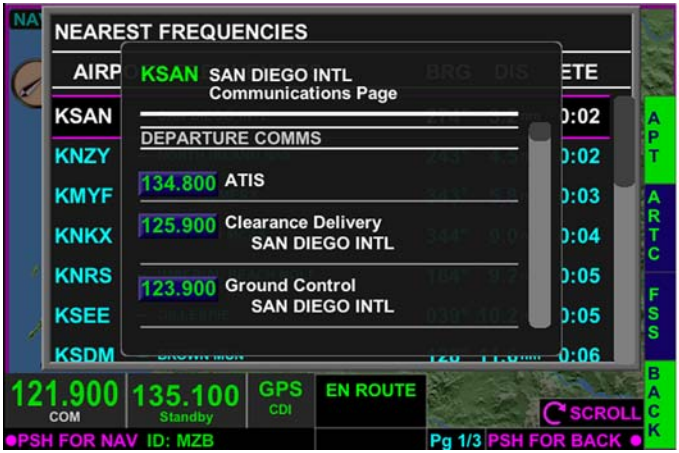


Figure 5-14
Selected Airport COM Frequencies

The frequencies are displayed in the following order: DEPARTURE COMMS, ARRIVAL COMMS, ALL COMMS.

The frequency list is scrolled by rotating the joystick knob or dragging the scroll bar using the touchscreen. Frequencies are displayed in green text on a blue background, similar to the standby frequency in the radio tuning window. The frequency is tuned to the standby frequency field by using the touchscreen to select the desired frequency.

The nearest frequencies window does not close when a frequency is entered. Pushing the **BACK** bezel softkey twice closes the window.

Nearest ARTCC Frequency Control

When the **NEAREST FREQUENCIES** box is displayed, pushing the **ARTC** bezel softkey displays a list of the ARTCC frequencies, as shown in Figure 5-15.

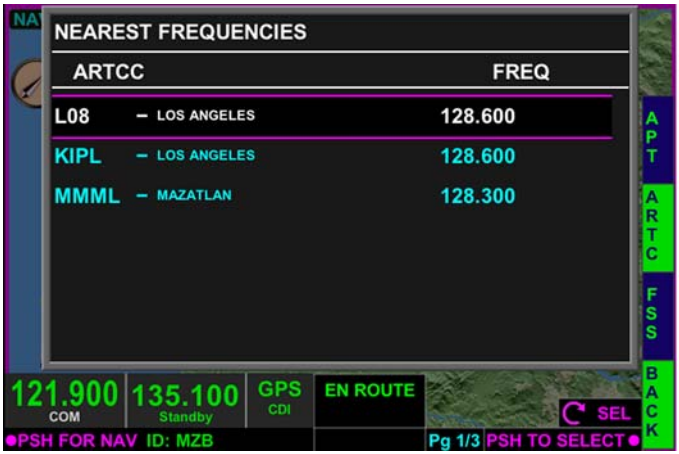


Figure 5-15
Nearest ARTCC Frequencies

A frequency is selected by rotating the joystick knob and pushing the knob for selection or by pushing the desired frequency twice on the touchscreen. When the selection is made, the frequency is entered in the standby field.

The 20 nearest ARTCC frequencies within 100 NM from the present position can be displayed, with the closest listed first and the farthest listed last.

The nearest frequencies window does not close when a frequency is entered. Pushing the **BACK** bezel softkey closes the window.

Nearest FSS Frequency Control

When the **NEAREST FREQUENCIES** box is displayed, pushing the **FSS** bezel softkey displays a list of the FSS frequencies, as shown in Figure 5–16.

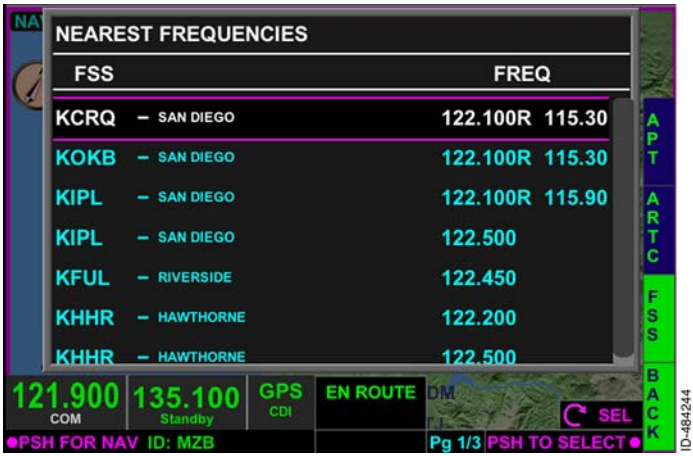


Figure 5-16
Nearest FSS Frequencies

A frequency is selected by rotating the joystick knob and pushing the knob for selection or by pushing the desired frequency twice on the touchscreen. When the selection is made, the frequency is entered in the standby field. If an FSS has both COM and NAV frequencies displayed and is selected, both COM and NAV frequencies are entered in the standby field.

The 20 nearest FSS frequencies within 100 NM from the present position can be displayed, with the closest listed first and the farthest listed last.

The nearest frequencies window does not close when a frequency is entered. Pushing the **BACK** bezel softkey closes the window.

Nearest NAV Frequency Control

Pushing the **NRST** bezel softkey when the NAV radios are selected displays the **NEAREST FREQUENCIES** pop-up window, shown in Figure 5-17. Only the nearest VOR frequencies are displayed when the navigation radios are selected.

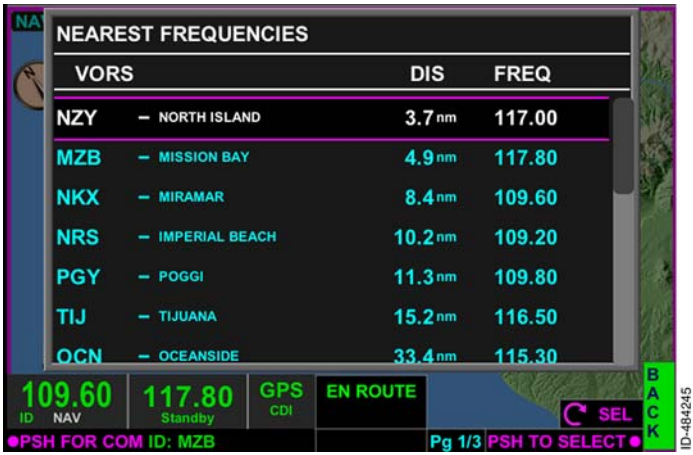


Figure 5-17
Nearest VOR Frequencies

A frequency is selected by rotating the joystick knob and pushing the knob for selection or by pushing the desired frequency twice on the touchscreen. When the selection is made, the frequency is entered in the standby NAV field.

The 20 nearest VOR frequencies can be displayed within 100 NM from the present position, with the closest listed first and the farthest listed last.

The nearest frequencies window does not close when a frequency is entered. Pushing the **BACK** softkey closes the window.

Abnormal Radio Annunciations

If either the NAV or COM radio fails, dashes are displayed in place of the active and standby frequencies, as shown in Figure 5-18. The NAV/COM status field displayed in the upper-left corner of the display is also shown with dashes.

Figure 5-18
NAV/COM Radio Failure

If the transmit function of the radio fails, **XMIT FAIL** is displayed in amber in the failure/status window, as shown in Figure 5-19.

Figure 5-19
XMIT FAIL

STUCK MIC is displayed in the failure/status window, as shown in Figure 5-20, 30 to 35 seconds after the microphone button has been pushed. When the stuck microphone annunciator is displayed, the radio immediately stops transmitting.

Figure 5-20
STUCK MIC

6. Navigation Map View

INTRODUCTION

This section describes the many navigation functions featured in the KSN 765/770. The ***navigation map view*** is customizable to display symbols depicting the location of NAVAIDs, intersections, airways, airports, topographic information, boundaries, and FMS flight plans and waypoints. The map can be displayed in VFR or IFR styles and various overlays can be selected using ***bezel softkeys***. The overlays include traffic, terrain, lightning, and datalink weather.

NOTE: The navigation database valid date range is viewed on the acknowledgement page and the menu, described in Section 4, Menu.

NAVIGATION MAP OVERVIEW

The navigation map view is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the NAV MAP view, shown in Figure 6–1, is displayed.

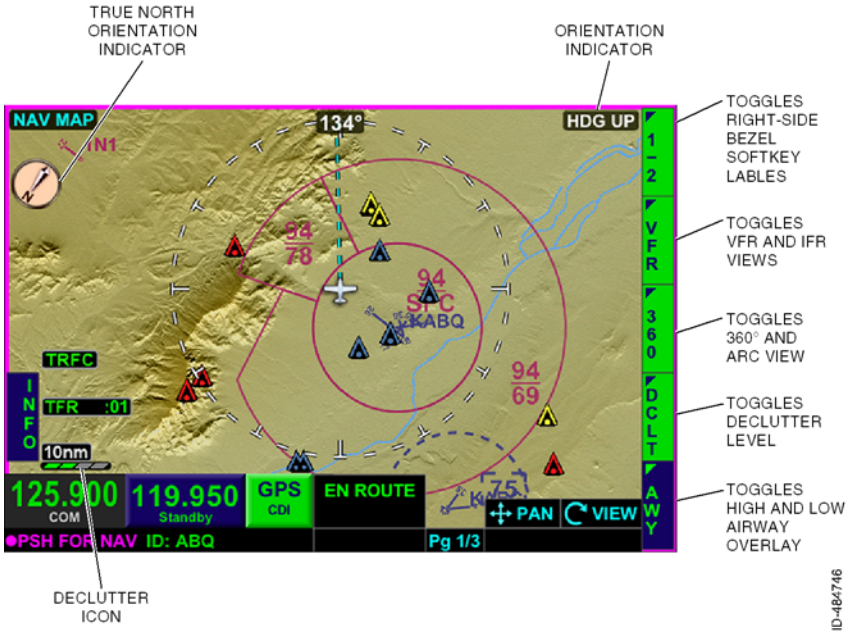


Figure 6–1
Navigation Map View

CAUTION

THE NAVIGATION DATABASES MUST BE UPDATED ON A REGULAR BASIS TO ENSURE THE BEST POSSIBLE ACCURACY. DO NOT USE OUTDATED INFORMATION.

The navigation map view initializes the current position or last known position if the current position is unavailable following a power cycle.

The navigation map view can be configured to display a navigation map in one of many styles, with various information overlays that can be turned on and off with the bezel softkeys.

NOTE: Display and operation of the ***bezel softkey labels*** associated with lightning, NEXRAD, and traffic overlays are optional and require additional equipment. When not installed, the associated bezel softkey labels are not displayed.

The navigation map view has the following options, which are controlled using the bezel softkeys along the right-side of the display.

- VFR/IFR – Configures the map as either a visual flight rules (VFR) or instrument flight rules (IFR) style map.
- 360/ARC – Configures the map view as either 360-degree mode (aircraft shown in center of display) or arc mode (aircraft shown at bottom of display).
- DCLT (Declutter) – Declutters the map display in a round-robin fashion from High → Medium/High → Medium/Low → Low → Off → Repeat.
- AWY (Airway) – Configures the airway overlay as either none, low, or high airways.
- TERR (Terrain) – Toggles the terrain overlay on and off.
- LTNG (Lightning) – Configures the lightning overlay as off, on, strike, and cell. (Optional and requires an external WX-500 Stormscope®.)

- NXRD (NEXRAD) – Toggles the datalink weather overlay of NEXRAD on and off. Optional and requires XM WX subscription.

- TRFC (Traffic) – Configures the traffic overlay as off, normal, unrestricted, above, and below. Optional and requires an external traffic sensor.

Details of each of the overlay modes are described later in this section.

The menu can be used to further customize and configure the map display. The pilot can customize the navigation map to consist of the following symbols:

- Navigational aids (NAVAIDs)
- Intersections
- Airports
- Topographic information
- Cultural data
- Boundaries
- FMS flight plan and waypoints.

The map has three user–selected display modes that are chosen using the menu:

1. North–up – True north up (N–UP MODE).
2. Heading–up – Magnetic heading up (HDG–UP MODE) (if configured).
3. Track–up – Magnetic FMS ground track up (TRK–UP MODE).

NOTE: The selected map display mode is retained following a power cycle.

Navigation Map Orientation Annunciators

The true north orientation indicator symbol is displayed in the upper–left corner of the navigation map view, as shown in Figure 6–1. Table 6–1 lists the possible orientation annunciators when panning is inactive.

Table 6–1
Navigation Map Orientation Annunciators (Panning Inactive)

	North–Up Orientation Annunciator	Track–Up Orientation Annunciator	Heading–Up Orientation Annunciator
Heading and GPS ground track available	NORTH UP	TRK UP	HDG UP
Heading is available and GPS ground track is invalid (DEAD RECKONING)	NORTH UP	NORTH UP	HDG UP
Heading is available and GPS ground track is invalid (LOSS OF NAV/GPS FAIL)	NORTH UP	NORTH UP	NORTH UP
Heading is not available or invalid, and GPS ground track is available	NORTH UP (HDG FAIL)	TRK UP (HDG FAIL)	TRK UP (HDG FAIL)
Heading is not available and GPS ground track is invalid	NORTH UP (HDG FAIL)	NORTH UP (HDG FAIL)	NORTH UP (HDG FAIL)

Table 6-1 (cont)
Navigation Map Orientation Annunciators (Panning Inactive)

	North-Up Orientation Annunciator	Track-Up Orientation Annunciator	Heading-Up Orientation Annunciator
Heading source is not configured and GPS ground track is available	NORTH UP	TRK UP	See Note
Heading source is not configured and GPS ground track is invalid	NORTH UP	NORTH UP	See Note
NOTE: In this case, the HDG-UP orientation is not supported and the HDG-UP MODE setting is removed from the menu.			

When panning mode is active, **PAN MODE** is displayed in the upper-center of the navigation map view and **LOCKED** is displayed under the true north orientation indicator symbol, as shown in Figure 6-2.

NOTE: When panning is active and the traffic overlay is selected, the traffic is removed and the **TRFC RMVD** annunciation is displayed in the lower-left corner.

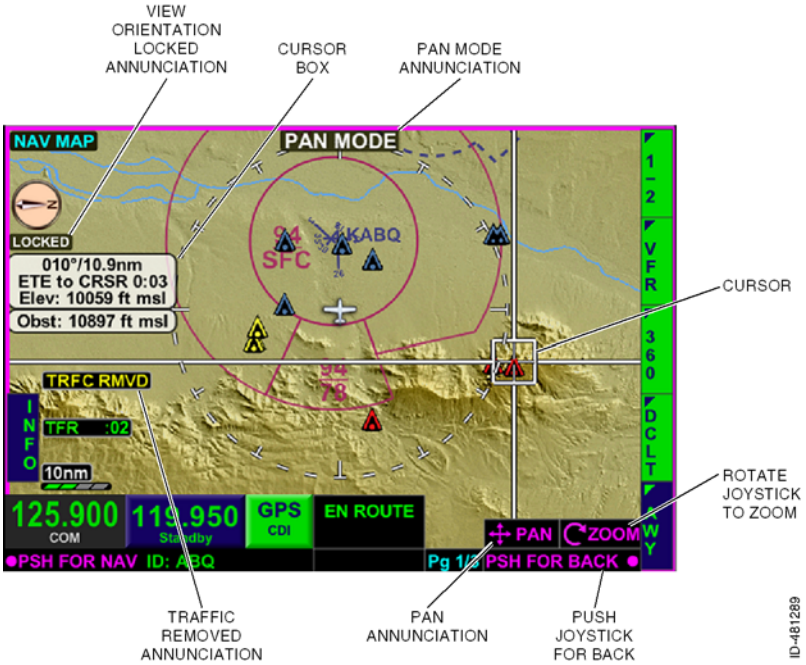


Figure 6-2
PAN MODE Active

Table 6-2 lists the possible orientation displays of the navigation map view with panning active.

Table 6-2
Navigation Map Orientation (Panning Active)

	North-Up Orientation Displayed	Track-Up Orientation Displayed	Heading-Up Orientation Displayed
Heading and GPS ground track available	NORTH UP	TRK UP	HDG UP
Heading is not available or invalid, and GPS ground track is available	NORTH UP	TRK UP	TRK UP
Heading available and GPS ground track is unavailable or invalid	NORTH UP	NORTH UP	HDG UP
Heading and GPS ground track is unavailable or invalid	NORTH UP	NORTH UP	NORTH UP
Heading source is not configured and GPS ground track is available	NORTH UP	TRK UP	See Note

Table 6-2 (cont)
Navigation Map Orientation (Panning Active)

	North-Up Orientation Displayed	Track-Up Orientation Displayed	Heading-Up Orientation Displayed
Heading source is not configured and GPS ground track is invalid	NORTH UP	North Up	See Note

NOTE: In this case, the HDG-UP orientation is not supported and the HDG-UP MODE setting is removed from the menu.

If the internal GPS ground track is not available, the aircraft symbol is removed from the navigation map view.

Heading and Track Display

In heading-up or track-up mode, the direction of flight value displays the heading/track with a resolution of 1 degree and a range of 1 to 360 degrees, as shown in Figure 6-3.

NOTE: The direction of flight value is removed from the display when panning mode is active.

Figure 6-3
Direction of Flight - Numerical Value

When the track data is available, a cyan dashed line (▬▬) is displayed from the current aircraft symbol to the range ring, as shown in Figure 6-4.

NOTE: The track data line is removed from the display when panning mode is active.

Figure 6-4
Track Line

If the track data is invalid or unavailable, the track line is not displayed.

Range Selection

Range selection is depicted as an outer range ring arc or circle with the corresponding numerical value displayed in the lower-left corner. The ***zoom-in/+ and zoom-out/- bezel keys***, shown in Figure 6-5, are used to select the range . When panning is active, range can also be controlled by rotating the joystick knob.

Figure 6-5
Range Selection

When auto-range is not active, the navigation map view scale is selected by the pilot such that the outer radius of the primary range ring represents **0.5** , **1** , **2** , **3** , **5** , **10** , **15** , **20** , **30** , **40** , **60** , **80** , **100** , **200** , **500** , **1000** , and **2000** nautical miles (NM) from the current aircraft position.

NOTE: Range settings are retained following a power cycle of the unit.

AUTO-RANGE

The auto-range feature automatically scales the range (to the closest range setting) to two times the distance between the ownship and the active waypoint. The auto-range feature is selected on the menu using the **NAV MAP AUTO RNG** option, described in Section 4, Menu.

To activate the auto-range feature, **ENABLE** must be selected for the **NAV MAP AUTO RNG** option on the menu and a valid TO waypoint must exist in the active flight plan. Auto-range is activated in the following two ways:

1. When the selected range is at the lowest map range, the zoom-in/+ bezel key is pushed and held for 2 seconds.
2. When the selected range is at the highest map range, the zoom-out/- bezel key is pushed and held for 2 seconds.

When **DISABLE** is selected on the menu, the auto-range feature cannot be activated.

When auto-range is active, an **A** is displayed in white reverse video and is displayed before the numeric range (**A XXXXnm**), as shown in Figure 6-6.

Figure 6-6
Auto-Range Active

When in auto-range mode, pushing the zoom-in/+ bezel key cancels the auto-range mode and the next lower map range scale is displayed. Pushing the zoom-out/- bezel key cancels the auto-range mode and the next highest map range scale is displayed.

Table 6-3 lists the range that is set in auto-range mode.

Table 6-3
Auto-Scale Range Scale - Nautical Miles

Distance Between the Present Position and the Active Waypoint	Range Scale
450 or greater	1000
180-450	500
90-180	200
72-90	100
54-72	80
36-54	60
27-36	40
18-27	30
13.5-18	20
9-13.5	15
4.5-9	10
2.7-4.5	5
1.8-2.7	3
0.9-1.8	2
0.45-0.9	1
Less than 0.45	0.5
NOTE: When in auto-range mode, the ranges are selected automatically to give the best NAV MAP view of the current position of the aircraft to the active waypoint. As the aircraft gets closer, the range value automatically decreases until the aircraft reaches the active waypoint.	

NOTE: If the distance to the active flight plan waypoint is not valid, the map range remains at the current numeric range value.

Navigation Map View Features

When the navigation map view is displayed, the map is capable of, but not limited to, displaying the following information:

- Navigation aids
- Airports
- Water features
- Boundaries
- Controlled airspace
- Special use airspace
- Obstructions
- Relative terrain
- Miscellaneous annunciators.

The FMS flight plan overlays all other symbols on the navigation map except for the ownship, GPS track, and traffic symbols. The map displays active leg and waypoint in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails. All other waypoints and legs are displayed in white.

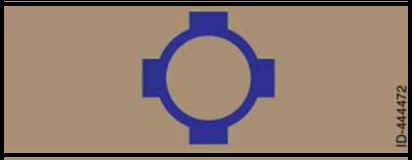
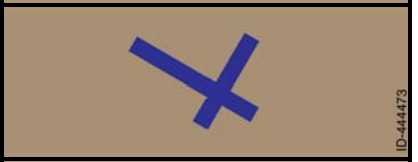
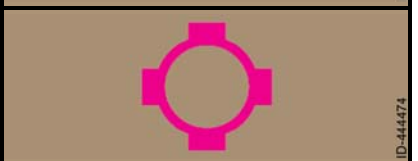
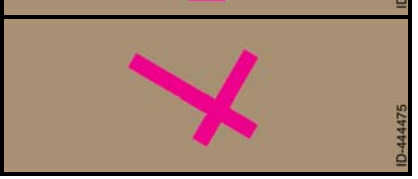
AIRPORT SYMBOLS

Airport symbols are positioned on the navigation map view display at the location corresponding to the airports latitude and longitude location obtained from the navigation database.

If the internal SD card is removed from the card slot, or communications with the card fail, the unit will continue to operate using the last data that was loaded into memory. As the aircraft position changes, the software will attempt to access the data card to retrieve additional data for a new location. When this occurs, if the data card cannot be detected, an annunciation **DATABASE FAILURE** is displayed. The previously loaded data remains available, but new information (such as roads and detailed terrain data not yet loaded into memory) will not be available to add to the navigation map.

Table 6-4 lists the possible airport symbols that can be displayed.

Table 6-4
Airport Symbols

Airspace Description	Symbol
Airport With Control Tower	
Airport With Control Tower – Scaled Runway	
Airport With No Control Tower	
Airport With No Control Tower – Scaled Runway	

Airport symbols are replaced with a scaled runway symbols when the range is set between 0.5 and 20 NM.

Runway numbers are displayed when the range is set between 0.5 and 10 NM.

AIRSPACE SYMBOLS

Airspace symbols are positioned on the navigation map view at the location corresponding to airspace latitude and longitude locations, obtained from the navigation database.

Table 6–5 lists the possible airspace symbols that can be displayed.

Table 6–5
Airspace Symbols

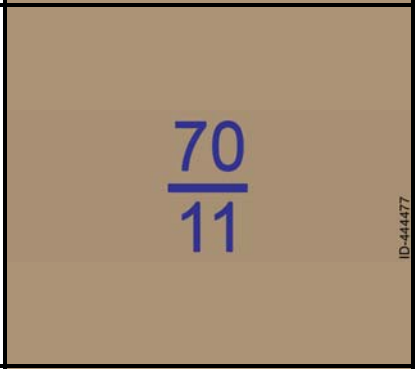
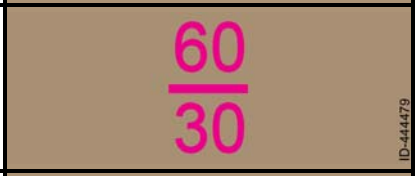
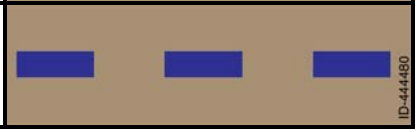
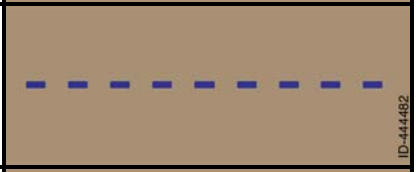
Airspace Description	Symbol
Class B airspace	
Class B and Class D altitude limit (the top number is the ceiling of the altitude limit in hundreds of feet MSL, and the bottom number is the floor of the altitude limit in hundreds of feet MSL). The Class D altitude limit is displayed in this format when the altitude does not extend to the surface.	
Class C airspace	
Class C altitude limit (the top number is the ceiling of the altitude limit and the bottom number is the floor of the altitude limit in hundreds of feet MSL).	
Class D airspace	

Table 6-5 (cont)
Airspace Symbols

Airspace Description	Symbol
Class D airspace upper altitude limit (where the altitude limit is in hundreds of feet MSL). The Class D altitude limit is displayed in this format when the altitude limit extends to the surface.	
Various aerodrome traffic zones	
ADIZ, prohibited, restricted, warning, or alert area.	
Military operating areas (MOA)	

NAVIGATION SYMBOLS

Table 6-6 lists the navigation symbols that can be displayed.

Table 6-6
Navigation Symbols

Navigation Description	Symbol
Active waypoint – Associated with magenta active leg	
Active waypoint – Associated with green active leg	
Active leg – CDI left/right deviations available and autopilot GPS steering (GPSS) available	

Table 6-6 (cont)
Navigation Symbols

Navigation Description	Symbol
Active leg – CDI left/right deviations available and autopilot GPSS not available	
Other waypoint	
Other leg	
VOR without a compass rose	
VORTAC or VOR/DME without a compass rose	
DME or TACAN without a compass rose	
Intersection (INT)	
NDB	

TRANSPORTATION SYMBOLS

Table 6-7 lists the transportation symbols that can be displayed.

Table 6-7
Transportation Symbols

Boundary Description	Symbol
Major Road	
Minor Road	
Railroad	

BOUNDARY SYMBOLS

Table 6-8 lists the boundary symbols that can be displayed.

Table 6-8
Boundary Symbols

Boundary Description	Symbol
International boundaries	
Political boundaries	

OBSTRUCTION SYMBOLS

Obstruction symbols are positioned on the navigation map view at the location corresponding to the obstructions latitude and longitude locations, obtained from the navigation database. The possible obstruction symbols that can be displayed are shown in Figure 6–7.

NOTE: Only reported obstacles are shown.

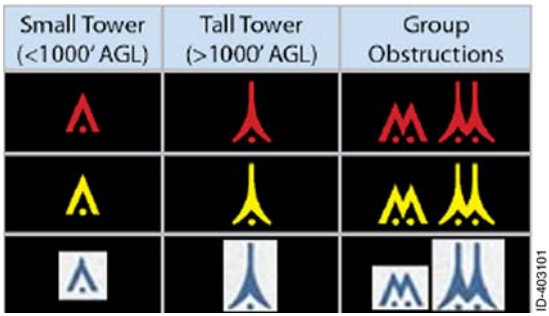


Figure 6–7
Obstruction Symbols

NAV MAP TFR SYMBOLS

When configured to display datalink weather, TFRs are displayed on the NAV MAP view. TFRs are always active for display and cannot be disabled by the pilot. A TFR status annunciation is displayed in the lower–left corner of the NAV MAP view. TFRs are described in detail in Section 10, Datalink Weather View.

Navigation Map Declutter

The amount of features displayed on the navigation map can be controlled by the pilot. Features can be set to off or auto using the menu described in Section 4, Menu. Features configured in the menu as **OFF** are never displayed at any map range level. Table 6-9 lists the features displayed when configured as **AUTO** and the map range is within the specified range.

Table 6-9
Auto Range Declutter

Feature Group	Feature	Max Displayed Range (NM)
Navigation	Flight plan legs and waypoints	1,000
	Active flight plan waypoint identifier	1,000
	Next flight plan waypoint identifier after the active flight plan waypoint identifier	1,000
	All other flight plan waypoint identifiers	200
	Intersection symbols	15
	Intersection identifiers	15
	VOR symbols	200
	VOR identifiers	100
	TACAN symbols	200
	TACAN identifiers	100
	VOR/DME/VORTAC/ TACAN rose symbol (minimum range for Rose is 15 NM)	100
	NDB symbols	15
	NDB identifiers	15

Table 6-9 (cont)
Auto Range Declutter

Feature Group	Feature	Max Displayed Range (NM)
Airports	Large airport symbol	1,000
	Large airport identifier	1,000
	Medium/large airport symbol	500
	Medium/large airport identifier	100
	Medium airport symbol	200
	Medium airport identifier	80
	Medium/small airport symbol	100
	Medium small airport identifier	60
	Small airport symbol	60
	Small airport identifier	40
Water	Oceans/seas [1]	1,000
	Rivers/lakes [1]	1,000
Transportation	Roads and railroads	20
Boundaries	International	1,000
	State or province	1,000

Table 6-9 (cont)
Auto Range Declutter

Feature Group	Feature	Max Displayed Range (NM)
Airways (Airways selected for display using a bezel softkey.)	Low legs (Victor) [1]	200
	High legs (Jet) [1]	200
	Airway designator and outbound/inbound radials [1]	200
Terrain (Relative terrain and obstructions are selected for display using a bezel softkey.)	Relative terrain [1, 2]	Limited to 100, but displayed to 1,000.
	Obstructions [1]	Limited to 40, but displayed to 1,000.
Controlled Airspace	Class A, B, and C without sectors	200
	Class A, B, C, D, and F with sectors	60
	Class G	60
	Various aerodrome traffic zones	60
	Class B, C, and D altitude limits	40

Table 6-9 (cont)
Auto Range Declutter

Feature Group	Feature	Max Displayed Range (NM)
Special Use Airspace	Prohibited	200
	Prohibited number	40
	TFRs [1, 2, 3]	1,000
	Restricted, Warning, Training, and Danger	200
	Restricted and Warning number	40
	MOA, Alert	200
	MOA and Alert number	40
	Special flight rules area	200
	Special flight rules area identifier	40
	ADIZ	500
	ADIZ identifiers	40

[1] – These map features are not configurable with the menu.

[2] – Always on regardless of declutter settings.

[3] – The TFR annunciation is always displayed directly above the range setting.

NOTE: Display settings are retained following a power cycle of the unit.

The navigation map can also be decluttered using the DCLT bezel softkey. Each push of the DCLT bezel softkey changes the declutter level in the following order:

High → Medium/High → Medium/Low → Low → Off → Repeat

In general, the higher the declutter level, the more features displayed on the navigation map. The selected declutter level is displayed using a declutter icon in the lower–left corner of the navigation map display. Figure 6–8 shows five declutter levels.

Figure 6–8
Declutter Icons

Table 6–10 lists the features displayed on the navigation map for each declutter level.

Table 6–10
Declutter Levels

Feature	High	Med/ High	Med/ Low	Low	Off
MFD Function Flight Plan Legs and Waypoints	x	x	x	x	

Table 6-10 (cont)
Declutter Levels

Feature	High	Med/ High	Med/ Low	Low	Off
FMS Function Flight Plan Legs and Waypoints (Not Configurable With The Menu	x	x	x	x	x
Intersections	x				
VORs	x				
NDBs	x				
Hard Surfaced Airports	x	x	x	x	
Other Than Non-Hard Surfaced Airports	x	x	x	x	
Oceans/Seas	x	x	x	x	x
Rivers/Lakes	x	x	x	x	x
Roads and Railroads	x				
International Boundaries/ADIZ	x	x			
Province or State Boundaries	x				
Controlled Airspace	x	x	x		
TFR and Prohibited Airspace	x	x	x	x	x
Special Use Airspace (Not Including TFRs and Prohibited Airspace)	x	x			

NAVIGATION MAP VIEW STYLES

The pilot can choose to display the navigation map in a 360-degree or arc view as well as a VFR or IFR map. The selected setting is retained following a power cycle of the unit.

360-Degree Or Arc View

The pilot can toggle between arc and 360 views by pushing the **ARC** and **360** bezel softkeys. When in arc view, the **ARC** bezel softkey label is displayed and the ownship symbol is located near the bottom of the view, as shown in Figure 6-9.

Figure 6-9
ARC Mode

When in 360-degree view, the **360** bezel softkey label is displayed and the ownship symbol is located in the center of the view, as shown in Figure 6-10.

Figure 6-10
360-Degree Mode

VFR Map Style

The VFR map style is a surrogate for the map style used in VFR sectional aeronautical charts. This means that the map background is color coded based on the MSL elevation of the terrain at each coordinate on the map. In addition, the map can depict cultural data, such as cities, towns, highways, roads, railroads, etc., as shown in Figure 6-11.

Figure 6-11
VFR Map

Overlaid on this background is aeronautical navigation information such as airspace, navigation aids, fixes, etc., that are shown in all styles of the navigation map view. Relative terrain and obstacle information are configured with the menu and are displayed as a layer on top of the background MSL terrain chart.

The VFR map style is displayed when the VFR bezel softkey label is active in 2R, as shown in Figure 6-11.

IFR Map Style

The IFR map style is a surrogate for the map style used on IFR en route charts. This style displays a map that can show radio aids to navigation, controlled and special use airspace, and the high or low air route structure. This means the map background is blank, NAVAIDs, airports and airspace are shown, and cultural data, such as cities, towns, highways, roads, and railroads are not, as shown in Figure 6-12.

Figure 6-12
IFR Map

Relative terrain and obstacle information are configured for display with the menu.

The IFR map style is displayed when the **IFR** bezel softkey label is active, as shown in Figure 6-12.

NAV MAP OVERLAY BEZEL SOFTKEY LABELS

The pilot has the ability to select the following map overlays using bezel softkeys:

- Airways
- Terrain
- Lightning
- Datalink weather
- Traffic.

Each of the overlays is selected for display using the bezel softkeys and the bezel softkey labels displayed on the right side of the display.

Airways Overlay

When an airway overlay is selected, the airway legs identifiers for each airway are displayed, as shown in Figure 6–13.

Figure 6-13
LOW Airways

Pushing the bezel softkey on ***page*** **1-2** in 5R toggles through the various airway overlay settings. When **LOW** is displayed, the published low–level airways are displayed. When **HI** is displayed, the published high–level airways are displayed. When **ARWY** is displayed, neither the low or high level airways are displayed.

NOTE: The airway overlay setting is retained following a power cycle of the unit.

Terrain Overlay

The terrain overlay permits terrain data to overlay on the navigation map display. The terrain overlay is controlled using the TERR bezel softkey on page 2-2 displayed in 2R shown in Figure 6-14.

Figure 6-14
Terrain Overlay

The terrain overlay is active when the TERR bezel softkey label is displayed and inactive when the TERR bezel softkey label is displayed.

NOTE: When the terrain overlay is inactive, only obstructions within 500 feet are displayed.

The terrain overlay and NEXRAD overlay are mutually exclusive. Only one can be displayed at a time on the navigation map. The TERR bezel softkey label is inactive when the NXRD bezel softkey is pushed.

When corrected barometric altitude is configured and valid, the BARO TERR annunciation is displayed in the lower-left corner of the display, as shown in Figure 6-14. When barometric altitude is not configured or invalid and geometric altitude is valid, GPS TERR is displayed in the lower-left corner of the display.

If the corrected barometric altitude, geometric altitude, aircraft position, or heading and GPS track are invalid, a white TERR annunciator is displayed with a red (▬) line through the annunciator and the obstruction coloring is removed from the display.

If terrain and obstruction data is invalid or unavailable, cyan is shown in place of the invalid or unavailable terrain.

NOTE: An expired database does not display the basemap feature as invalid.

Terrain color for the overlay view is described in detail in Section 8, Terrain View.

Lightning Overlay

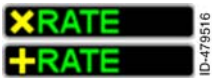
The lightning overlay permits datalink satellite lightning information or WX-500 Stormscope® data to overlay on the navigation map display. The lightning overlay is controlled using the bezel softkey on page 2-2 displayed in 3R, shown in Figure 6-15.

Figure 6-15
Lightning Overlay

The lightning overlay bezel softkey label is a four-position label that controls the lightning overlay. The following is a description of the four possible positions of the bezel softkey label.

- **LTNG** - Lightning overlay is off.
- **LTNG** - Datalink weather lightning overlay is active.
- **STRK** - WX-500 Stormscope® strike mode symbols (**X**) overlay is active.
- **CELL** - WX-500 Stormscope® cell mode symbols (**+**) overlay is active.

NOTE: The lightning overlay setting is retained after a power cycle of the unit.



When WX-500 Stormscope® overlay is active on the navigation map view, the lightning, strike, or cell rate annunciator is displayed in the lower-left of the display. The WX-500 Stormscope® does not require a valid heading to display on the NAV MAP overlay. A valid heading is required only for the strikes view.

If the GPS position is invalid or unavailable, the lightning symbols are removed from the display, and a red horizontal **line** is displayed over the rate annunciator.

Satellite lightning is described in Section 10, Datalink Weather View. Lightning is described in detail in Section 12, Lightning Detection View.

Lightning symbols are removed from the navigation map and **xRMVD** or **+RMVD** replaces the rate annunciator in the lower-right corner when the range is less than 20 NM. Lightning data is not displayed if aircraft heading information is not available.

Datalink Weather Overlay

The datalink weather overlay enables display of NEXRAD and precipitation on the navigation map, as shown in Figure 6-16. Coverage is limited to the US, Puerto Rico, and Canada. The datalink weather overlay is active when the NXRD bezel softkey label is displayed and inactive when the NXRD bezel softkey label is displayed. The datalink weather overlay default setting is inactive (NXRD).

Figure 6-16
Datalink Weather Overlay

The NEXRAD overlay and terrain overlay are mutually exclusive. Only one can be displayed at a time on the navigation map. The NXRD bezel softkey label becomes inactive when the TERR bezel softkey is pushed.

The XM product ages box is displayed in the lower-left corner of the navigation map and datalink weather pages. The XM product ages for the selected weather products are displayed (in minutes) in green when data is being received and updated.

If the generated data age is not available or after startup no valid data has been received from the receiver, the XM data ages are displayed as dashes.

If the XM receiver is not operational for 30 seconds after an error is detected, the data age annunciator (except Puerto Rico NEXRAD) is displayed in black text on an amber background. If an error is detected but information has not expired and may still be valid, the data age annunciator is also displayed in black text on an amber background.

If a weather product is active and the data age exceeds the expiration time listed in Table 10–4, the age annunciators are displayed with a red dash and corresponding graphical data is removed.

NOTE: A complete description of the datalink weather feature is described in detail in Section 10, Datalink Weather View.

CAUTION

NEXRAD WEATHER IMAGES COULD BE AS MUCH AS 20 MINUTES OLDER THAN ACTUAL WEATHER CONDITIONS. THE XM PRODUCT AGES BOX ASSOCIATED WITH THE NEXRAD DISPLAY DATA INDICATES THE TIME IN MINUTES SINCE THE IMAGE WAS RECEIVED BY THE SYSTEM (NOT WHEN IT WAS CREATED OR SENT BY XM WEATHER). THIS DELAY SHOULD BE CONSIDERED WHEN USING NEXRAD IMAGERY, AS THE MOVEMENT AND INTENSITY OF THE WEATHER COULD ADVERSELY AFFECT SAFETY OF FLIGHT.

Traffic Overlay

The traffic overlay permits traffic information to overlay on the navigation map display. The traffic overlay is controlled using the bezel softkey on page **2-2** displayed in 5R, shown in Figure 6-17.

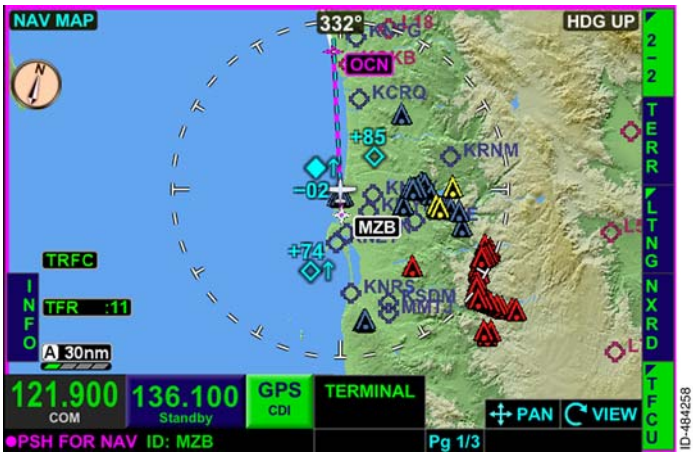


Figure 6-17
Traffic Overlay

The traffic overlay bezel softkey label in 5R is a five-position label that controls the traffic overlay. The following is a description of the five possible positions of the label.

- **TRFC** - The traffic overlay is off.
- **TFCN** - Displays the traffic overlay in the normal traffic setting. Traffic is displayed within 2,700 feet above and below the current aircraft.
- **TFCU** - Displays the traffic overlay in the unrestricted traffic setting. Traffic is displayed within 9,900 feet above and below the current aircraft.
- **TFCA** - Displays the traffic overlay in the above traffic setting. Traffic is displayed within 2,700 feet below the current aircraft, to 9,900 feet above the current aircraft.
- **TFCB** - Displays the traffic overlay in the below traffic setting. Traffic is displayed within 2,700 feet above the current aircraft, to 9,900 feet below the current aircraft.

WARNING

THE PILOT MUST NOT USE THE TRAFFIC DISPLAY TO INITIATE EVASIVE MANEUVERING. ATC PROCEDURES AND VISUAL ACQUISITION OF THE INTRUDER PRIOR TO INITIATION OF EVASIVE MANEUVERS MUST CONTINUE TO BE THE PRIMARY MEANS OF ENSURING AIRCRAFT SEPARATION. THE SYSTEM LACKS THE RESOLUTION (THE ACCURACY) NECESSARY FOR EVASIVE MANEUVERING.

When a TAS TCAS sensor is installed and traffic information is in a failure status, the TRFC annunciation is displayed in white text with a red line through. When a TAS TCAS sensor is installed and valid traffic information is being received, the **TRFC** annunciation is displayed. When a TIS TCAS sensor is installed and traffic information is unavailable or out of range, the **TRFC UNAV** annunciation is displayed.

When panning is active, and the traffic overlay is on, the traffic overlay is removed from the display and the amber **TRFC RMVD** annunciator is displayed. When panning is exited, the traffic overlay is again displayed.

When the traffic overlay is active with the navigation map view oriented north-up (in split or thumbnail view), and a ***traffic view*** is selected in another ***window***, the traffic overlay is removed from the navigation map to avoid confusion and the amber **TRFC RMVD** annunciator is displayed.

Traffic is described in detail in Section 9, Traffic View.

CURSOR

When panning is active, the cursor is displayed in white with two lines (horizontal and vertical) extending to the edge of the window, as shown in Figure 6-18. To activate the cursor, briefly hold the joystick in any direction (up/down/left/right).

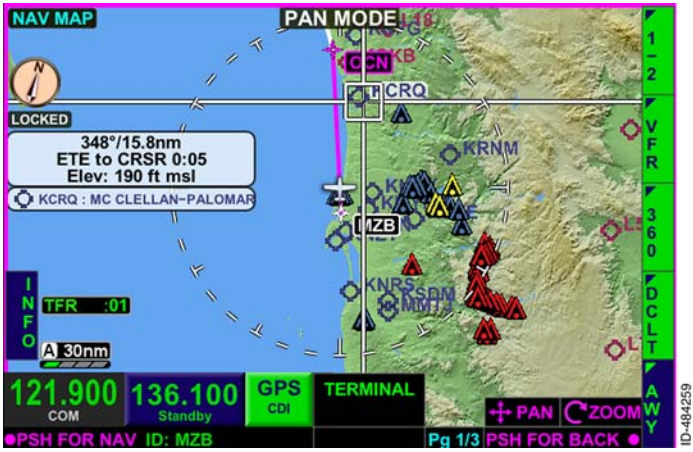


Figure 6-18
Cursor

The cursor position remains stationary until the joystick knob is moved or the touchscreen is pushed. Holding the joystick knob in a single direction changes the rate of the cursor movement.

Rotating the joystick knob changes the zoom level, as indicated by Zoom in the lower-right corner of the display. The zoom level can also be adjusted by pushing the zoom-in/+ and zoom-out/- bezel keys.

NOTE: When the range of the display is decreased using either method, the map pans so the cursor position becomes the center of the view.

Cursor Selection Box

The cursor selection box displays associated detailed information, which changes depending on where the cursor is positioned. For example, when the cursor is centered over an airport, the cursor's detailed information includes the airports identifier, bearing and distance, estimated time en route (ETE), elevation, and weather and instrument approach information (when available).

The cursor can also be positioned over non-object navigation map features such as terrain, rivers, and highways. When the cursor is moved over a non-object, the non-object cursor box is displayed, as shown in Figure 6-19.

Figure 6-19
Non-Object Cursor Box

The information displayed in the non-object cursor box is as follows:

- Bearing and distance from the current aircraft symbol to the cursor
- Estimated time en route from the current aircraft symbol to the cursor using current groundspeed
- Terrain elevation at the cursor.

When the pilot moves the cursor over an object, the object cursor box is displayed directly below the non-object cursor box, as shown in Figure 6-20.

Figure 6-20
Object Cursor Box

When either the right window of the thumbnail ***layout*** or the full screen layout is in use, and the cursor is over multiple objects, no more than five object cursor boxes are displayed.

When the right or left window of the split screen layout is in use, and the cursor is over multiple objects, no more than three object cursor boxes are displayed.

Table 6-11 lists the priority of the objects that are displayed in the object cursor box when the cursor is over multiple objects.

Table 6-11
Object Cursor Box Priority

Object	Priority
Obstacle	1
Airport	2
VOR	3
NDB	4
Intersection	5
Airspaces	6 (See Note)
NOTE: Airspaces are prioritized by size (small to large). When the size of the airspace is identical, then the airspace is prioritized by class.	

If the internal GPS is not available, the cursor selection box displays dashes (---). When the estimated time en route (ETE) is greater than 9 hours, 59 minutes (9:59), the cursor selection box displays dashes (-:--).

Table 6-12 lists the information displayed in the object cursor boxes.

Table 6-12
Object Cursor Box Information

Object	Information
Obstacle	Obstacle elevation at the cursor
Airport	Symbol, identifier, and name
VOR	Symbol, identifier, and name
NDB	Symbol, identifier, and name
Intersection	Symbol and name
Various aerodrome traffic zones	Name of airspace
Class D	Name of airspace followed by Class D

Table 6-12 (cont)
Object Cursor Box Information

Object	Information
Class C	Name of airspace followed by Class C
Class B	Name of airspace followed by Class B
Special use airspace	Name of special use airspace, followed by type (i.e., TFRs, advisory, ADIZ, MOA, restricted, TSA, etc.)

When controlled airspace is under the cursor, the airspace border and altitude limit for the controlled airspace is highlighted, as shown in Figure 6-21. When special use airspace is under the cursor, the airspace border and airspace name are highlighted.

Figure 6-21
Airspace Highlighted

The identifier is highlighted when an airport, VOR, NDB, or intersection is under the cursor. Figure 6-22 shows an example of an airport identifier highlighted.

Figure 6-22
Airport Highlighted

The cursor is removed by pushing in the joystick knob, as indicated by **PSH FOR BACK•** in the lower-right corner of the display. This action will also return the NAV display to the own-ship position. The cursor can be removed by pushing the VIEW bezel key.

NAVIGATION MAP INFO VIEW

The navigation map can provide detailed information about airports, VORs, intersections, airspace, and TFRs shown on the display. The navigation map info view is activated by pushing the INFO bezel softkey, shown in Figure 6-23.

NOTE: The INFO bezel softkey label is also displayed in the FMS view when either the waypoint list or navigation map window is selected.

Figure 6-23
Navigation Map Info Key

When the navigation map **INFO** bezel softkey label is active, the bezel softkey labels shown in Figure 6-24 are displayed. The bezel softkey labels permit the pilot to selectively display or exclude detailed information for airports (APT); special use airspace (SUA); class B, C, and D airspace (ATC); navigation aids (NAV); and temporary flight restrictions (TFR).

Figure 6-24
Select Navigation Map Info

Once the bezel softkey label selections are made, rotating the joystick knob toggles through detailed information for the active bezel softkey labels within the navigation map display area. A navigation map item is indicated as active with **blue** reverse text and inactive with **green** reverse text. Table 6-13 lists the NAV map info bezel softkey labels and the associated graphical symbols.

Table 6-13
NAV Map Info Bezel Softkey Labels

NAV Map Info Bezel Softkey Labels	Graphical Symbols
APT	Airport Symbols
SUA	Prohibited Areas Restricted Areas Alert Areas Warning Areas Military Operations Areas ADIZ
ATC	Class B sectors Class C sectors Class D sectors Various Aerodrome Traffic Zones
NAV	VOR Symbols NDB Symbols Intersection Symbols
TFR	Temporary Flight Restrictions

NOTE: The NAV map info bezel softkey label selections are retained following a power cycle of the unit.

Navigation Map Selection Box

When the **INFO** bezel softkey label is active, the joystick knob can be rotated to toggle through the various navigation map info items. Only items active for display by the bezel softkey labels are shown. The **SEL INFO** annunciator is displayed in the lower-right corner of the display, as shown in Figure 6-25, to indicate that rotating the joystick knob cycles the selected navigation map items.

Figure 6-25
Navigation Map Selection Box

When controlled airspace is selected, the airspace and altitude limits are highlighted, as shown in Figure 6-25. When special use airspace is selected, the airspace and name are highlighted.

When an airport is selected, the text color matches the airport graphic color. Airports with control towers are cyan, all others are magenta.

When the range is set to a low setting, there may not be any items selectable to display. When there are no objects displayed within the selectable view, the message **No selectable items within view** is displayed, as shown in Figure 6-26. Changing the range to a larger scale usually displays objects into the view. Panning to an area that has objects using the same range may also display objects.

Figure 6-26
No Selectable Items Within View

Table 6-14 lists the information displayed in the navigation map selection box for the various selected symbols.

Table 6-14
Selection Box Text

Symbol	Selection Box Row Number	Displayed Text Information
Airport	1	Bearing and distance from aircraft to the airport
	2	Estimated time en route from aircraft to the airport
	3	Elevation at the airport
	4	METAR flag
	4 or 5 (Only on row 5 when the METAR flag is available.)	Instrument approach procedure title
VOR	1	Bearing and distance from the aircraft to the VOR
	2	Estimated time en route from the aircraft to the VOR
	3	Frequency of the VOR
NDB	1	Bearing and distance from the aircraft to the NDB
	2	Estimated time en route from aircraft to the NDB
	3	Frequency of the NDB

Table 6-14 (cont)
Selection Box Text

Symbol	Selection Box Row Number	Displayed Text Information
Intersection	1	Bearing and distance from the aircraft to the intersection
	2	Estimated time en route from the aircraft to the intersection
Controlled Airspace	1	Facility
	2	Altitude
Special Use Airspace	1	Number or name
	2	Altitude
TFRs	1	Type of restricted area
	2	Altitude

NOTE: When the estimated time en route (ETE) is greater than 9 hours, 59 minutes (9:59), the selection box displays a dash (-) over the ETE.

If the GPS position is unavailable, the selection box displays a dash (-) over the bearing, distance, and ETE, as shown in Figure 6-27.

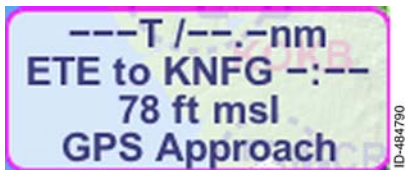


Figure 6-27
Selection Box With Position Unavailable

The NAV map INFO view becomes inactive by pushing the INFO bezel softkey or by pushing in the joystick knob. When the INFO bezel softkey or joystick knob is pushed in, the PSH FOR BACK• and the SEL INFO annunciator is removed from the display.

Navigation Map Detail Control

When the INFO bezel softkey label is active, the DETL bezel softkey label is displayed on the left-side of the display. Pushing the DETL bezel softkey displays a detail information box based on the item selected on the navigation map display, as shown in Figure 6-28.

NOTE: The DETL bezel softkey label is not displayed when selectable items are not within view.

Figure 6-28
Navigation Map Detail

The detail bezel softkey labels displayed along the right side of the display vary depending on the item selected on the navigation map. Figure 6-28 shows an example of a detail information box of KOKB and the associated bezel softkey labels.

Table 6-15 lists the selectable navigation map items and the associated NAV map detail bezel softkey labels displayed.

Table 6-15
NAV Map Detail Control Bezel Softkey Labels

Graphical Symbol	Bezel Softkey Labels
Airport	**APT** **COM** **RWY** **WX** (Displayed when XM WX is configured.) **CHRT** (Displayed when the selected airport has an associated terminal procedure.)
VOR	**VOR**
Intersection	**INT**
NDB	**NDB**
TFR	**TFR**
Special Use Airspace	**SUA**
Controlled Airspace	**ATC**

NOTE: Only one NAV map detail control bezel softkey label can be active at a time.

Pushing in the joystick knob or pushing the **DETL** bezel softkey deactivates the NAV map detail control mode and returns to the NAV map INFO view.

Table 6-16 lists the information displayed in the detail information box.

Table 6-16
Detailed Box Text

Symbol	Detailed Bezel Softkey Label	Information Displayed (if available)
Airport	APT	Airport identifier Name of airport Location (city, state, and country) Elevation of airport Bearing TO and FROM airport Distance to airport Estimated time en route (ETE) to airport Latitude and longitude at airport
	COM	Frequencies and call signs
	RWY	Airport identifier Name of airport Runway Runway lengths and widths Runway surface type Type of runway lighting Runway approach and frequency; includes push button (KSN 770 only) which will populate NAV standby frequency when pushed
	WX	METAR and TAF text information

Table 6-16 (cont)
Detailed Box Text

Symbol	Detailed Bezel Softkey Label	Information Displayed (if available)
VOR	VOR	VOR identifier Name and type of VOR Location (city, state, and country) VOR frequency Bearing TO and FROM VOR Distance to VOR ETE to VOR Latitude and longitude at VOR Elevation at VOR Magnetic variation to VOR Type of VOR
NDB	NDB	NDB identifier Name and type of NDB Location of NDB (city, state, and country) NDB frequency Bearing TO and FROM NDB Distance to NDB ETE to NDB Latitude and longitude at NDB Elevation at NDB Type of NDB

Table 6-16 (cont)
Detailed Box Text

Symbol	Detailed Bezel Softkey Label	Information Displayed (if available)
Intersection	INT	Intersection identifier Name of intersection Bearing TO and FROM intersection Distance to intersection ETE to intersection Latitude and longitude at intersection Type of reporting point (compulsory or non-compulsory)
Controlled Airspace	ATC	Facility Altitude Low/High separation altitude Approach control and unicom frequencies
Special Use Airspace	SUA	Number or name Type of special use airspace Altitude Low/High separation altitude Controlling agency Contact facility
TFR	TFR	Type of restricted area Name Affected altitude Data and time the TFR was created and modified Data and time the TFR is active and expires

The frequencies available when the COM detail bezel softkey is pushed and the navigation map detail information box are displayed are listed in Table 6-17.

Table 6-17
COM Frequencies

Airspeed < 60 Knots (Kts)	Airspeed > 60 Knots or Unavailable
Departure	Arrival
ATIS	ATIS
AWOS	AWOS
ASOS	ASOS
Clearance Delivery	Approach Control
Ground Control	Tower
Tower	Ground Control
Departure Control	Unicom
Unicom	Flight Service Station
Flight Service Station	Remote Flight Service Station
Remote Flight Service Station	Emergency
Emergency	Departure
Arrival	ATIS
ATIS	AWOS
AWOS	ASOS
ASOS	Clearance Delivery
Approach Control	Ground Control
Tower	Tower
Ground Control	Departure Control
Unicom	Unicom
Flight Service Station	Flight Service Station
Remote Flight Service Station	Remote Flight Service Station
Emergency	Emergency
All Available Communication Frequencies	All Available Communication Frequencies

SELECTING CHARTS WITH THE NAVIGATION MAP

When a detail information box is displayed for an airport that has a terminal procedure, the CHRT navigation map bezel softkey label is displayed. When the CHRT bezel softkey is selected, the ***charts view*** is displayed.

An airport diagram at the selected airport is displayed (when available) when the airspeed is less than 60 knots.

Pushing the CHRT bezel softkey when the airspeed is greater than 60 knots (or the airport diagram is unavailable) displays an instrument approach procedure (IAP).

Exiting the charts view control mode is accomplished by selecting the RTRN bezel softkey.

INVALID GPS STATES

If the internal GPS sensor is invalid or failed, an amber GPS FAIL annunciator is displayed at the bottom of the display, as shown in Figure 6-29.

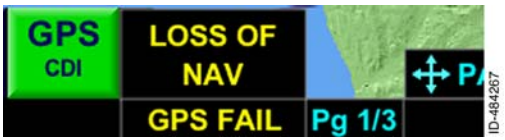


Figure 6-29
GPS Fail

If there is a loss of integrity monitoring, an amber LOI annunciator is displayed.

In the event of a complete GPS failure, the navigation map stops moving and reverts to a stationary map orientated NORTH UP and the ownship symbol is removed. The navigation map may be manually panned to correlate to the estimated aircraft position by other means.

7. Charts View

INTRODUCTION

The primary purpose of the ***charts view*** is for viewing National Aeronautical Charting Office (NACO) terminal charts on the KSN 765/770. An example of the charts view is shown in Figure 7-1.

NOTE: The Charts view can be enabled or disabled for viewing during installation.

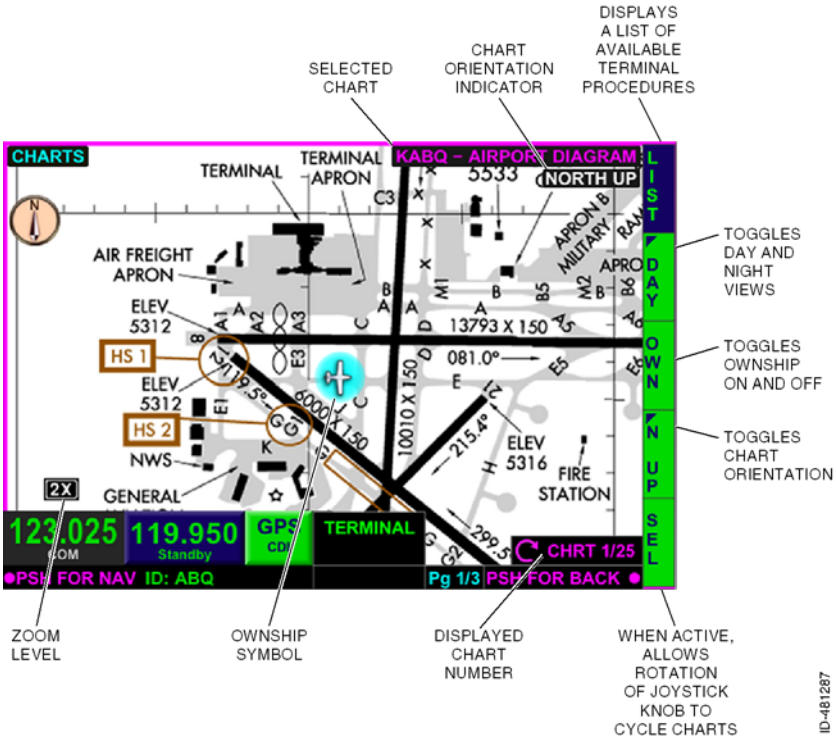


Figure 7-1
Chart Display

The charts view can be configured by the pilot to display the following list of items:

- Instrument approach procedure (IAP) charts
- Departure procedure (DP) charts

- Standard terminal arrival route (STAR) charts
- Airport diagrams (APD)
- Take-off minimums and obstacle departure procedures
- Alternate minimums (MIN).

CAUTION

CONSULT ALL APPLICABLE NOTAMS PRIOR TO FLIGHT. THE INFORMATION PROVIDED IS INTENDED TO SUPPLEMENT YOUR NORMAL NAVIGATION FUNCTION. DO NOT USE EXPIRED DATABASES.

CHARTS OVERVIEW

The charts view is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the charts view is displayed. When the **SEL** ***bezel softkey label*** is active, the charts view control mode is active, as shown in Figure 7-2.

NOTE: The instrument procedure charts database valid date range is viewed on the acknowledgement page and on the menu, described in Section 4, Menu.

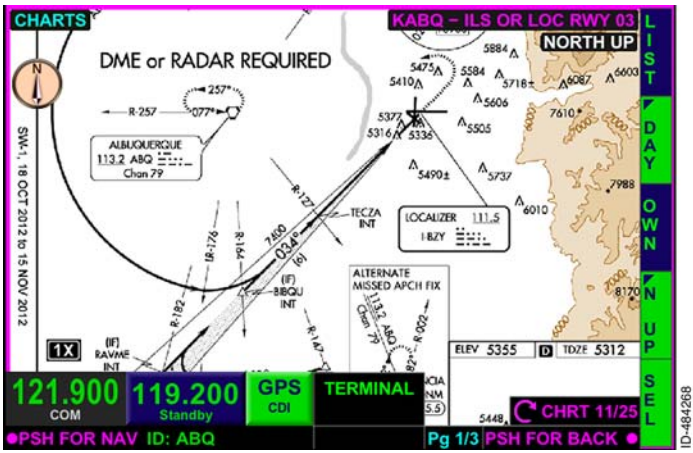


Figure 7-2
Charts View Control Mode Active

When the charts view control mode is active, a magenta CHRT #/# annunciator is displayed in the lower-right corner of the display. The first # is the selected chart number, and the second # is the total number of charts available for the selected airport. Chart view control mode allows the pilot to rotate the joystick knob to view different terminal charts. Charts can also be selected by using the charts list, described later in this section.

NOTE: Pushing the SEL softkey again or pushing in the joystick knob disables the charts view control mode.

When the charts view control mode is inactive, the CHRT #/# annunciator is removed from the display.

NOTE: If the charts database is invalid or unavailable, a gray DATABASE FAILURE annunciator is displayed.

Range

The pilot has the ability to select the change range of a selected chart at **1x**, **2x**, and **3x** zoom levels. The zoom level is displayed in the lower-left corner of the charts view, as shown in Figure 7-3. The zoom range is adjusted by using the ***zoom-in/+ and zoom-out/- bezel keys***.

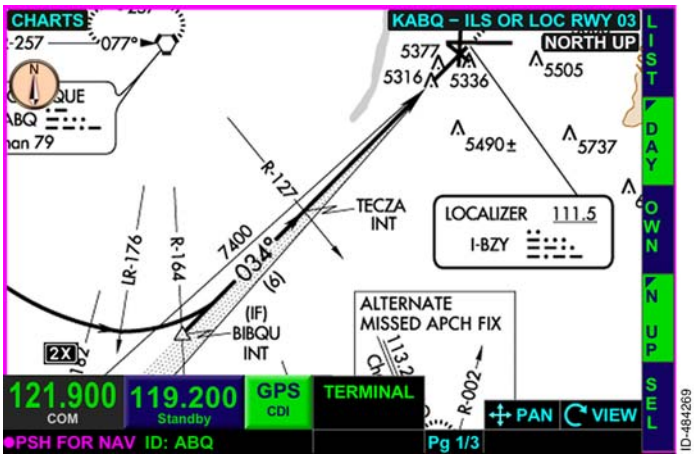


Figure 7-3
Charts Zoom Range

Panning

Panning can be activated on charts by momentarily pushing the joystick knob in any direction. Unlike the navigation map display, the cursor is not displayed on the charts view when panning is active.

NOTE: When panning becomes active, the touchscreen can be used to control panning.

When panning becomes inactive and the current aircraft symbol is not on the chart, the selected chart centers within the ***window***. When panning becomes inactive and the current aircraft symbol is on the chart, the current aircraft symbol is centered within the window.

Charts List

When the **LIST** bezel softkey label is active, available charts for a particular airport are listed, as shown in Figure 7-4. The last selected chart identifier is displayed at power-up.

NOTE: Only the charts applicable to the selected airport are listed.

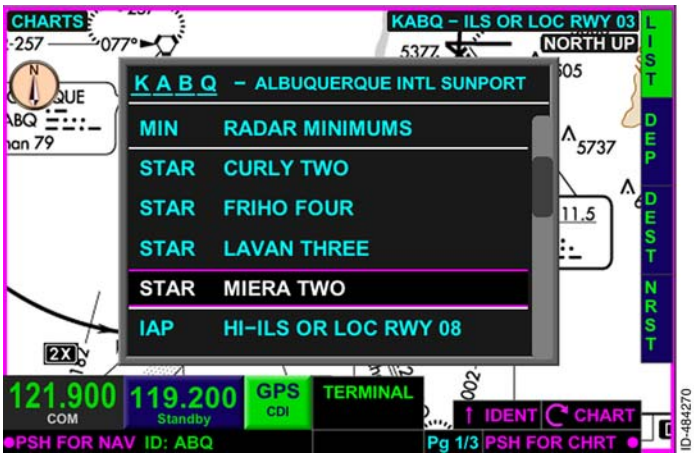


Figure 7-4
Charts List

When available, the following charts are displayed and listed in the order shown in Figure 7-5.

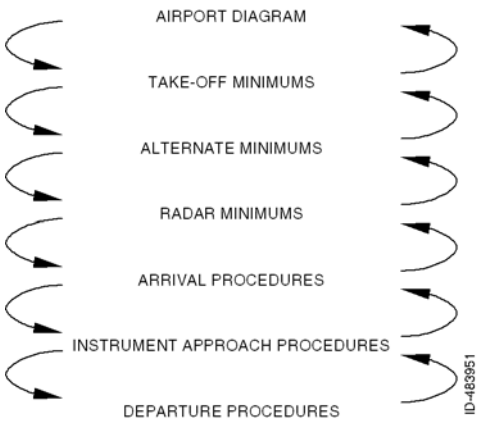


Figure 7-5
Chart Information Selection

To enter the procedures list for the displayed airport, toggle the joystick knob down to the procedures list and then rotate the joystick knob. Pushing in the joystick knob selects the highlighted chart.

A prefix is displayed before the chart heading to indicate the chart type (i.e., MIN for takeoff minimums, alternate minimums, and radar minimums, STAR and arrival procedures, IAP for instrument approach procedures, APD for the airport diagram, and DP for departure procedures).

To change the airport and the associated charts, rotate and toggle the joystick knob to enter the desired new airport identifier. Alternatively, the touchscreen can be used to change the airport identifier by touching the airport selection box at the top of the airport list and using the ***QWERTY keypad*** to enter the new airport identifier.

DEP, DEST, AND NRST BEZEL SOFTKEY LABELS

When the LIST bezel softkey label is active, the second, third and fourth right bezel softkey labels display DEP , DEST , and NRST respectively.

- DEP – Pushing the DEP bezel softkey automatically fills the identifier of the airport (with an instrument approach procedure) closest to the startup latitude/longitude point. In addition, the SELECTING DEPARTURE message is displayed for 1 second.
- DEST – Pushing the DEST bezel softkey automatically fills the identifier of the airport (with an instrument approach procedure) closest to the destination latitude/longitude point or the airport closest to the startup latitude/longitude point when a destination is not entered in the flight plan. In addition, the SELECTING DESTINATION message is displayed for 1 second.
- NRST – Pushing the NRST bezel softkey automatically fills the identifier of the nearest airport (with an instrument approach procedure) to the aircraft present position. At startup, this is the same as the DEP bezel softkey. In addition, the SELECTING NEAREST message is displayed for 1 second.

NOTES:

1. The destination latitude/longitude is based on the flight plan of the FMS.
2. The DEP , DEST , and NRST bezel softkey labels are removed from display if the aircraft position becomes unavailable.

Day and Night Display

The pilot has the ability to select two chart styles:

- Night chart display
- Day chart display.

When the **NITE** bezel softkey label is active, the chart is displayed with white text on a black background, as shown in Figure 7-6. This display is conducive to flying at night.

Figure 7-6
Night Chart Display

When the **DAY** bezel softkey label is active, the chart is displayed with black text on a white background, as shown in Figure 7–7. This display is conducive to flying during the day.

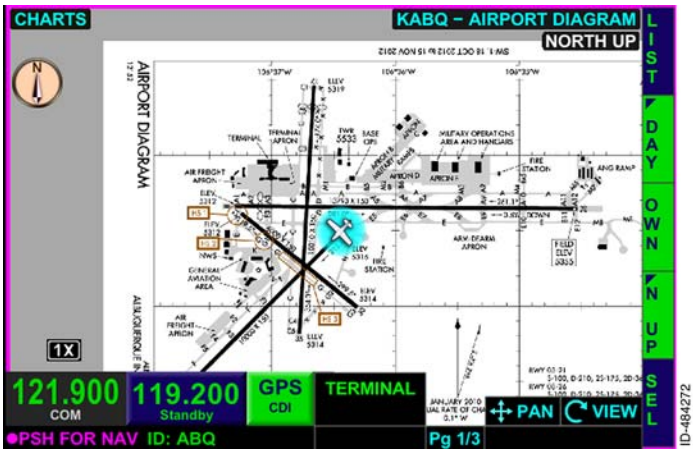


Figure 7–7
Day Chart Display

The last pilot–selection is retained following a power cycle.

Current Aircraft (Ownship)

The pilot can overlay the Ownship symbol on airport diagrams and instrument approach procedures. When the **OWN** bezel softkey label is active, the Ownship symbol is displayed. When the aircraft is located within the valid display area of the airport diagram or a geo-referenced instrument approach procedure with the GPS track (greater than 30-knot groundspeed) or heading information valid, the Ownship symbol is displayed and oriented appropriately.

When the heading input is not installed or if a heading failure occurs, and the GPS track is not valid or less than 30-knot groundspeed, the aircraft symbol is removed from the display and only the cyan circle remains. The cyan circle displays approximate GPS location, however heading orientation is not given. When GPS track is valid and the groundspeed is greater than 30 knots, the ownship symbol is displayed regardless of not having a heading input or having a heading failure.

NOTE: The plan-view portion of geo-referenced instrument approach procedures can display the Ownship symbol. The Ownship symbol display is limited to the to scale area of terminal procedures. Most standard instrument departure (SIDs), STARS, DPs, and ODPs are not to scale and therefore cannot display the Ownship symbol.

CAUTION

OWNSHIP OVERLAY ON INSTRUMENT APPROACH PROCEDURES IS INTENDED TO ENHANCE SITUATIONAL AWARENESS ONLY AND IS NOT TO BE USED FOR NAVIGATION.

Airport diagrams are specifically designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations. Airport diagrams are not intended to be used for approach and landing or departure operations.

In some instances the aircraft symbol is not available for display or is not on the chart. When this occurs, there are two annunciators that are displayed in the chart view:

- **OWNSHIP NOT AVAILABLE** – Indicates the ownship symbol cannot be displayed on the selected terminal procedure.
- **OWNSHIP OFF CHART** – Indicates the ownship symbol is off the currently displayed terminal procedure.

Table 7-1 lists the possible scenarios in which one of the previously mentioned annunciators is displayed.

Table 7-1
Ownship Annunciators

Selected Chart	OWN Bezel Softkey Label State	Current Aircraft Symbol	Annunciator
Non Geo-Referenced APD, DP, DPO, IAP, or STAR	Active	Not displayed	OWNSHIP NOT AVAILABLE
Non Geo-Referenced APD, DP, DPO, IAP, or STAR	Inactive	Not displayed	No annunciator
Geo-Referenced APD, DP, IAP, DPO or STAR and GPS position is available	Active	Not visible	OWNSHIP OFF CHART
Geo-Referenced APD, DP, IAP, DPO or STAR and GPS position is available	Active	Displayed	No annunciator
Geo-Referenced APD, DP, IAP, DPO or STAR and GPS position is not available	Active	Not visible	OWNSHIP NOT AVAILABLE

Table 7-1 (cont)
Ownship Annunciators

Selected Chart	OWN Bezel Softkey Label State	Current Aircraft Symbol	Annunciator
Geo-Referenced APD, DP, IAP, DPO or STAR	Inactive	Not displayed	No annunciator
Other than APD, DP, DPO, IAP or STAR	Not displayed	Not displayed	No annunciator

NOTE: If the GPS is invalid or has failed, an amber **GPS FAIL** annunciator is displayed.

Chart Orientation

The charts view orientation is selected with the chart orientation bezel softkey label in 4R. The following is a list of bezel softkey labels that the pilot can toggle through:

- **NORM** - Normal-up

  NOTE: The normal-up orientation is the same as the presentation provided by the normal orientation of a paper chart.

- **N UP** - True north-up

- **HDG** - Heading-up

  NOTE: The **HDG** bezel softkey label is only displayed when a heading source is configured and available. When a heading source is not configured or available, the **HDG** bezel softkey label is not displayed.

- **TRK** - Track-up.

NOTE: The chart orientation bezel softkey labels at 4R are not displayed when panning mode is active.

The orientation annunciator is displayed in the top-left corner of the display, as shown in Figure 7-8.

NOTE: The orientation indicator is only displayed when the orientation indicator in the overlay menu is set to on.

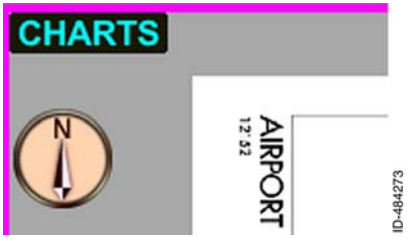


Figure 7-8
Orientation Annunciator

Table 7-2 lists the possible orientation annunciators that are displayed when panning is inactive.

Table 7-2
Orientation Annunciators - Panning Inactive

	N-UP Bezel Softkey Label Active	NORM Bezel Softkey Label Active	HDG Bezel Softkey Label Active	TRK Bezel Softkey Label Active
Heading Available and Chart Geo-Referenced	NORTH UP	NORMAL UP	HDG UP	TRK UP
Heading Available and Chart Not Geo-Referenced	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED

Table 7-2 (cont)
Orientation Annunciators - Panning Inactive

	N-UP Bezel Softkey Label Active	NORM Bezel Softkey Label Active	HDG Bezel Softkey Label Active	TRK Bezel Softkey Label Active
Heading Not Available or Invalid, Track Available, and Chart Geo-Referenced	NORTH UP (HDG FAIL)	NORMAL UP (HDG FAIL)	NOT DISPLAYED	TRK UP (HDG FAIL)
Heading Not Available or Invalid, Track Available, and Chart Not Geo-Referenced	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED
Heading and Track Not Available or Invalid	NORTH UP (HDG FAIL)	NORMAL UP (HDG FAIL)	NOT DISPLAYED	NOT DISPLAYED

NOTES:

1. When the chart orientation is HDG UP when heading becomes not available or invalid, TRK UP orientation is selected when the selected chart supports the Normal Up and North Up orientations or the Normal Up and North Up orientations are the same in the selected chart.
2. When the chart orientation is TRK UP when heading or track status becomes not available or invalid, NORMAL UP orientation is selected when the Normal Up and North Up orientations are not the same in the selected chart.
3. When the chart orientation is TRK UP when heading or track status becomes not available or invalid, NORTH UP orientation is selected when the Normal Up and North Up orientations are the same in the selected chart.

Table 7-3 lists the possible orientation displays of the charts view when panning in active.

Table 7-3
Orientation Annunciators - Panning Active

	N-UP Bezel Softkey Label Active	NORM Bezel Softkey Label Active	HDG Bezel Softkey Label Active	TRK Bezel Softkey Label Active
Heading Available and Chart Geo-Referenced	NORTH UP - PAN MODE	NORMAL UP - PAN MODE	PAN MODE	PAN MODE
Heading Available and Chart Not Geo-Referenced	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED
Heading Not Available or Invalid, Track Available, and Chart Geo-Referenced	NORTH UP - PAN MODE (HDG FAIL)	NORMAL UP - PAN MODE (HDG FAIL)	NOT DISPLAYED	PAN MODE (HDG FAIL)
Heading Not Available or Invalid and Chart Not Geo-Referenced	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED
Heading and Track Not Available or Invalid	NORTH UP - PAN MODE (HDG FAIL)	NORMAL UP - PAN MODE (HDG FAIL)	NOT DISPLAYED	NOT DISPLAYED

NOTES:

1. When the chart orientation is HDG UP when heading becomes not available or invalid, TRK UP orientation is selected once panning mode is inactive when the selected chart supports the Normal Up and North Up orientations or the Normal Up and North Up orientations are the same in the selected chart.

2. When the chart orientation is TRK UP when heading or track status becomes not available or invalid, NORMAL UP orientation is selected once panning mode is inactive when the Normal Up and North Up orientations are not the same in the selected chart.

3. When the chart orientation is TRK UP when heading or track status becomes not available or invalid, NORTH UP orientation is selected once panning mode is inactive when the Normal Up and North Up orientations are the same in the selected chart.

Selected Chart

The **selected chart** (airport identifier and chart title) is displayed in cyan in the upper–right corner of the charts view when the charts view control mode is inactive. When the charts view control mode is active (**SEL** bezel softkey label is active), the **chart title** (airport identifier and name) is displayed in magenta, as shown in Figure 7–9.

Figure 7–9
Chart Title

NOTE: The last selected chart is retained after a power cycle of the unit.

AIRPORT DIAGRAM POP-UP FUNCTION

The airport diagram pop-up feature setting is controlled using the APD QUICK ACCESS FUNCTION menu item on the menu. The APD QUICK ACCESS FUNCTION has three settings: AUTO , MANUAL , and OFF .

NOTE: The setting is retained after a power cycle of the unit.

When the AUTO airport diagram pop-up function is active, the airport diagram is automatically displayed at startup or after landing. The after landing condition is met when the indicated airspeed and groundspeed transition from greater than 30 knots to less than 30 knots. The airport closest to the current latitude/longitude is automatically displayed (when available).

In the MANUAL setting, at startup or after landing, the airport diagram can be selected by pushing the PUSH FOR AIRPORT DIAGRAM bezel softkey or ***touchscreen button***.

NOTE: The AUTO and MANUAL settings perform no actions when there is no airport diagram for the current aircraft location.

When the airport diagram is displayed, the BACK touchscreen button is displayed in the left-side of the display. Pushing the BACK bezel softkey or touchscreen button returns to the previous active screen display.

In the OFF setting, the airport diagram must be manually selected using the normal selection procedures.

Manual Airport Diagram Pop-Up Function

When the **MANUAL** airport diagram pop-up function is active, after startup or when the indicated airspeed or groundspeed transition from greater than 30 knots to less than 30 knots, **APD LOAD Airport Diagram** is displayed in the top-center of the screen the **PUSH FOR AIRPORT DIAGRAM** touchscreen button is displayed in 1R, and the **CLEAR** touchscreen softkey is displayed in 2R, as shown in Figure 7-10.

Figure 7-10
Manual Airport Diagram Pop-Up

PUSH FOR AIRPORT DIAGRAM or **CLEAR** must be pushed before this screen can be exited.

Pushing the **PUSH FOR AIRPORT DIAGRAM** touchscreen softkey displays the airport diagram for the closest to the current latitude/longitude (when available).

Pushing the **CLEAR** touchscreen softkey clears the airport diagram function and allows the pilot to continue using the previously selected display.

The airport diagram is removed from display when the indicated airspeed or groundspeed transitions from less than 30 knots to greater than 30 knots.

Blank Page

8. Terrain View

INTRODUCTION

The ***terrain view*** depiction is threat-based and highlights threatening terrain in various colors depending on the vertical proximity of the terrain to the current aircraft altitude. A terrain database is used to provide terrain and obstacle awareness.

Terrain cells are based on the difference between the terrain and aircraft computed baro-corrected or GPS (not pressure altitude) height in mean sea level (MSL). Accurate relative terrain presentation depends entirely on an accurate barometric altimeter setting.

CAUTION

TERRAIN INFORMATION IS FOR AWARENESS ONLY. DO NOT MANEUVER BASED SOLELY ON THIS INFORMATION.

The terrain effectivity date is viewed on the power-up display and on the menu, described in Section 4, Menu.

TERRAIN VIEW OVERVIEW

There are two ways in which terrain is displayed:

- Terrain overlay on the navigation map
- Terrain view in full screen, split screen, and thumbnail layouts.

The terrain overlay is described in Section 6, Navigation Map View.

The terrain view is displayed by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the terrain view is displayed. When the terrain view is selected the surrounding terrain and obstructions are displayed, as shown in Figure 8–1.

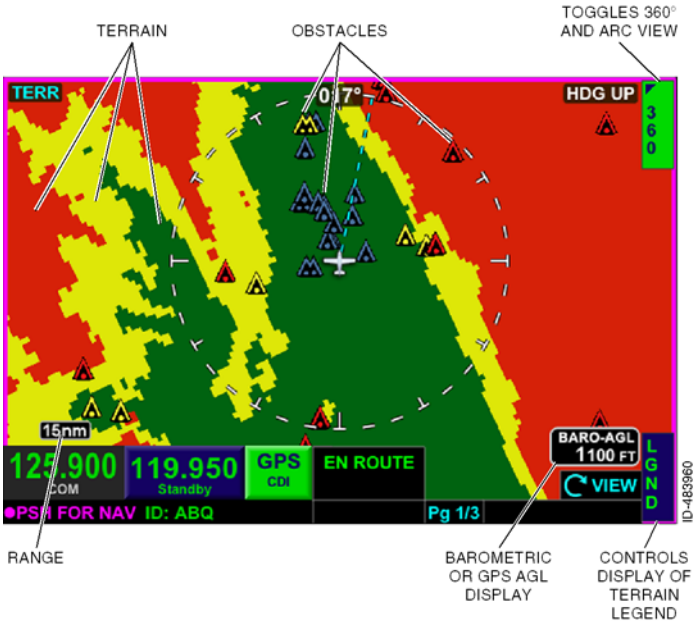


Figure 8-1
Terrain View

Terrain View Display Modes

The pilot can select two terrain view modes by activating either of the following ***bezel softkey labels***.

- **ARC** – Displays arc view mode
- **360** – Displays 360° compass view mode.

The display mode is indicated by the active bezel softkey label in the upper-right corner of the terrain view. Figure 8-2 shows the arc view mode as indicated by **ARC** displayed as the upper-right bezel softkey label.

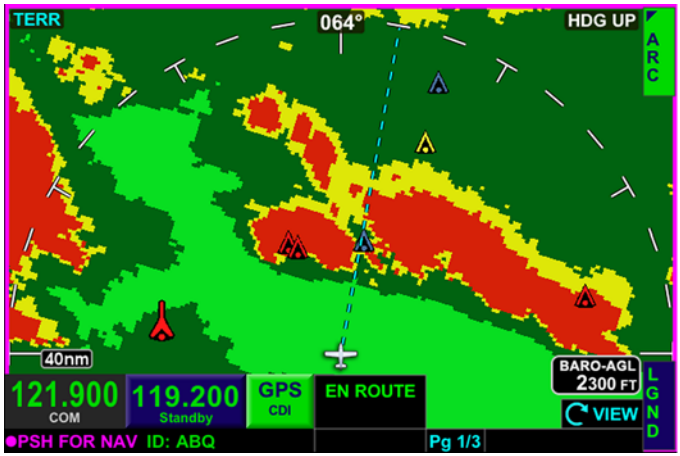


Figure 8-2
Terrain View – Arc

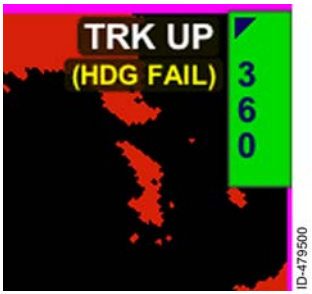
In arc or 360° compass mode, the range scale is selected with the ***zoom-in/+ and zoom-out/- bezel keys***, such that the outer radius of the primary range ring represents **5** , **10** , **15** , **20** , **30** , **40** , **60** , **80** , and **100** nautical miles (NM) from the current aircraft position.

NOTE: The terrain view display range setting is retained following a power cycle.

A magnetic GPS ground track is displayed with a dashed cyan line (**---**) from the current aircraft to the range ring, in either the arc or 360° compass mode.

Terrain View Heading and Track

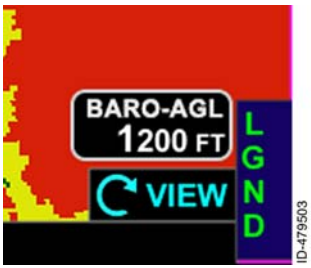
When in the terrain view and the heading is available, HDG UP is displayed in the upper-right corner of the terrain view.



The terrain view uses the magnetic heading from the magnetic ground track of the internal global positioning system (GPS) if the heading of the aircraft is invalid or unavailable and TRK UP (HDG FAIL) is displayed in the upper-right corner of the terrain view.

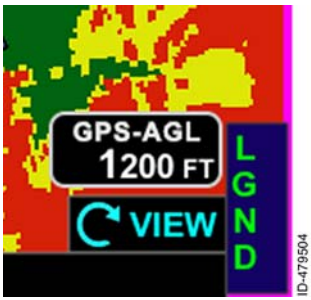
In heading-up or track-up mode, the direction of flight value displays the heading/track with a resolution of 1 degree and a range of 1 to 360 degrees.

Terrain View - Above Ground Level (AGL) Display



When configured to receive corrected barometric altitude and corrected barometric altitude is available and valid, the current height AGL, as computed from baro-corrected altitude and the terrain height directly below the aircraft, is shown in the **BARO-AGL** box in the lower-right of the display.

NOTE: In thumbnail views, the annunciation is shown as **AGL** .



When corrected barometric altitude is not available, not configured, or invalid and GPS altitude is available and valid, the current height AGL, as computed from the GPS altitude and the terrain height directly below the aircraft, is shown in the **GPS-AGL** box in the lower-right of the display.

NOTE: In thumbnail views, the annunciation is shown as **GSL** .

The AGL values are displayed and rounded down to the nearest hundreds of feet (i.e., 899 feet is rounded to 800 feet).

NOTE: The AGL value is not displayed if the GPS position information is not available.

CAUTION

CORRECT BAROMETRIC PRESSURE IS ESSENTIAL TO ACCURATE TERRAIN DEPICTION.

The AGL value is dashed (**- - - - -**) when there is no terrain coverage for the present position, or when the AGL value is above 51,000 feet or below 500 feet.

Terrain Legend

When the **LGND** bezel softkey label is active, a detailed terrain/obstacle legend is displayed, as shown in Figure 8-3.

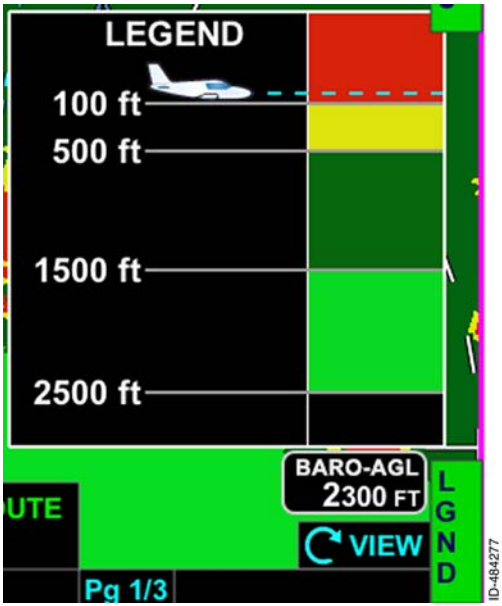


Figure 8-3
Airplane Terrain and Obstacle Legend

The terrain legend is removed from the display by any of the following pilot actions:

- **LGND** bezel softkey label is inactive
- The ***PAGE bezel key*** is pushed
- The ***VIEW bezel key*** is pushed.

OBSTRUCTION AND TERRAIN COLORING

The KSN 765/770 supports airplane obstructions and terrain thresholds based on the installed configuration.

NOTE: Only reported obstructions are displayed.

CAUTION

TERRAIN AND OBSTRUCTIONS DISPLAYED ARE ADVISORY ONLY, NOT FOR PRIMARY AVOIDANCE.

Obstruction Coloring

Obstructions are displayed on the terrain view within 40 NM of the ownship, as an inverted colored V symbol, relative to the ownship altitude. Figure 8-4 shows the obstruction height symbology for small towers, tall towers, and group obstructions.

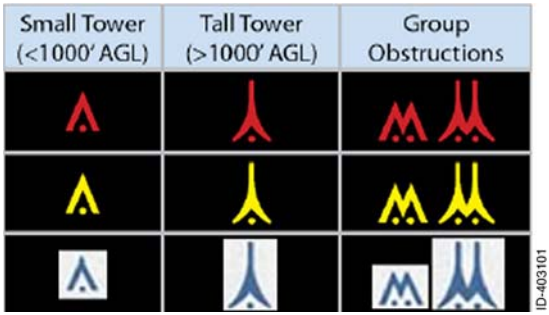


Figure 8-4
Obstruction Height

Obstructions 200 feet AGL and higher are displayed on the navigation map overly and terrain view. Table 8-1 lists obstruction thresholds for airplane installations.

Table 8-1
Obstruction Thresholds

	Obstruction Thresholds	Color
Airplane	Obstruction is between 1,000 feet and 600 feet below the current aircraft.	Blue
	Obstruction is between 600 feet and 200 feet below the current aircraft.	Yellow
	Obstruction is above the current aircraft or within 200 feet below the altitude of the current aircraft.	Red
NOTE: Values include a safety threshold of 100 feet.		

Terrain Coloring

The terrain view and overlay is displayed during the following modes:

- Ground and landing mode
- Departure mode
- En route and approach mode.

NOTE: When in ground, departure, or landing mode, the terrain color threshold is moved up 300 feet so the surrounding area is not displayed in red.

GROUND AND LANDING MODE

Ground mode is active when groundspeed is less than 40 knots. Landing mode is active when less than 800 feet AGL, the distance to the closest runway is less than 2 NM, and the aircraft is descending. Table 8-2 lists the ground and landing mode coloring for the terrain view and terrain overlay.

Table 8-2
Ground and Landing Mode Coloring

	Terrain Height	Terrain View Colors	Terrain Overlay Colors
Airplane	Less than 100 feet and below	Black	Topographic Terrain
	100 feet and above	Red	Red

DEPARTURE MODE

Departure mode is entered when groundspeed is greater than 40 knots when less than 800 feet AGL and within 2 NM of the closest runway. When departure mode is entered, terrain greater than or equal to 100 feet above the runway elevation is shown in red or yellow while terrain less than 100 feet is shown in topographic terrain. When the aircraft is 700 feet above the runway, terrain coloring gradually transitions to the en route mode, as shown in Figure 8–5.

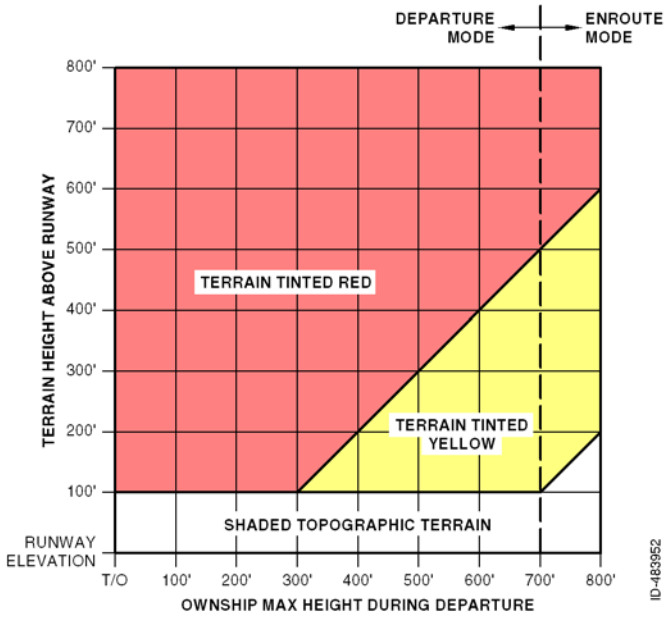


Figure 8–5
Departure Mode

EN ROUTE AND APPROACH MODE

En Route mode is entered when greater than 800 feet AGL and the distance to the closest runway is greater than 2 NM. Table 8-3 lists the en route and approach mode coloring for the terrain view and terrain overlay.

Table 8-3
En Route and Approach Mode Coloring

	Terrain Height	Terrain View Colors	Terrain Overlay Colors
Airplane	Terrain is greater than 2,600 feet below the current aircraft.	Black	Topographic Terrain
	Terrain is 1,600 feet to 2,600 feet below the current aircraft.	Light Green	Topographic Terrain
	Terrain is 600 feet to 1,600 feet below the current aircraft.	Dark Green	Topographic Terrain
	Terrain is 200 feet to 600 feet below the current aircraft.	Yellow	Yellow
	Terrain is above the current aircraft or within 200 feet below the current aircraft.	Red	Red

Terrain View Failures

An amber **TERRAIN FAIL** annunciator is displayed in the center of the terrain view and all symbols are removed when any of the following conditions occur:

- Altitude is invalid
- Position is invalid
- Heading and GPS track is invalid.

9. Traffic View

INTRODUCTION

This section describes the ***traffic view***. Traffic awareness is an optional feature and requires an external traffic sensor. When the KSN 765/770 is configured with one of the following traffic sensors, the unit can display traffic information:

- BendixKing TPU-66A
- BendixKing KTA-810/910
- BendixKing KMH 820/920
- BendixKing KTA 74
- Avidyne 9900BX
- Garmin GTX-330
- L-3 Skywatch™ TRC-497 and HP TRC-899.

WARNING

TIS AND TAS CANNOT GIVE ALERTS FOR TRAFFIC CONFLICTS FOR TARGET AIRCRAFT WITHOUT OPERATING TRANSPONDERS.

Traffic Information System (TIS) coverage is limited to specific areas listed in the Aeronautical Information Manual (AIM). TIS uses a ground surveillance-based radar system that provides traffic advisories and proximity alerts to aircraft equipped with mode A, C, and S transponders with an altitude encoder and a means to display the airborne traffic.

A traffic advisory or proximity alert is given to a TIS-equipped aircraft by a ground-based surveillance radar system. TIS provides relative bearing, relative range, relative altitude, heading, altitude trends, and traffic status (threatening or proximity) of up to eight intruder aircraft within a specified TIS airspace volume.

NOTE: See the AIM for detailed information about TIS requirements, capabilities, and limitations.

Traffic Awareness System (TAS) is an active, self-contained system that detects other aircraft with mode 3A transponders. TAS provides traffic advisories and proximity alerts for any aircraft equipped with a transponder, anywhere it flies.

All intruders tracked by a TAS are ranked and the intruder information is sent to the display in prioritized order.

NOTES:

1. For detailed information on the proper use and interpretation of the displayed traffic data when using TAS or TIS systems, refer to the pilot's guide that is provided with the traffic avoidance system.

2. The traffic function of the KSN 765/770 does not relieve the pilot of **see and avoid** responsibility. No avoidance maneuvers are provided or recommended by the traffic function.

TRAFFIC DISPLAY

WARNING

THE PILOT MUST NOT USE THE TRAFFIC DISPLAY TO INITIATE EVASIVE MANEUVERING. ATC PROCEDURES AND VISUAL ACQUISITION OF THE INTRUDER PRIOR TO INITIATION OF EVASIVE MANEUVERS MUST CONTINUE TO BE THE PRIMARY MEANS OF ENSURING AIRCRAFT SEPARATION. THE SYSTEM LACKS THE RESOLUTION (THE ACCURACY) NECESSARY FOR EVASIVE MANEUVERING.

There are two ways in which traffic is displayed:

- Traffic overlay on navigation map
- Traffic view in full screen, split screen, and thumbnail layouts.

The traffic overlay is described in Section 6, Navigation Map View.

The traffic view is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the traffic view is displayed. The traffic view is oriented heading-up, with either a 360° or arc compass view. When the traffic view is selected, the surrounding traffic is displayed, as shown in Figure 9-1.

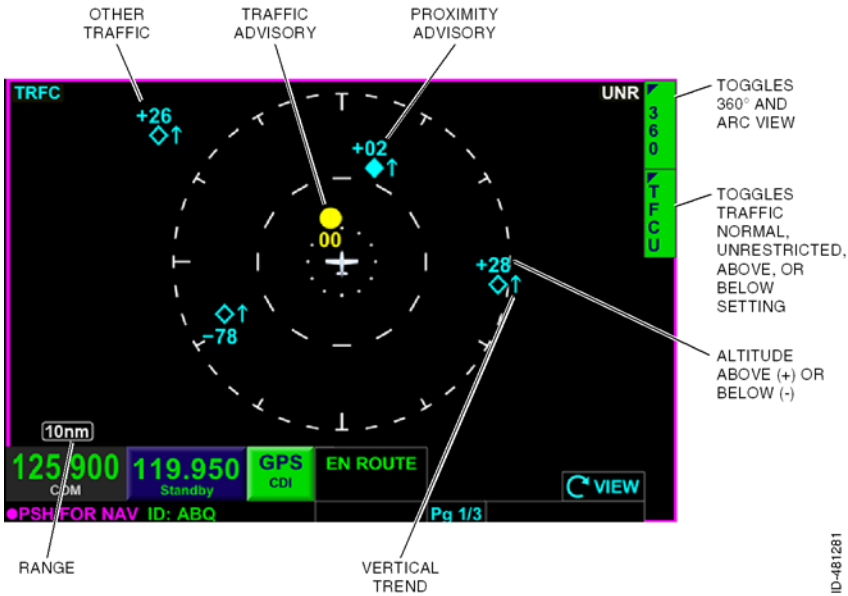


Figure 9-1
Traffic View

The range scale is selected with the ***zoom-in/+ and zoom-out/- bezel keys***, such that the outer radius of the primary range ring represents **2** , **3** , **5** , **10** , **15** , **20** , **30** , and **40** nautical miles (NM) from the current aircraft position.

NOTE: The range setting is retained following a power cycle of the unit.

When the pilot selects a range, the range is represented by the outer ring. The inner ring is roughly half the selected range. 360° and arc traffic views are available. Traffic advisories (TAs), proximity alerts, and other alerts are displayed in their positions relative to the current position and heading of the aircraft.

Supplemental traffic symbol information includes approximate altitude difference in hundreds of feet and whether the traffic is climbing or descending.

Traffic Features

In the traffic view and traffic overlay mode, the traffic symbols are displayed using traffic alert and collision avoidance system (TCAS) symbols and colors, shown in Figure 9-2.

Figure 9-2
Traffic Awareness Symbols

The traffic symbol data block displays the relative altitude and vertical direction of the traffic symbol. The relative altitude of the displayed traffic data block consists of the following requirements:

- Consists of two digits indicating the difference in hundreds of feet
- When the traffic altitude is not available, the altitude information is not displayed
- The + symbol indicates the traffic is above the current aircraft
- The - symbol indicates the traffic is below the current aircraft
- The data block for traffic within 100 feet of the current aircraft is displayed as **00**
- The **00** is displayed above the traffic symbol when the traffic is above the current aircraft, and displayed below the traffic symbol when the traffic is below the current aircraft.

The traffic vertical trend is displayed by an up-arrow (for climbing) or a down-arrow (for descending) to the right of the traffic symbol. The vertical trend arrow is not displayed when the intruder traffic is flying level or when the intruder traffic is not reporting altitude.

NOTE: The vertical trend arrow is displayed when traffic is climbing or descending at greater than or equal to 500 feet per minute.

Traffic Altitude Filter

The traffic overlay ***bezel softkey label*** in 2R is a four-position label that controls the traffic display. The following is a description of the four possible positions of the label.

- **TFCN** - Displays traffic in the normal traffic setting, which is indicated by the white **NRM** annunciator in the upper-right corner of the display. Traffic is displayed within 2,700 feet above and below the current aircraft.

- **TFCU** - Displays traffic in the unrestricted traffic setting, which is indicated by the white **UNR** annunciator in the upper-right corner of the display. Traffic is displayed within 9,900 feet above and below the current aircraft.

- **TFCA** - Displays traffic in the above traffic setting, which is indicated by the white **ABV** annunciator in the upper-right corner of the display. Traffic is displayed within 2,700 feet below the current aircraft to 9,900 feet above the current aircraft.

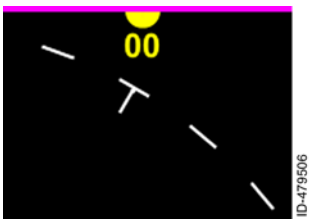
- **TFCB** - Displays traffic in the below traffic setting, which is indicated by the white **BLW** annunciator in the upper-right corner of the display. Traffic is displayed within 2,700 feet above the current aircraft to 9,900 feet below the current aircraft.

No Bearing Advisories

Intruding traffic that generates a traffic advisory and does not have bearing data is displayed in text format.

No bearing traffic advisories are centered on the display below the current aircraft with up to two text format traffic advisories. The highest priority TA is displayed first with the lower priority TA displayed below the higher priority TA.

Off Scale and Symbol Overlap



TAs outside the current range are indicated by a half-symbol at the edge of the display with the correct data block. Proximity advisories and other traffic outside of the current range are not displayed.

When multiple traffic symbols partially or completely overlap, the symbols are visually stacked, with the highest priority alert data on top, obscuring the lower priority alert. When a traffic symbol and the ownship symbol partially or completely overlap, the traffic symbol and data block will overlay the ownship symbol and indicate if the traffic is above or below the aircraft.

Traffic Pop-Up Mode

When a TA occurs, an amber TRAFFIC ALERT annunciator is displayed in the lower-center of the screen along with a thumbnail size traffic view, as shown in Figure 9-3.

NOTES:

1. When the TA is no longer valid, the annunciators are removed from the display.
2. If a TA occurs when the menu is displayed, the menu overlay is removed.

Figure 9-3
TA When Not in Traffic View

The thumbnail size traffic view range defaults to 3 NM The range can be controlled using the zoom-in/+ and zoom-out/- bezel keys.

The TA pop-up alert continues to be displayed until the TA is no longer valid or the CLEAR touchscreen softkey or ***bezel softkey*** is pushed. When the TA pop-up alert is displayed, only control of the ***CDI***, radios (through dedicated knobs and bezel softkeys), volume, and menu (for brightness) is permitted for use.

When a TA occurs and the manual airport diagram pop-up function or back function is active (indicated airspeed and groundspeed less than 30 knots), the manual airport diagram pop-up function and back function take precedence over the traffic pop-up function because the aircraft is on the ground.

Traffic Status Display

There are four possible states for the TAS traffic sensor status:

- Operational
- Standby
- Test
- Failure.

Traffic symbols are removed and a status annunciation is displayed when the traffic sensor is operating in any mode other than operational.

Table 9-1 lists the traffic awareness annunciators when the traffic view is in full screen, split screen, or thumbnail ***layout*** with traffic in the right ***window*** only.

Table 9-1
Traffic Awareness Annunciators - Full Screen, Split Screen, or Thumbnail Right Window

Type of Sensor	Status	Annunciation
TAS	Standby	TRFC STBY
TAS	Test	TRFC TEST
TAS	Failure	TRFC FAIL
TIS	Unavailable or out of range	TRFC UNAVAILABLE
NOTE: The ownship symbol is removed for the above status conditions.		

Table 9-2 lists the traffic awareness annunciators when the traffic view is in the thumbnail layout and the traffic view is selected in the top or bottom windows. Table 9-2 also list the traffic awareness annunciators when the traffic overlay is active.

Table 9-2
Traffic Awareness Annunciators - Top or Bottom Thumbnail Window or Traffic Overlay Active

Type of Sensor	Status	Annunciation
TAS	Standby	
TAS	Test	TRFC TEST
TAS	Failure	
TIS	Unavailable or out of range	TRFC UNAV
NOTE: The ownship symbol is removed for the above status conditions.		

TIS traffic is normally displayed in real time. When the traffic sensor information has not been refreshed for 6 seconds, the **TRFC COAST** annunciation and age indicator are displayed. After 12 seconds with no updates, the age indicator continues to be displayed and a **TRFC RMVD** (traffic removed) annunciator is displayed.

If the GPS fails or heading is invalid or unavailable, the traffic status becomes failure.

10. Datalink Weather View

INTRODUCTION

Datalink weather provides graphical and textual descriptions of weather-related information received from XM WX Satellite weather for the continental United States, Puerto Rico, and parts of Canada.

NOTE: A separate subscription and sensor is required for XM WX Satellite weather.

Each ***page*** within the ***datalink weather view*** can display one or more weather products using ***bezel softkeys*** to select the products.

CAUTION

THE USE OF THE DATALINK WEATHER VIEW IS FOR LONG-RANGE PLANNING PURPOSES ONLY, NOT SHORT-RANGE AVOIDANCE ADVICE. DO NOT USE INFORMATION PROVIDED TO PENETRATE WEATHER, THUNDERSTORMS, CELLS, OR LINES OF CELLS. THE AERONAUTICAL INFORMATION MANUAL RECOMMENDS AVOIDING THUNDERSTORMS IDENTIFIED AS SEVERE OR GIVING AN INTENSE RADAR ECHO BY AT LEAST 20 MILES.

There are two ways in which XM weather is displayed:

- NEXRAD and lightning overlay on navigation map
- Datalink weather view.

The weather overlay on the navigation map is described in Section 6, Navigation Map View.

WEATHER VIEW OVERVIEW

The weather view is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the weather view is displayed. The weather view gives the pilot the ability to view all of the available weather products without interfering with the ***navigation map view***, as shown in Figure 10–1.

Figure 10-1
Datalink Weather View

Table 10–1 lists the weather products that can be displayed in the datalink weather view.

Table 10-1
Datalink Weather View Products

Weather Product View	Weather Product Displayed
Convective	US and Puerto Rico NEXRAD US precipitation type Datalink lightning NEXRAD coverage Canada radar Canada coverage Convective SIGMETs
METARs	Graphical depiction and text information window
Echo Tops	Radar echo tops
Cloud Tops	Satellite mosaic
AIRMET/SIGMETs	Graphical depictions and text Information window
TFRs	Graphical depictions and text Information window
Winds Aloft	Wind speed and direction
XM Status	XM receiver status
XM Legends	Legends for listed XM supported views

Datalink Weather View Orientation

The datalink weather view displays the ownship symbol and flight plan overlaid on a black background, oriented to north-up in a 360° range ring. Table 10-2 lists the possible orientation annunciators that are displayed in the upper right corner of the datalink weather view.

NOTE: When the panning view control mode is on in weather view, the cursor is removed from the display.

Table 10-2
Weather View Orientation Annunciators

	Panning Inactive	Panning Active
Heading and GPS Ground Track is Available	NORTH UP	PAN MODE
Heading not Available or Invalid and GPS Ground Track is Available	NORTH UP (HDG FAIL)	PAN MODE (HDG FAIL)
Heading Available and GPS Ground Track is Unavailable or Invalid	NORTH UP	PAN MODE
Heading and GPS Ground Track Unavailable or Invalid	NORTH UP (HDG FAIL)	PAN MODE (HDG FAIL)

The datalink weather view uses the current heading or current track from the GPS if heading is invalid or unavailable for the ownship symbol display.

Following a power cycle, the datalink weather view initializes using either current position or last known position if the current position is not available.

In order to provide situational awareness, each screen displays international boundaries; state or province boundaries for the United States, Mexico, and Canada; and water features.

The datalink weather view is oriented north-up with the ownship oriented in the direction of the true heading or true track if heading information is unavailable. If the current heading or track is not available, **(HDG FAIL)** is displayed in the upper-right corner. If both the heading and track are unavailable, the ownship symbol is removed from display.

Datalink Weather View Range Selection

The datalink weather view scale is selected using the ***zoom-in/+ and zoom-out/- bezel keys***, such that the outer radius of the primary range ring represents **10** , **15** , **20** , **30** , **40** , **60** , **80** , **100** , **200** , **500** , and **1000** nautical miles (NM) from the current aircraft position.

NOTE: The range selection is retained following a power cycle of the unit.

The datalink weather view displays flight plan legs and waypoints from the FMS flight plan (when available).

XM Product Ages

CAUTION

NEXRAD WEATHER IMAGES COULD BE AS MUCH AS 20 MINUTES OLDER THAN ACTUAL WEATHER CONDITIONS. THE XM PRODUCT AGES BOX ASSOCIATED WITH THE NEXRAD DISPLAY DATA INDICATES THE TIME IN MINUTES SINCE THE IMAGE WAS RECEIVED BY THE SYSTEM (NOT WHEN IT WAS CREATED OR SENT BY XM WEATHER). THIS DELAY SHOULD BE CONSIDERED WHEN USING NEXRAD IMAGERY, AS THE MOVEMENT AND INTENSITY OF THE WEATHER COULD ADVERSELY AFFECT SAFETY OF FLIGHT.

The XM product ages box is displayed in the lower-left corner of the navigation map and datalink weather pages. The XM product ages for the selected weather products are displayed (in minutes) in green when data is being received and updated.

Table 10-3 lists the age annunciators associated with the datalink products and the pages in which they are displayed.

Table 10-3
Product Age Annunciators

Annunciator	XM Product/Displayed Page
NXRD	NEXRAD - Convective page and datalink weather overlay.
LTNG	Lightning - Convective page and datalink weather overlay.
SIG	SIGMETs - Convective page and AIRMET/SIGMET page.
AIR	AIRMETs - AIRMET/SIGMET page.
AGE	General Data Age - METAR, echo top, cloud top, TFR, and winds aloft pages.
TFR	TFR - TFR overlay and navigation map.

If the generated data age is not available or after startup no valid data has been received from the receiver, the XM data ages are displayed as dashes.

If the XM receiver is not operational for 30 seconds after an error is detected, the data age annunciator (except Puerto Rico NEXRAD) is displayed in black text on an amber background. If an error is detected but information has not expired and may still be valid, the data age annunciator is also displayed in black text on an amber background.

If a weather product is active and the data age exceeds the expiration time listed in Table 10-4, the age annunciators are displayed with a red dash and corresponding graphical data is removed.

Table 10–4 lists the expiration time for the available weather products.

Table 10–4
Weather Product Expiration Times

Weather Product	Expiration Time (Minutes)	Update Frequency (Minutes)
US NEXRAD	30	5
Puerto Rico NEXRAD	30	5
High Resolution (Canada) Radar	30	10
US Radar Coverage	30	5
Canada Radar Coverage	30	10
Precipitation Type	30	5
Echo Top	30	7.5
Cloud Top	60	15
Datalink Lightning	30	5
SIGMET	60	12
AIRMET	60	12
METAR	75	12
Winds Aloft	140	12
TFR	60	12
TAF	75	12

DATALINK WEATHER PAGES

The pilot can select any of the following weather pages from the datalink weather page by activating the SEL *bezel softkey label* and rotating the joystick knob:

- Convective page
- METARs page
- Echo tops page
- Cloud tops page
- AIRMET/SIGMETs page
- TFR page
- Winds aloft page
- XM status page.

When the SEL bezel softkey label is active, the weather product selection function is active. Wx X/8 is displayed in the lower-right corner of the display, where X indicates current weather product screen. The selected weather product name is displayed as the header of each datalink weather page in magenta when the SEL bezel softkey label is active.

Rotating the joystick knob selects another weather product screen. The datalink weather display, bezel softkey labels, header, and Wx X/8 label change as different weather product screens are selected.

When the SEL bezel softkey label is inactive, the weather product selection function is exited. Rotating the joystick knob when the SEL bezel softkey label is displayed alternates the *MFD* views (navigation map, terrain, etc.).

When the touchscreen is inactive, the weather product page titles are flat and not selectable. When the touchscreen is active, the weather product page title (shown in Figure 10-2 as METARS) and view title (shown in Figure 10-2 as WEATHER) become embossed and selectable. When the touchscreen is active and either of the embossed ***touchscreen buttons*** are selected, the weather view page list is displayed, as shown in Figure 10-2. The weather pages can be directly selected by using the touchscreen to select a weather product from the list.

Figure 10-2
Weather View Page List

The currently displayed weather page is displayed with blue text on a green background in the list. All other pages are displayed with green text on a blue background. Any of the pages can be displayed by using the touchscreen to select the desired page title and then pushing OK on the touchscreen. The weather view page list is removed after 5 seconds of inactivity.

NOTE: The page selection is retained following a power cycle of the unit.

Convective Page

The convective page, shown in Figure 10-3, can display the following radar coverages:

- US and Puerto Rico NEXRAD
- US precipitation type
- Convective SIGMETs
- Datalink lightning
- Canada radar
- US NEXRAD coverage
- Canada coverage.

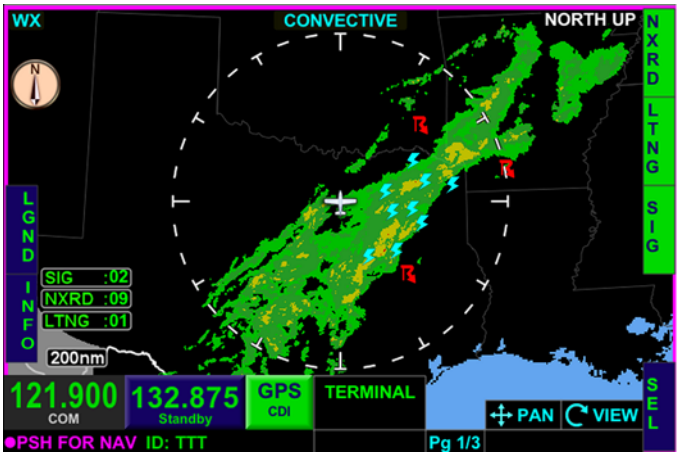


Figure 10-3
Convective Page

NEXRAD (next-generation radar) detects precipitation and atmospheric movement. NEXRAD is a network of 159 high-resolution Doppler radars operated by the National Weather Service (NWS), an agency of the National Oceanic and Atmospheric Administration (NOAA), to detect meteorological data for the United States. The data can be processed and displayed in a mosaic map showing patterns of precipitation and movement. Each NEXRAD radar site has a maximum range of 250 NM.

CAUTION

NEXRAD WEATHER IMAGES COULD BE AS MUCH AS 20 MINUTES OLDER THAN ACTUAL WEATHER CONDITIONS. THE XM PRODUCT AGES BOX ASSOCIATED WITH THE NEXRAD DISPLAY DATA INDICATES THE TIME IN MINUTES SINCE THE IMAGE WAS RECEIVED BY THE SYSTEM (NOT WHEN IT WAS CREATED OR SENT BY XM WEATHER). THIS DELAY SHOULD BE CONSIDERED WHEN USING NEXRAD IMAGERY, AS THE MOVEMENT AND INTENSITY OF THE WEATHER COULD ADVERSELY AFFECT SAFETY OF FLIGHT.

The NEXRAD radar also has the following limitations:

- Although reflectivity echoes are possible up to 248 NM, the interpretation of the data does not work beyond 186 NM. After which only the general shape of the storms can be made out.
- NEXRAD is unable to differentiate between types of precipitation.
- The radar beam is oriented 5 degrees above the horizon. As a result, the farther from the antenna, the higher the area scanned by the beam. This translates to limited low storm detection farther from the individual radar location. Conversely, there is limited high altitude storm detection directly above the radar location.
- The image that is shown on the cockpit display is a collage of radar images from multiple ground radar sites. When the NEXRAD display in the cockpit is updated, it may or may not contain new information from each ground site.
- Weather conditions depicted on the mosaic image will always be older than the time indicated on the display. By the time radar images are captured and processed by the ground radar sites and then transmitted to the aircraft, the image on the cockpit display may exceed the time monitor indication by as much as 20 minutes. This delay in information dissemination should be considered when using NEXRAD imagery for weather avoidance as the movement and intensity of the weather could affect the safety of the flight.

CONVECTIVE PAGE BEZEL SOFTKEY LABELS

The convective page displays severe weather information overlaid on a map. Precipitation is displayed as a color coded NEXRAD radar overlay on the map. In the convective page, when the radar **NXRD** bezel softkey label (at 1R) is active, the following coverages are displayed (when available):

- US and Puerto Rico NEXRAD
- US Precipitation type
- Lightning
- US NEXRAD coverage
- Canada radar
- Canada coverage.

When the **NXRD** bezel softkey label is inactive, the graphical NEXRAD depictions are removed from the display.

When the **LTNG** bezel softkey label (at 2R) is active, datalink lightning (when available) is displayed, as shown in Figure 10–4.

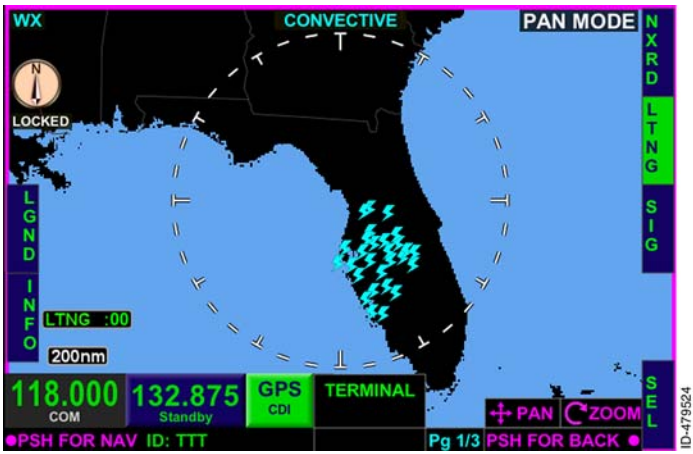


Figure 10–4
Datalink Lightning

When the **LTNG** bezel softkey label is inactive, the graphical lightning depictions are removed from the display.

When the convective SIG bezel softkey label (at 3R) is active, the SIGMET graphical depictions (when available) are displayed, as shown in Figure 10–5.

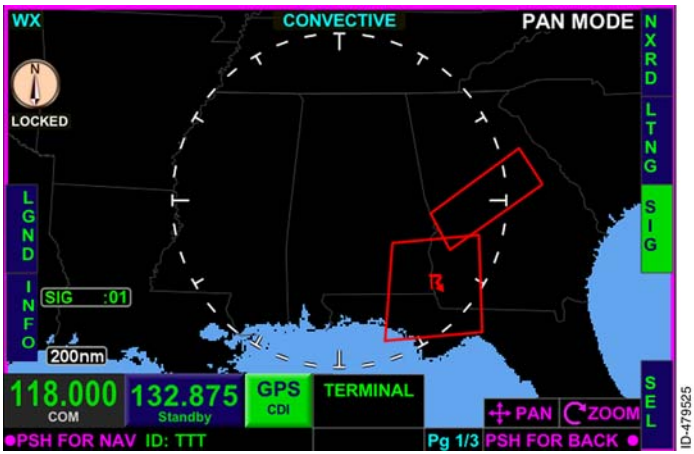


Figure 10-5
SIGMETs

When the SIG bezel softkey label is inactive, the SIGMET graphical depictions are removed from the display.

When the convective **INFO** bezel softkey label (at 4L) is active, convective graphical depictions are individually selectable and highlighted, as shown in Figure 10-6. Rotating the joystick knob toggles through the selectable items depicted on the convective page. The touchscreen display can also be used to select individual convective displays.

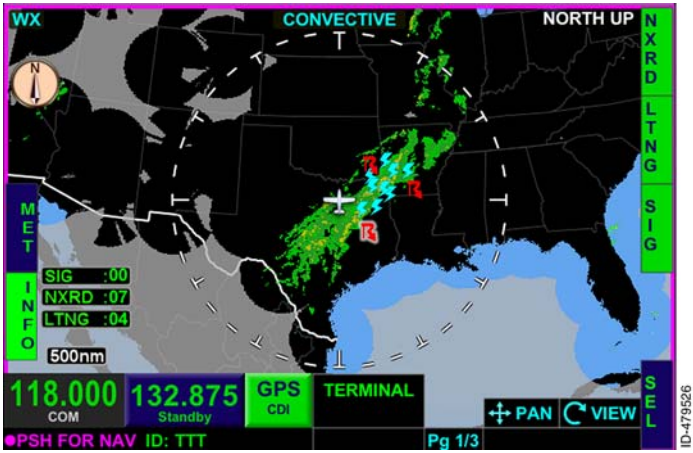


Figure 10-6
Convective Info Bezel Softkey Label

When the AIRMET/SIGMET description (MET) bezel softkey label (at 1L) is active, a textual description of the highlighted convective item is displayed, as shown in Figure 10–7. Rotating the joystick knob toggles through the selectable items depicted on the convective page.

Figure 10-7
Convective Detail

CONVECTIVE PAGE LEGEND DISPLAY

The convective page legend, shown in Figure 10–8, is displayed when the LGND bezel softkey label is inactive. The convective page legend assists the pilot in recognizing the different graphical weather depictions.

NOTE: The LGND bezel softkey label is displayed when the INFO bezel softkey label is inactive. LGND is replaced with MET when INFO is active.

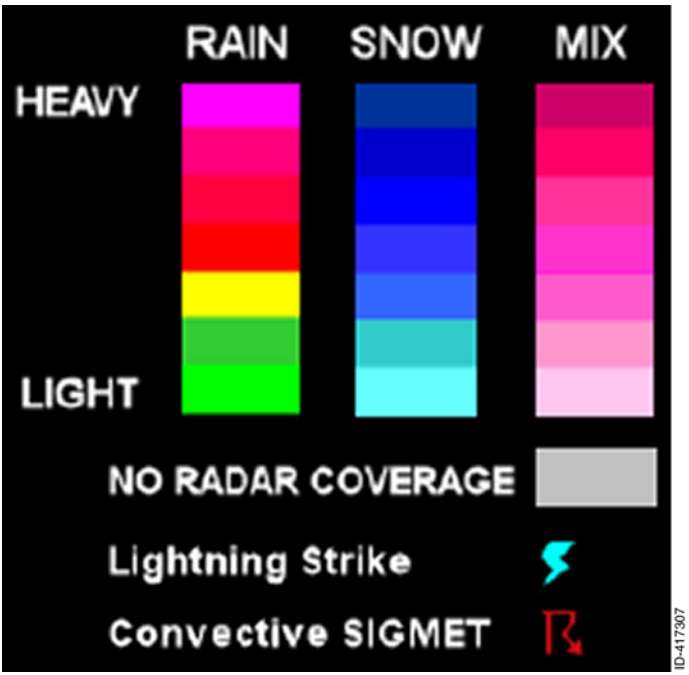


Figure 10-8
Convective Legend

When the US precipitation type is not available but US NEXRAD radar is available, the graphical weather depiction is displayed as rain.

When the US precipitation type is available and US NEXRAD radar is not available, the US NEXRAD data is not displayed.

When US coverage is not available or expired and US NEXRAD is available, the weather depiction is displayed as if all US radar sites are valid.

When Canada coverage is not available and Canada radar is available, the Canada weather depiction is rendered as if all Canadian radar sites are valid.

Areas without radar coverage are displayed with a transparent gray color when the **NXRD** bezel softkey label is active, as shown in Figure 10–9.

NOTE: The convective weather product screen does not display echo tops or cloud tops to avoid confusion with the gray areas of no coverage with either weather option.

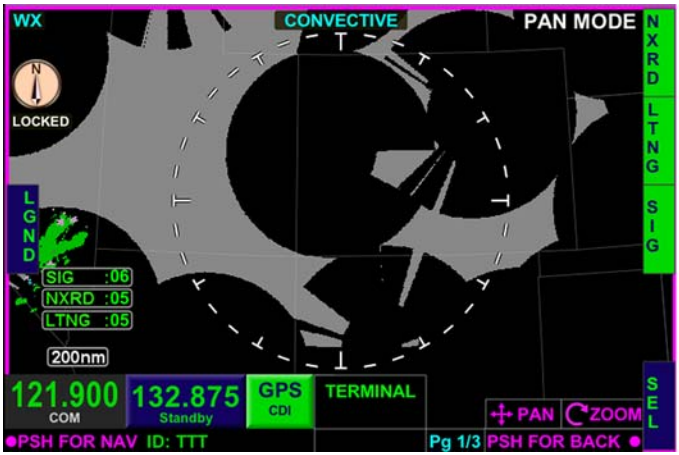


Figure 10-9
No Radar Coverage

When US NEXRAD radar or Canada radar exceed the specified expiration time, the radar depiction is rendered as no coverage (transparent gray).

When Puerto Rico NEXRAD radar exceeds the update rate by 1 minute, the radar depiction is rendered as no coverage.

NOTE: Radar cells indicating reflectivity below 10 dBZ are not displayed.

CONVECTIVE PAGE DATALINK LIGHTNING DISPLAY

Satellite lightning is displayed as a cyan-colored lightning symbol, shown in Figure 10-10, on top of the NEXRAD radar display.

Figure 10-10
Datalink Lightning Symbol

Lightning symbols show the reported approximate location of cloud-to-ground lightning strikes. The lightning symbol is displayed at full intensity for 5 minutes following a lightning strike and then begins to fade out over a 15-minute time frame.

METARS Page

The METARS page displays graphical Aviation Routine Weather Reports (METARs) with a color-coded flag at weather reporting airports. A METAR is an hourly weather report from the reporting airport (not all airports have a report). METARs issued in the United States and Canada generally provide METAR information about the airport, date and time, wind direction and speed, visibility, precipitation, current weather conditions, cloud cover and layer, temperature, barometric pressure, and other critical data. International METARs may vary.

The METARS page displays graphical METAR data as colored flags, as shown in Figure 10-11. The METARS page displays the flags at airport locations from which the METAR is reported, overlaid on a map.

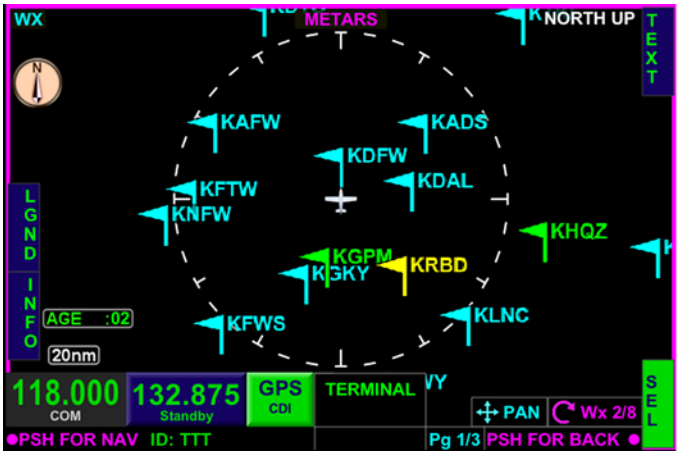


Figure 10-11
METARS Page

METARS DISPLAY

The METARS page legend, shown in Figure 10-12, assists the pilot in recognizing the different flight conditions reported at the airport. The graphically displayed flags are color-coded to indicate the different flight conditions. When the LGND bezel softkey label is active for display, the METARS legend is displayed.

Figure 10-12
METAR Legend

Table 10-5 lists the METAR flags and airport identifiers that are decluttered according to a selected range.

Table 10-5
METARS Page Range Declutter

Airport Size	Range (NM) - METAR Flag and Airport ID	Range (NM) - Only METAR Flag Displayed
Large Airports	10 – 1,000	1,000
Medium/Large Airports	10 – 200	500
Medium Airports	10 – 100	200
Medium/Small Airports	10 – 80	100
Small Airports	10 – 60	80

METAR FLAG VIEW CONTROL MODE

When the **INFO** bezel softkey label is active, the pilot can select a METAR flag by rotating the joystick knob or by touching the displayed symbol on the touchscreen. The selected METAR flag and airport identifier are displayed and increased in size, as shown in Figure 10-13.

Figure 10-13
METAR Flag and Identifier

Clockwise rotation of the joystick knob selects the METAR flags in a left to right, top to bottom order. Counterclockwise rotation of the joystick knob cycles through the METAR flags from right to left, bottom to top order.

When an airport identifier is selected and the METAR flag is within the visible area of the view, the METAR flag for the selected airport identifier is selected when the select weather depiction view control mode is active.

When an airport identifier is selected and the METAR flag is not within the visible area of the view, the METAR flag which is South of the airport identifier selected (within the visible area of the view) is selected.

METAR TEXT

When METAR APT bezel softkey label is active, the latest METAR text, previous METAR text, and latest terminal aerodrome forecast (TAF) text are displayed (when available), as shown in Figure 10-14.

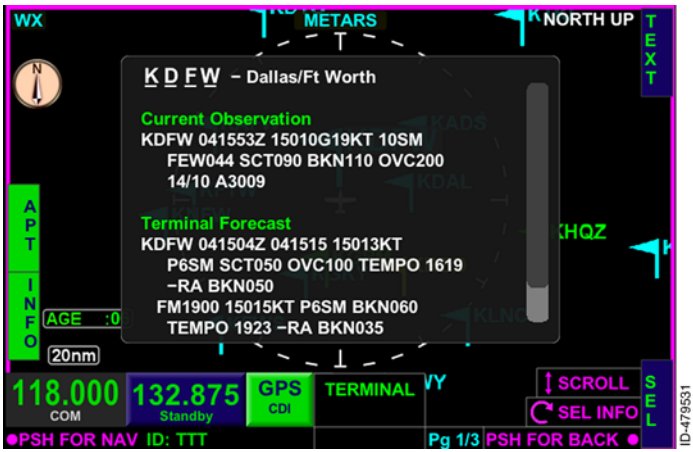


Figure 10-14
METAR Text

When available, **Special Observation** and **Current Observation** are displayed above the special and current observations in cyan. **Previous Observation** is displayed above the previous METAR text, and **Terminal Forecast** is displayed above the latest TAF text.

There are two options for viewing textual METARs:

1. Rotating the joystick knob through multiple airports METARs, or

2. Viewing an individual airport METAR by entering the airport identifier using the joystick knob to change the airport identifier or by tapping on the airport identifier and entering the desired identifier using the ***QWERTY keypad***.

DEP, DEST, AND NRST BEZEL SOFTKEY LABELS

When the **TEXT** bezel softkey label is active, **DEP** , **DEST** , and **NRST** bezel softkey labels are displayed along the right side, as shown in Figure 10–15.

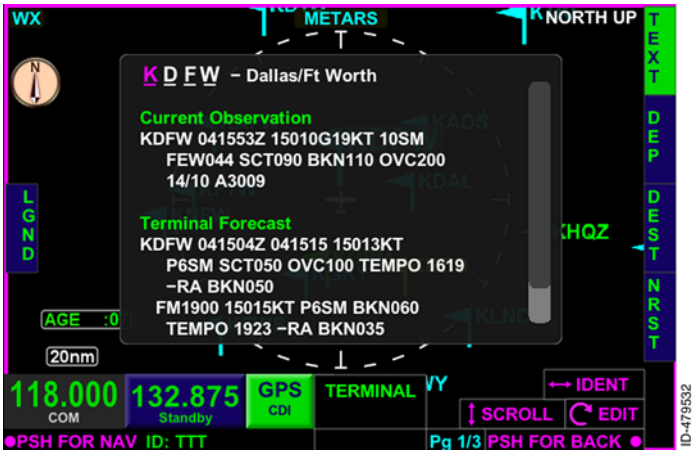


Figure 10–15
DEP, DEST, and NRST

The following paragraphs describe the DEP, DEST, and NRST bezel softkey label functions:

- **DEP** – Pushing the **DEP** bezel softkey automatically fills the identifier of the airport (with METAR information) closest to the startup latitude/longitude point. In addition, the **SELECTING DEPARTURE** message is displayed for 1 second.

- **DEST** – Pushing the **DEST** bezel softkey automatically fills the identifier of the airport (with METAR information) closest to the destination latitude/longitude point or the airport closest to the startup latitude/longitude point when a destination is not entered in the flight plan. In addition, the **SELECTING DESTINATION** message is displayed for 1 second.
- **NRST** – Pushing the **NRST** bezel softkey automatically fills the identifier of the nearest airport (with METAR information) to the aircraft present position. At startup, this is the same as the **DEP** bezel softkey. In addition, the **SELECTING NEAREST** message is displayed for 1 second.

NOTES:

1. The destination latitude/longitude is based on the flight plan of the GPS receiver.
2. At start-up the **DEP** , **DEST** , and **NRST** bezel softkey labels associated with the METAR weather view are only displayed when the aircraft position information is available.
3. The **DEP** , **DEST** , and **NRST** bezel softkey label are removed from display if the aircraft position becomes unavailable.

METARs and TAFs for airports other than the departure, destination, and nearest can be viewed by using joystick knob and the touchscreen to change the airport identifier as desired, or by tapping on the airport identifier and entering the desired identifier using the QWERTY keypad.

Echo Tops Page

Echo tops data indicates the highest altitude at which precipitation is falling. The echo tops page is overlaid on a mosaic map display. Echo tops indicate the location and altitude (above MSL) of the highest radar echo, as shown in Figure 10-16.

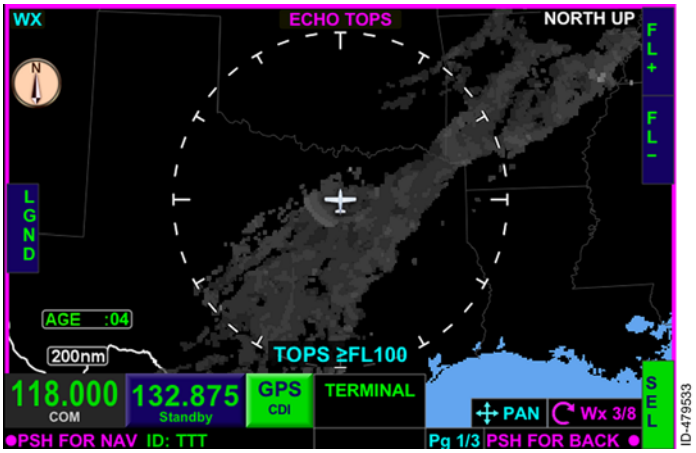


Figure 10-16
Echo Tops Page

The echo tops display is similar to cloud tops. However in most cases the top of the cloud will be somewhat higher than the top of the precipitation echoes. Echo tops are useful when determining the intensity of a storm's updraft. Generally the higher the echo tops, the stronger the updraft within a storm, which makes convective wind gusts and large hail more likely.

The echo tops page displays graphical echo tops information at or above the selected altitude filter. The pilot can select and increase the altitude filter by pushing the FL+ bezel softkey. Decreasing the altitude filter is accomplished when the pilot pushes the FL- bezel softkey. The current filter level is displayed in the lower-center of the display.

NOTE: The echo tops altitude filter value moves in increments of 5,000 feet. The altitude filter can be adjusted up to 70,000 feet to as low as 5,000 feet and is retained following a power cycle.

The graphical echo tops is displayed in 15 shades of gray, with dark gray displayed as the lowest altitude filter, and white displayed as the highest altitude filter. The echo tops legend, shown in Figure 10–17, is displayed when the **LGND** bezel softkey is pushed.

Figure 10–17
Echo Tops Legend

Cloud Tops Page

The cloud tops page displays a cloud top graphical depiction. Cloud tops are the height of convective and upper-level clouds determined from the satellite mosaic. When the datalink weather view cloud tops page is selected, cloud tops are overlaid on a mosaic map, as shown in Figure 10-18.

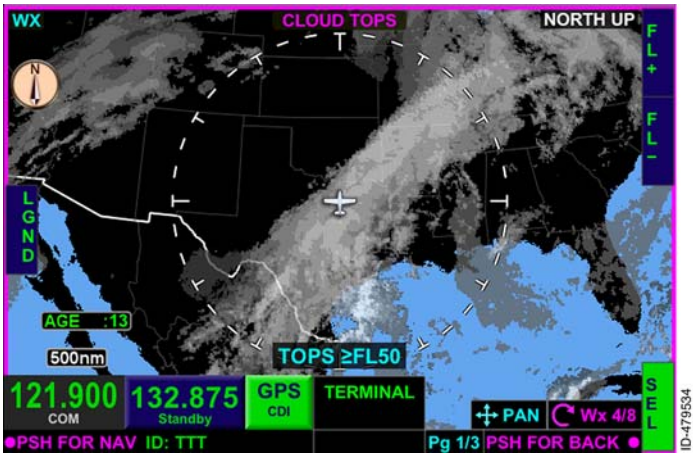


Figure 10-18
Cloud Tops Page

The cloud tops page displays graphical cloud tops information at or above the selected altitude filter. The pilot can select and increase the altitude filter by pushing the **FL+** bezel softkey. Decreasing the altitude filter is accomplished when the pilot pushes the **FL-** bezel softkey. The current filter level is displayed in the lower-center of the display and is retained following a power cycle.

NOTE: The cloud tops altitude filter increments based on the datalink data.

The graphical cloud tops page is displayed in 7 shades of gray, with dark gray displayed as the lowest altitude filter, and white displayed as the highest altitude filter. The cloud tops legend, shown in Figure 10–19, is displayed when the **LGND** bezel softkey is pushed.

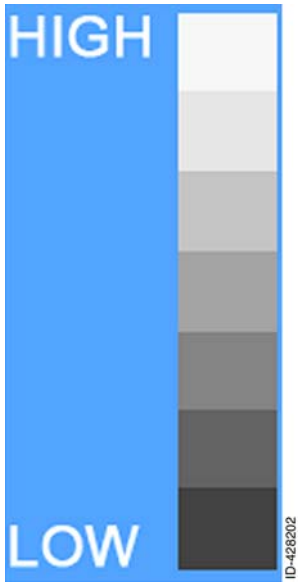


Figure 10–19
Cloud Tops Legend

AIRMET/SIGMET Page

The AIRMET/SIGMET page displays a graphical depiction of AIRMETs (Airmen's Meteorological information) and SIGMETs (Significant Meteorological information). AIRMETs and SIGMETs are weather advisories broadcast by the National Weather Service for the lower 48 contiguous United States and adjacent coastal waters. The AIRMET/SIGMET page displays advisories as graphical images overlaid on a map, as shown in Figure 10–20.

Figure 10-20
AIRMET/SIGMET Page

The following is a description of the bezel softkey labels displayed on the AIRMET/SIGMET page:

- ICNG – When the **ICNG** bezel softkey label is active, icing AIRMETs and SIGMETs (when available) are displayed. When the **ICNG** bezel softkey label is inactive, icing AIRMETs and SIGMETs are removed from the display.
- TURB – When the **TURB** bezel softkey label is active, turbulence AIRMETs and SIGMETs, and surface wind AIRMETs (when available) are displayed. When the **TURB** bezel softkey label is inactive, turbulence AIRMETs and SIGMETs, and surface wind AIRMETs are removed from the display.
- IMC – When the **IMC** bezel softkey label is active, IFR AIRMETs, mountain obstruction AIRMETs, dust storm SIGMETs, volcanic ash SIGMETs, and sandstorm SIGMETs (when available) are displayed. When the **IMC** bezel softkey label is inactive, Instrument Meteorological Conditions (IMC) graphical data is removed from the display.

- CONV – When the **CONV** bezel softkey label is active convective SIGMETs (when available) are displayed. When the **CONV** bezel softkey label is inactive, convective SIGMETs are removed from the display.

The AIRMET/SIGMET page legend, shown in Figure 10–21, is displayed to assist the pilot in recognizing the different AIRMETs and SIGMETs reported. The graphically displayed AIRMETs and SIGMETs indicate the different conditions. The legend is displayed when the **LGND** bezel softkey label is active.

Figure 10–21
AIRMET/SIGMET Legend

When the **INFO** bezel softkey label (at 2L) is active, AIRMET and SIGMET graphical depictions are individually selectable and highlighted, as shown in Figure 10-22. Rotating the joystick knob toggles through the selectable items depicted on the AIRMET/SIGMET page. The touchscreen can also be used to select individual AIRMETs and SIGMETs.

Figure 10-22
AIRMET/SIGMET Info Bezel Softkey Label

When the MET bezel softkey label (at 1L) is active, a textual description of the highlighted AIRMET or SIGMET is displayed, as shown in Figure 10-23. Rotating the joystick knob toggles through the selectable items depicted on the AIRMET/SIGMET page.

Figure 10-23
AIRMET/SIGMET Detail

Temporary Flight Restriction (TFR) Page

The TFR page displays a graphical depiction of temporary flight restrictions, outlined in red on a mosaic map, as shown in Figure 10–24. TFRs are usually issued in the United States and are typically short term. TFRs can include major sporting events, air shows, natural disaster areas, space launches, and Presidential movements.

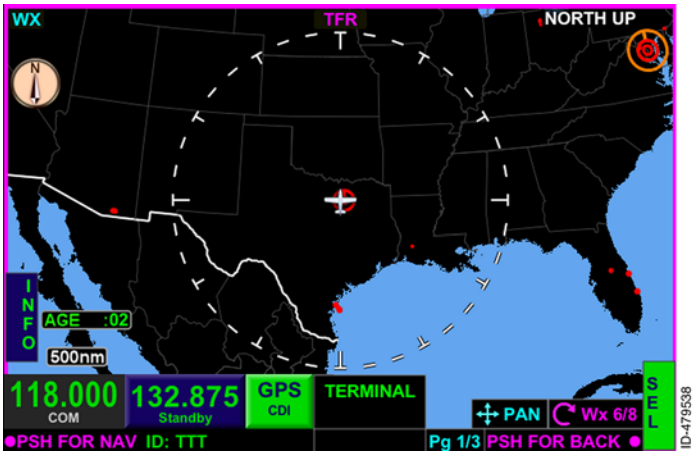


Figure 10–24
TFR Page

When the INFO bezel softkey label (at 2L) is active, TFR graphical depictions are individually selectable and highlighted, as shown in Figure 10-25. Rotating the joystick knob toggles through the selectable items depicted on the TFR page. The touchscreen can also be used to select individual TFRs.

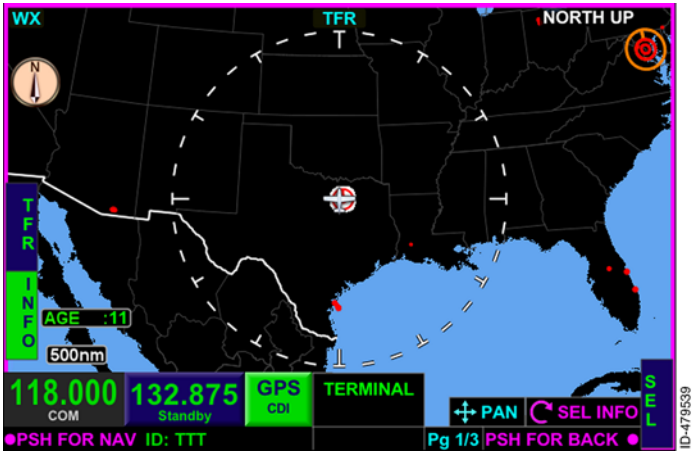


Figure 10-25
Selectable TFRs

When the TFR bezel softkey label (at 1L) is active, a textual description of the highlighted TFR is displayed, as shown in Figure 10-26. Rotating the joystick knob toggles through the selectable items depicted on the TFR page. The type of restricted area, the name, the altitudes affected, the date and time the TFR was created and modified, and the date and time the TFR is active and expires (when available) are displayed.

Figure 10-26
TFR Selected

Winds Aloft Page

The winds aloft page displays the forecast wind speed and direction at the selected altitude above MSL on a mosaic map. When the winds aloft page is selected, wind information is displayed with wind arrows extending out from station circles, as shown in Figure 10-27.

Figure 10-27
Winds Aloft Page

NOTE: When the range selection is at or below 500 NM, the wind barbs are displayed. When the range selection is larger than 500 NM, the wind barbs are not displayed.

The pilot can select and increase the altitude filter by pushing the **FL+** bezel softkey. Decreasing the altitude filter is accomplished when the pilot pushes the **FL-** bezel softkey. The current filter level is displayed in the lower-center of the display.

NOTE: The winds aloft altitude filter value moves in increments of 3,000 feet. The altitude filter is adjusted up to FL420 to as low as the surface and is retained following a power cycle.

WIND ARROWS

The wind arrows are depicted with short or long barbs, as shown in Figure 10-28. The short barb indicates winds at 5 knots. The long barbs indicate that the winds are at 10 knots. A pennant indicates the winds are at 50 knots. The barbs and pennants are oriented downwind. The winds aloft legend is displayed when the **LGND** bezel softkey label is active.

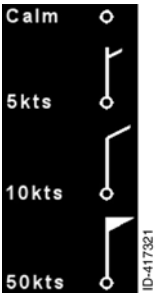


Figure 10-28
Winds Aloft Legend

NOTE: The wind arrow supports up to 3 pennants and 4 long barbs for a maximum representation of 190 knots.

When the wind speed is less than 5 knots, the wind arrow is replaced with a white **circle** which indicates calm winds.

XM Status Page

When the datalink weather XM status page is selected, the XM receiver status pop-up box is displayed, as shown in Figure 10-29.

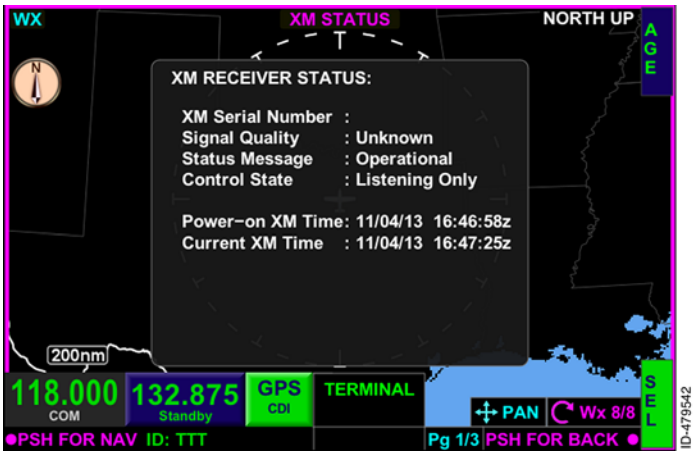


Figure 10-29
XM Receiver Status Page

The XM receiver status pop-up box displays the following information:

- XM serial number

  NOTE: XM serial number is only displayed when the KSN is configured as the Controller. Consult an avionics installer.

- Signal quality
- Status message
- Control state
- Time
- Descriptive messages.

XM SERIAL NUMBER

The XM serial number is displayed as an 8-digit alphanumeric code. When the serial number is not available, the XM serial number is blank.

SIGNAL QUALITY

Table 10-6 lists the available signal quality annunciators that are displayed in the XM receiver status pop-up box.

Table 10-6
Signal Quality Annunciators

Annunciator	Description
No Signal	No satellite signal is received. This is a reception problem, or a broken or missing antenna.
Weak	XM receiver is receiving some signal, but the quality is low, which can prevent the data products from being received and displayed.
Marginal	XM receiver is receiving some signal, but the quality is marginal, which can prevent some of the data products from being received and displayed.
Good	The receiver is detecting a normal satellite signal and data is reliable.
Unknown	No signal information is available.

STATUS MESSAGES

Table 10-7 lists the available status message annunciators that are displayed in the XM receiver status pop-up box.

Table 10-7
Status Message Annunciators

Annunciator	Description
Operational	The XM receiver is initialized and ready to receive data.
Powering Up	The XM receiver is in the process of initializing. If the receiver does not communicate or fails to initialize, the KSN 765/770 attempts to power-up again after 15 seconds. Continued failure to power-up means there is an issue with the power to the receiver, a bad connection between the KSN 765/770 and receiver, or a bad connection between the KSN 765/770 and the XM receiver.
Tuning	The XM receiver is attempting to locate the satellite and tune to the correct channel to receive the weather products. If this state persists, then it means a broken or disconnected antenna, or the satellite signal is obstructed.
Saving Config	Periodically, the unit configuration is saved (such as subscription data) and reboots. This is done automatically and is synced by XM such that no weather data products are lost during the cycling.
Unknown Error	An error is indicated, but the receiver does not specify what the error is.
No Service	No service is available.
Data Unavailable	The receiver is tuned to the satellite, but data is not available (such as: off the air, weak signal condition, or service is blocked).
XM Error Indicated	The XM receiver indicates that there is an error, but did not specify the source of the error.

Table 10-7 (cont)
Status Message Annunciators

Annunciator	Description
Activation Required	The XM receiver is indicating that the receiver is not activated. Follow the instructions to activate the receiver.
Antenna Failure	The XM receiver is reporting that no antenna is connected.
No Communications	The XM receiver is not communicating with the KSN 765/770. Continued failure to power-up means there is an issue with power to the receiver, a bad connection between the KSN 765/770 and receiver, or a bad connection between the KSN 765/770 and the XM receiver.
No Signal	The XM receiver is indicating that no signal is found.

CONTROL STATE

Table 10-8 lists the available control state annunciators that are displayed in the XM receiver status pop-up box.

Table 10-8
Control State Annunciators

Annunciator	Description
Retrying	Doing a soft boot of the XM unit by sending a power-down command and waiting 15 seconds.
Powering Up	Initializing communications with the XM unit.
Operational	Normal operation mode, where any data products received is displayed.

Table 10-8 (cont)
Control State Annunciators

Annunciator	Description
Listening Only	The KSN 765/770 is in listen-only mode. This means that a different KSN 765/770 is controlling the XM receiver, but this unit still displays any weather product that is received. Initializing the XM unit and responding to errors is the responsibility of the other KSN 765/770, and this unit is only passively listening.
Configuring	The XM unit is configured to send certain periodic messages (such as signal quality and time).
Tuning	Searching for the satellite signal and tuning to the correct frequency for the weather products.
Validating - x	Validating the content channels for the weather products. There are 11 content channels that are used for the XM weather products, so each one is individually validated.
Validating - Done	The validation of the content channels is complete.
Saving Config	Periodically, the unit configuration is saved (such as subscription data) and reboots. This is done automatically and is synced by XM such that no weather data products are lost during the cycling.

DESCRIPTIVE MESSAGES

The following are two types of descriptive messages that are displayed in the XM receiver status pop-up box:

- Operational
- Error.

Only one descriptive message is displayed at a time, with error messages taking precedence over operational messages.

Table 10–9 lists the available operational descriptive messages that are displayed in the XM receiver status pop–up box.

Table 10–9
Operational Descriptive Messages

Displayed Descriptive Message	Description	Priority Order
The XM receiver is now operational, but may take several minutes before data products are displayed	This message is displayed when the XM receiver becomes operational after being inoperative.	1
Geographic limitation: XM Weather is not available	This message is displayed when the XM data is not available from the current location.	2
Winds Aloft data removed for ranges > 500 NM	This message is displayed when in the datalink weather view winds aloft page and the range selection is above 500 NM.	3

Table 10–10 lists the available error descriptive messages that are displayed in the XM receiver status pop–up box.

Table 10–10
Error Descriptive Messages

Displayed Descriptive Message	Description
XM receiver is not communicating with this KSN 7XX, check power and connections	This message is displayed when the XM receiver is not communicating with the KSN 765/770.
XM receiver is not activated, Call 800.985.9200, or go to xmweather.com to subscribe **Signal Quality Good time: ##.# minutes** **Activation requires 12 minutes of continual Good Signal Quality**	This message is displayed when the XM receiver is not activated. The **##.#** is a number in minutes that represents how long the signal has been good.
XM Receiver is not receiving satellite data, Check antenna connections	This message is displayed when the antenna status is not detected.

XM PRODUCT AGES

The age of each product is displayed as a time annunciation on each weather page. In addition, the pilot can view a list of each product's age from the XM Product Ages screen. When the **AGE** bezel softkey label in 1R is active, the XM Product Ages (Generated/Received) are displayed, as shown in Figure 10-30.

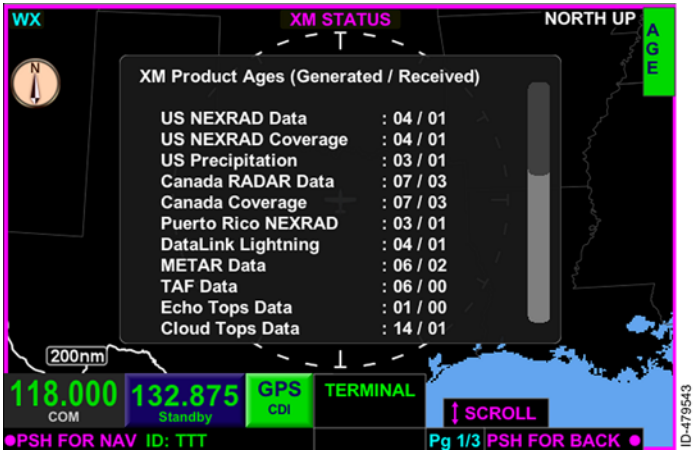


Figure 10-30
XM Product Ages

The XM Product Ages page displays the generated and received elapsed time of the following weather products in the following order:

- US NEXRAD Data
- US NEXRAD Coverage
- US Precipitation
- Canada RADAR Data
- Canada Coverage
- Puerto Rico NEXRAD
- DataLink Lightning
- METAR Data
- TAF Data
- Echo Tops Data
- Cloud Tops Data
- SIGMET Data

- AIRMET Data
- TFR Data
- Surface Winds
- Winds Aloft (3K)
- Winds Aloft (6K)
- Winds Aloft (9K)
- Winds Aloft (12K)
- Winds Aloft (15K)
- Winds Aloft (18K)
- Winds Aloft (21K)
- Winds Aloft (24K)
- Winds Aloft (27K)
- Winds Aloft (30K)
- Winds Aloft (33K)
- Winds Aloft (36K)
- Winds Aloft (39K)
- Winds Aloft (42K).

When the **AGE** bezel softkey label is inactive, the XM Product Ages display is closed.

Pushing the **RST** bezel softkey sends a reset command to the XM receiver.

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11. Weather Radar View

INTRODUCTION

Airborne weather radar gives a graphical depiction of the strength and type of precipitation (e.g., rain, snow). An example of external weather radar data in horizontal profile is shown in Figure 11-1.

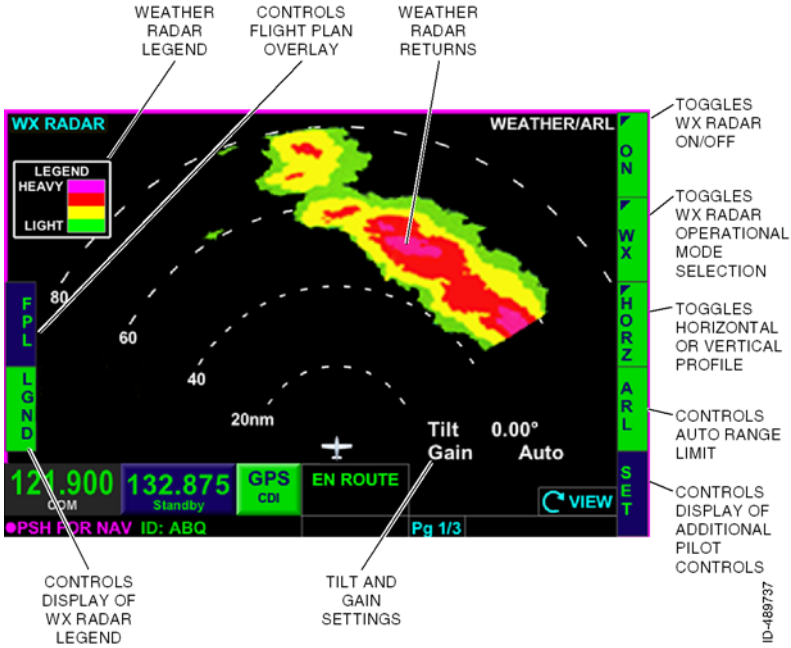


Figure 11-1
Weather Radar (Horizontal Profile)

The ***weather radar view*** is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the weather radar view is displayed.

WEATHER RADAR VIEW OVERVIEW

Weather radar is an optional feature and requires an external radar sensor and optional interface circuit card. The KSN 765/770 supports the display and control of the following external weather radar sensors:

- BendixKing RDS 82/84/86
- BendixKing RDS 82VP/84VP/86VP
- BendixKing RDR 2000/2100.

NOTE: For a detailed description of the external weather radar system and how to interpret the radar returns, refer to the external weather radar user guide.

Table 11-1 lists the external weather radars that the KSN 765/770 supports the display and control of the weather radar modes, operations, views, and characteristics that are enabled in the weather radar configuration module.

Table 11-1
Weather Radar Modes, Operation, Views, and Characteristics

Model	Azimuth Scan Angle	Vertical Profile	Vertical Scan Angle Degrees	Auto Tilt	WX Manual Gain	STAB	Sector Scan	ARL	Range (NM)	Forced Standby
RDR2000	100	Enabled	60	N/A	N/A	Enabled	N/A	N/A	10–240	Enabled
RDR2100	120	Enabled	60	Enabled	Enabled	Enabled	Enabled (60)	Enabled	10–240 (5–320)[5]	Enabled
RDS82	90	N/A	N/A	N/A	N/A	Enabled	N/A	N/A	10–240	Enabled
RDS82VP	90	Enabled	50	N/A	N/A	Enabled	N/A	N/A	10–240	Enabled
RDS84	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5–320	Enabled
RDS84VP	120	Enabled	60	N/A	N/A	N/A	N/A	N/A	5–320	Enabled
RDS86	120	N/A	N/A	Enabled	N/A	N/A	N/A	Enabled	5–320	Enabled
RDS86VP	120	Enabled	60	Enabled	N/A	N/A	N/A	Enabled	5–320	Enabled

NOTES:

1. N/A in Table 11-1 indicates options that are not selectable (or supported) for the selected radar type.
2. The KSN 765/770 does not support Track Line, Log Scale, WxA Mode, Auto Step Scan, and Checklist, even when supported by the weather radar.
3. Adjustable options are highlighted in gray.
4. Enabled indicates the corresponding KSN 765/770 feature is enabled by default for the selected radar type. The installer has the option to select Disabled.
5. Horizontal and vertical scan angle selections are restricted to default values according to the radar type.
6. Available alternate (non-default) selections are available as shown in parentheses. The selection of non-default values also require the appropriate configuration of the external radar.

Operational Mode Control

The following weather radar operational modes (as applicable to the configured installed external weather radar system) are available:

- **1L – Flight Plan Overlay On/Off** (FPL / FPL) – The overlay of the flight plan on the weather radar view is permitted during the following conditions:

  — Heading is configured and valid
  — Horizontal profile (HORZ) mode is active
  — FMS/GPS position and track are valid
  — FMS flight plan is active and available for display
  — Weather radar view is in Weather, WX/ARL, or GMAP mode
  — Weather radar is not in forced standby mode.

  When the FPL ***bezel softkey label*** is active, the flight plan symbols are overlaid on the weather radar view in magnetic heading-up orientation. When FPL is inactive, the flight plan overlay function is invalid.

  FPL RMVD is displayed in the lower-left corner of the display if heading or GPS position becomes invalid or a weather radar fault occurs when the FPL bezel softkey label is active.

- **2L – Legend** (LGND / LGND) – When active, the weather radar legend is displayed in the upper-left corner of the display.

- **1R – On/Off** (ON / OFF) – Toggles power control to the weather radar unit on and off. When the ON bezel softkey label is active, the power to the radar unit is turned on and the weather radar operational and view modes are active and selectable. The selected weather operational mode is displayed in the upper-right corner of the display.

  When the OFF bezel softkey label is active, the power to the radar unit is turned off and the weather radar operational and view modes are removed as well as radar images. OFF is displayed in the upper-right corner of the display when selected off.

  The last selection is displayed at power-up. When the weather unit is powered and the ON bezel softkey label is active, the range is set to 80 NM.

- **2R - Operational Mode** - The radar operational mode bezel softkey label controls the following weather radar operational modes:

  Weather → Ground Map → Standby → Test → Repeat

  Weather (WX) - Fully operation weather mode permitting for weather detection and the modes of operation and optional features applicable to the configured installed external weather radar system. **WEATHER** is displayed in the top-right corner as the operating mode.

  Ground Map Mode (GMAP) - Fully operating ground mapping or map mode to enhance returns from ground targets. In ground map mode, the Gain is switched from Auto to Manual and can be manually adjusted by the pilot. **GROUND MAP** is displayed in the top-right corner as the operating mode.

  Standby (STBY) - When STBY is selected, the weather radar sensor is ready for operation with TX off. Weather radar images are removed from display. **STANDBY** is displayed in the top-right corner as the operating mode.

  Test (TEST) - Activates a limited functional test of the external weather radar sensor. **TEST** is displayed in the top-right corner as the operating mode. The text pattern is shown in Figure 11-2.

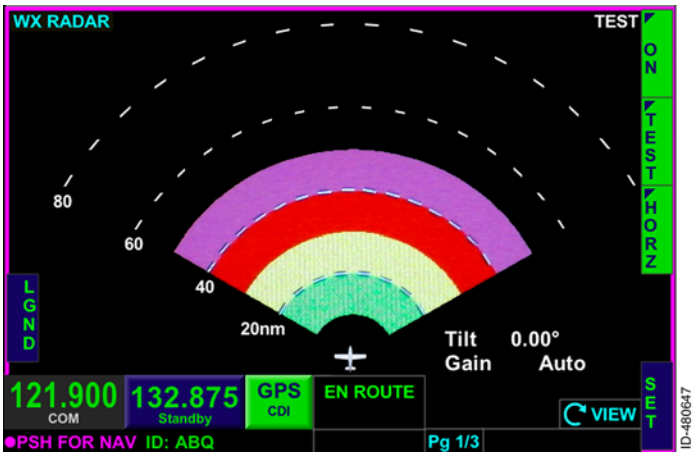


Figure 11-2
Weather Radar Test Pattern

- **3R - Horizontal/Vertical Profile** (HORZ / VERT) - The weather radar can be displayed in a horizontal or vertical display mode. The last selection is displayed at power-up. Horizontal display mode, shown in Figure 11-1, is active when the HORZ (horizontal profile) bezel softkey label is active. The KSN 765/770 supports the horizontal profile view up to 120° azimuth scan angle and a sector scan up to 60° azimuth scan angle. Vertical display mode is active when the vertical profile (VERT) bezel softkey label is active, as shown in Figure 11-3. The KSN 765/770 supports the vertical profile view up to 60° vertical scan angle.

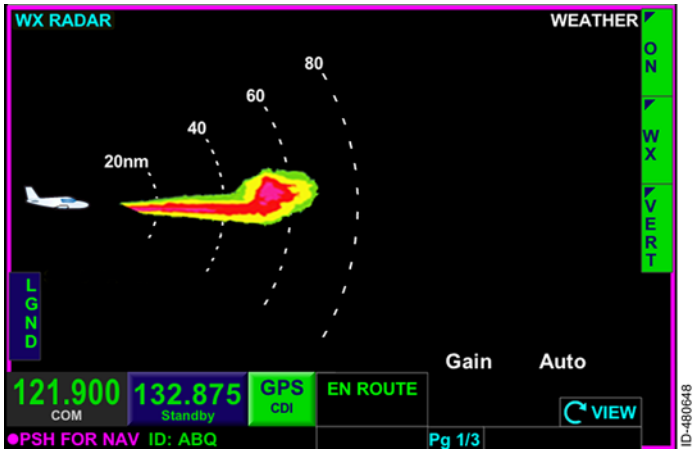


Figure 11-3
Weather Radar (Vertical Profile)

- **4R - Automatic Range Limit On/Off** - When selected on, as indicated by the ARL bezel softkey label, a blue area is displayed behind weather systems where weather detection is no longer possible because of attenuation. ARL is only selectable when the operational mode is weather and in the horizontal profile view. The ARL mode is automatically selected off and the ARL bezel softkey label is removed when the operational mode is anything other than weather (i.e., ground map, standby, or test). The power-up default is the last pilot selection. The GAIN is set to auto gain mode when ARL is selected.

Forced Standby Mode – The forced standby mode provides automatic safety controls to ensure the weather radar (when in WX or GMAP) does not transmit when the aircraft is on the ground. The weather radar operational mode is forced to standby when the following conditions are met:

- Weather radar control mode is **ON**
- Aircraft air/ground monitor indicates the aircraft is on the ground or invalid.

When in forced standby mode, only **STANDBY** and **TEST** modes are available.

The WX control and operational modes are displayed in the top-right of the ***Weather Radar view***. Table 11-2 lists the operational mode annunciations.

Table 11-2
Operational Mode Annunciations

WX Radar Selected Mode	WX Radar Mode Annunciation	Annunciation Criteria
OFF	OFF	WX radar is in off mode
STBY	STANDBY	WX radar is in standby mode or forced standby mode
TEST	TEST	WX radar is in test mode
WX	WEATHER	Normal WX mode
WX + ARL	WEATHER/ARL	ARL is selected
GMAP	GROUND MAP	System is in the air and ground map is selected

The weather radar feature SET bezel softkey label is displayed in 5R when the weather radar is powered ON , the operational mode is not STANDBY , and the HORZ view is active. When the weather radar feature SET bezel softkey label in 5R is active, the following pilot-selectable weather settings are configurable:

- **Stabilization ON/OFF** - When the weather radar is in weather mode (weather or ground map), the system uses pitch and roll to stabilize the antenna. When the STAB bezel softkey label is active, STAB ON is displayed in the lower-left corner of the display. When the STAB bezel softkey label is inactive, STAB OFF is displayed in the lower-left corner of the display. The power-up default is the last pilot selection.

  NOTE: When configured to use an RDS84/84VP/86/86VP weather radar, the KSN 765/770 does not support the Stab On/Off control. However, the KSN 765/770 displays the received Stab status message from the weather radar.

  If the commanded stabilization mode is not active while in weather, ground map, or weather/ARL mode, STAB FAULT is displayed in amber.

- **Scan Sector ON/OFF** - When active in the horizontal profile view, the total scanned area is cut in half, which provides faster updates to the remaining area. When the SECT bezel softkey label is active, SECT 60° is displayed in the lower-left corner of the display. When the SECT bezel softkey label is inactive, SECT 60° is removed from the display. Sector scan can be active in weather, ground map, or weather/ARL mode. The power-up default is the last pilot selection.

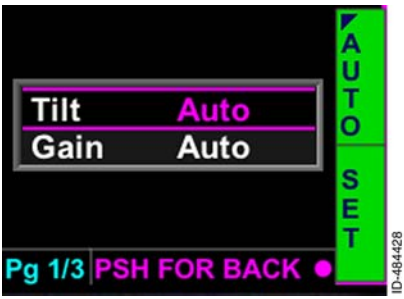
  NOTE: Sector scan is only functional in the horizontal profile view.

  If the commanded scan sector mode is not active while in weather, ground map, or weather/ARL mode, STAB FAULT is displayed.

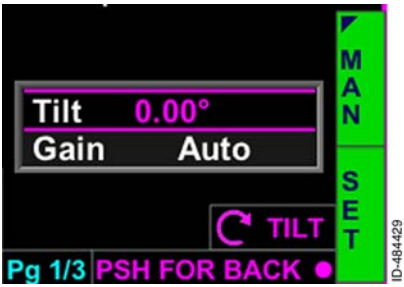
  The sector scan angle is limited to the full horizontal scan limits minus half the sector scan angle applicable to the configured installed external weather radar system. For example, a 120° azimuth scan angle is displayed for RDR2100 installations when sector scan is not active (60° either side of center). When sector scan is active, a 60° azimuth scan angle is displayed (30° either side of center).

  Sector scan control is removed when not applicable to the configured installed external weather radar system.

- **Tilt** – Controls the tilt auto/manual selection to the external weather radar system. The power-up default is the last pilot selection. Tilt control mode is active while in weather, ground map, test or weather/ARL mode.



Auto tilt mode is selected when the **AUTO** bezel softkey label is active. The tilt annunciation field displays **Tilt Auto** . Auto tilt permits the antenna position to be automatically adjusted to maintain a common beam intercept point with the earth. For example, if the last 10% of the display is ground returns, then during ascent or descent, the antenna automatically changes to maintain ground returns on 10% of the display.



Manual tilt is selected by activating the **MAN** bezel softkey label. The default tilt value is the last commanded manual tilt value and is displayed in the manual tilt field. Manual tilt mode has a range of ±15.0°. –15.0° represents the extreme counterclockwise rotation and +15.0° represents the extreme clockwise rotation. The tilt display value can be adjusted in 0.25-degree increments using the joystick knob.

When the **MAN** bezel softkey label is active, the tilt annunciation field displays TILT followed by the digital readout and Down for negative values or Up for positive values.

- **Gain** – Manual gain is supported in ground map mode and is optionally supported in weather mode depending on weather radar installation.

Weather Radar Range Selection

The weather radar view has a minimum range marker, a maximum range marker, and two other incremental range markers in both the horizontal and vertical profile views. Figure 11-3 shows the range markers as **20** , **40** , **60** , and **80** .

The KSN 765/770 supports a pilot-selectable range from 5 or10 NM to 240 or 320 NM, as applicable to the configured installed external weather radar system. The range of the weather radar view is controlled by the ***zoom-in/+ and zoom-out/- bezel keys***.

Table 11-3 lists the ranges that are selectable for both horizontal and vertical profile views.

Table 11-3
Weather Radar Ranges

Weather Radar Range (NM) Settings				
Range Setting	**Min. Range Marker**	**Range Marker (R1)**	**Ranger Marker (R2)**	**Max. Range Marker**
1*	1	2	3	5
2	2	5	7	10
3	5	10	15	20
4	10	20	30	40
5	20	40	60	80
6	40	80	120	160
7	60	120	180	240
8*	80	160	240	320
***** Range settings only applicable when configured and supported by external weather radar system.				

Weather Radar Alert Mode

When active by the WX configuration (during weather radar installation), the KSN 765/770 can provide a target alert annunciation during horizontal scan when the weather mode is WX.

NOTES:
1. A target alert is not provided during vertical scan.
2. Target alert is only applicable for RDR 2000 and RDR 2100 installations.

Target alert is a feature that provides warning of potential severe weather in the flight path that is detected beyond the current range displayed.

The criteria for a target alert is for the cell to be at least red intensity, within ±10° of aircraft heading, a minimum size of 2 NM in range and 2 degrees in azimuth, and within the range of 80 to 320 NM. When a target alert is issued, two red arcs, separated by a black arc will be displayed at the top of the display centered on the aircraft heading.

Target Alert is applied to each scan independent of the other when the radar is alternating scans.

When an alert condition exists, two red arcs separated by a black arc are displayed at the top of the display centered on the aircraft heading, as shown in Figure 11-4.

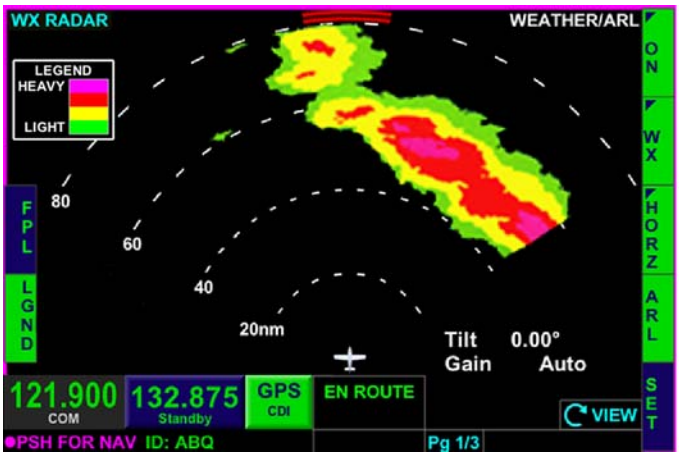


Figure 11-4
Target Alert

When GMAP mode is selected, the target alert function is inactive.

Weather Radar Faults

Weather radar faults are displayed near the bottom–middle portion of the screen. Table 11–4 lists the weather radar fault indications and associated descriptions.

Table 11–4
Weather Radar Fault Indications and Descriptions

Fault Indication	Description
WEATHER FAULT	WX radar control fault. Occurs for the following conditions: • WX command mode is not the same as the WX active received mode • When the mode is WX, GMAP, or WX/ARL and the manually commanded tilt or gain is not equal to the active received tilt or gain • When the mode is WX, GMAP, or WX/ARL and the commanded range is not equal to the active received range.
RECEIVER TRANSMITTER FAULT	Receiver/transmitter failure
TRANSMIT FAULT	Loss of antenna position
ANTENNA FAULT / TRANSMIT FAULT	Alternates fault indication display at a 1–second rate between ANTFLT and TxFLT. Indicates the radar has lost configuration data (probably lost communication with configuration module).
COM FAULT	Loss of ARINC 429 attitude data (pitch or roll)
STABILIZATION LIMIT	Stabilization limits exceeded (pitch/roll > 30°)

If a weather radar fault occurs when a flight plan overlay is displayed, the flight plan overlay is removed and **FPL RMVD** is displayed in the lower–left corner of the display.

NO DATA RECEIVED FROM WEATHER RADAR is displayed when any weather radar mode except **OFF** is selected and the weather radar picture bus is disconnected.

12. Lightning Detection View

INTRODUCTION

This section describes the ***lightning detection*** (strikes) ***view*** and control function, which lets the pilot control and display the WX-500 Stormscope® Series II weather mapping sensor. Lightning detection is an optional feature and requires the installation of the WX-500.

The WX-500 detects electrical discharges associated with thunderstorms within a 200 nautical miles (NM) radius of the aircraft. The information is then sent to the KSN 765/770, which displays the location of the electrical discharges on the lightning detection view or as a map overlay.

NOTE: Refer to the WX-500 Stormscope® Series II user guide for detailed information about storm mapping, operating, and weather display interpretation of the WX-500 receiver.

CAUTION

THE USE OF THE LIGHTNING DETECTION VIEW IS FOR LONG-RANGE PLANNING PURPOSES ONLY, NOT SHORT-RANGE AVOIDANCE. DO NOT USE INFORMATION PROVIDED TO PENETRATE WEATHER, THUNDERSTORMS, CELLS, OR LINES OF CELLS. THE AERONAUTICAL INFORMATION MANUAL RECOMMENDS AVOIDING THUNDERSTORMS IDENTIFIED AS SEVERE OR AVOIDING AN INTENSE RADAR ECHO BY AT LEAST 20 MILES.

STRIKES OVERVIEW

The strikes view is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the STRIKES view, shown in Figure 12–1, is displayed.

NOTE: When an active flight plan is available, the flight plan is overlaid on the lightning detection view.

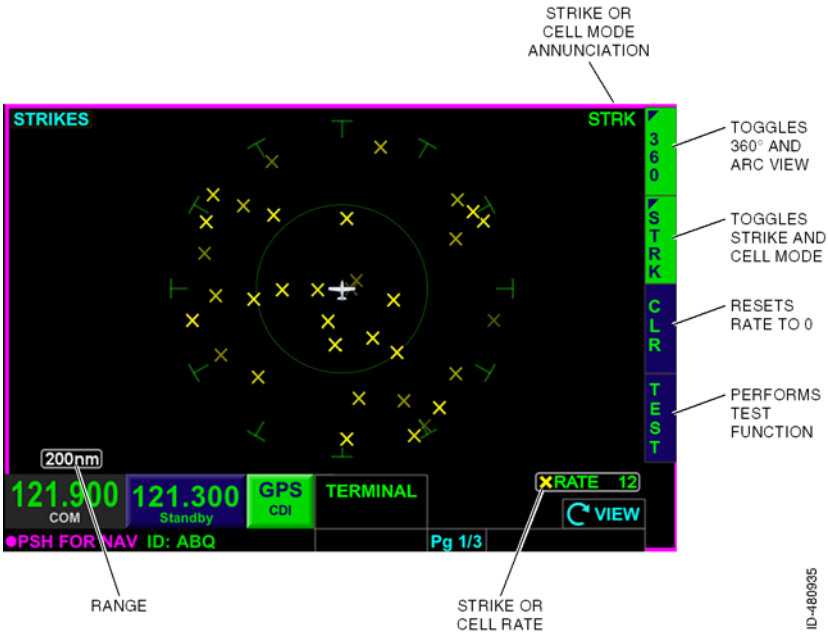


Figure 12-1
STRIKES View

Strikes View Modes

The pilot can select between the 360° compass view mode and the arc view mode.

The 360° compass view mode is displayed when the **360** ***bezel softkey label*** is active. When the 360° compass mode is displayed, the current aircraft symbol is located in the center of the strikes view, as shown in Figure 12–1.

The arc view mode is displayed when the **ARC** bezel softkey label is active. When the arc mode is displayed, the current aircraft symbol is located in the bottom of the strikes view, as shown in Figure 12-2.

Figure 12-2
Strikes View - Arc

The strikes view scale is controlled using the ***zoom-in/+ and zoom-out/- bezel keys***, such that the outer radius of the primary range ring represents **20** , **30** , **40** , **60** , **80** , **100** , and **200** NM from the current aircraft position. The last setting selected is stored following the power cycle of the unit.

Strikes Display Modes

The pilot can select two strike display modes by enabling either of the following bezel softkey labels in 2R:

- **STRK** - Activates strike mode
- **CELL** - Activates cell mode.

The display mode is indicated in the upper-right corner of the strikes view (i.e., **CELL** or **STRIKE**), as shown in Figure 12-2.

NOTE: The display mode annunciation is removed from display when the FAIL NO LINK annunciation is displayed.

When strike mode is active, the displayed symbols are actual strikes. When cell mode is active, the displayed symbols are cells, which are a combination of strikes.

Strike mode symbols are displayed as an amber **x** and cell mode symbols are displayed as an amber **+** . Both symbols are removed from the display after 3 minutes, and recent strikes overlay older strikes.

Strikes Sensor Status

When the Stormscope® is not in self-test mode, the rate annunciator (**+RATE #** or **xRATE #**), located in the lower-right corner of the view, displays the mode symbol and current strike rate. Figure 12-3 shows the strike mode rate annunciation. Figure 12-4 shows the cell mode rate annunciation.

NOTE: Pushing the **CLR** ***bezel softkey*** in 3R resets the rate to 0.

Figure 12-3
Strike Mode Rate Annunciator

Figure 12-4
Cell Mode Rate Annunciator

When the Stormscope® is in self-test mode, **STKS TEST** is displayed in place of the rate annunciation.

Lightning symbols are removed and **xRMVD** or **+RMVD** replaces the rate annunciator in the lower-right corner when the range is less than 20 NM. Lightning data is not displayed if aircraft heading information is not available.

Error Annunciators

Lightning symbols are removed from display and a red horizontal line is displayed through the strike or cell mode rate annunciator when any of the following conditions occur:

- The Stormscope® receiver reports a fault or error
- The heading is invalid or unavailable
- Lightning data is not detected
- Position invalid (only removed from NAV MAP view).

Table 12-1 lists the possible annunciators and conditions that are displayed in the middle of the STRIKES view when one of the conditions are met.

Table 12-1
Lightning Annunciators

Annunciator	Condition
TEST INIT	Displayed when sensor is in self-test mode.
TEST INIT FAIL	Displayed when a self-test report is not received within 10 seconds.
FAIL	The sensor status is an undefined or fatal fault.
ERROR	The sensor status is an undefined recoverable error.
ERROR ANT ERR	The sensor status is a recoverable antenna error.
ERROR MIC INHIBIT STUCK	The sensor status is a recoverable inhibit line stuck error.
ERROR ANT JMP CHG	The sensor status is a recoverable antenna jumper changed error.
FAIL HDG INVALID	Heading is invalid, not available, or not configured.
FAIL NO LINK	When configured and data is not detected.

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13. Terrain Awareness and Warning System (TAWS) View

INTRODUCTION

The ***TAWS view*** displays enhanced ground proximity warning systems (EGPWS) displays. EGPWS gives terrain display, situational awareness, terrain alerting and warning, and obstacle alerting and warning to the pilot. It is intended to give advanced alerting and warning to the pilot to help reduce the possibility of controlled flight into terrain (CFIT).

NOTE: This section does not supersede FAA-approved data, FAA flight manual supplements, or FAA required procedures. In addition, this guide is not intended to give all the details of proper usage and interpretation of EGPWS information. Reference the pilot's guide that is given with the EGPWS sensor for more information.

TAWS OVERVIEW

The TAWS view is different from the ***terrain view*** as the TAWS view uses an external TAWS sensor and the terrain view uses an internal terrain database. TAWS is an optional feature and requires an external TAWS sensor and optional interface circuit card. The KSN 765/770 supports the display and control of the following external TAWS sensors:

- BendixKing KGP 560/860 General Aviation EGPWS
- BendixKing KMH 880/980 Multi-Hazard Awareness System
- Honeywell MK-VI/MK-VIII EGPWS.

The TAWS view is selected by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the TAWS view is displayed, shown in Figure 13-1.

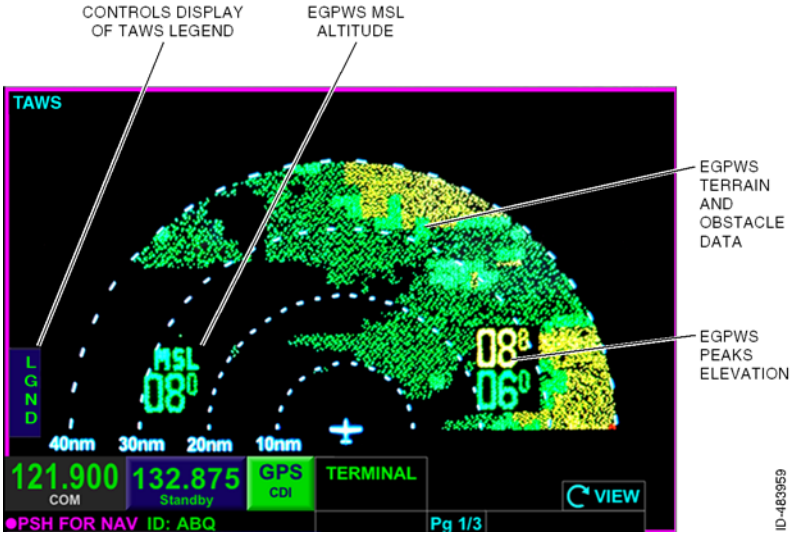


Figure 13-1
TAWS Display With MSL Altitude

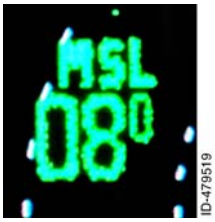
KGP 560/860 and KMH 880/980 installations display MSL altitude in the lower–left corner of the display, as shown in Figure 13–1.

NOTE: Honeywell MK–VI and MK–VIII installations do not display the MSL altitude in the lower–left corner of the display, as shown in Figure 13–2.

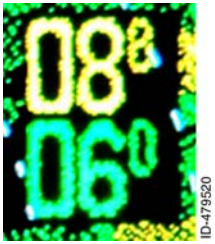
Figure 13-2
TAWS Display Without MSL Altitude

TAWS Symbols

The following paragraphs describe the symbols displayed on the TAWS view.



EGPWS Mean Sea Level (MSL) Altitude – The displayed MSL altitude is the computed Geometric altitude which is the internal calculation of the current MSL altitude. The EGPWS MSL altitude is only displayed for KGP 560/860 and KMH 880/980 installations.



EGPWS Peaks Elevation – The numerical maximum peaks elevation is displayed above the numerical minimum peaks elevation. Peaks elevation is displayed for all installations.

Display Orientation

Honeywell MK-VI and MK-VIII installations require a heading input and display the TAWS view in heading-up mode.

KGP 560/860 and KMH 880/980 installations do not require a heading input. When a heading input is available (as determined at the time of installation), the TAWS view is displayed in heading-up mode.

When a heading input in not available for KGP 560/860 and KMH 880/980 installations while in the air, TAWS images are displayed with an orientation indicator displayed on the top of the view. The orientation indicator is displayed as MAGXXXTRK, as shown in Figure 13-3.

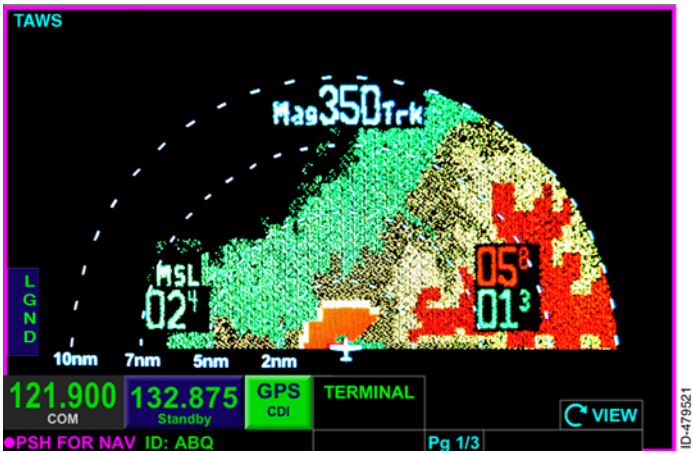


Figure 13-3
No Heading Input Installations - In Air

When a heading input is not available for KGP 560/860 and KMH 880/980 installations while on the ground, the TAWS images are displayed along with NORTH at the top of the view, as shown in Figure 13-4.

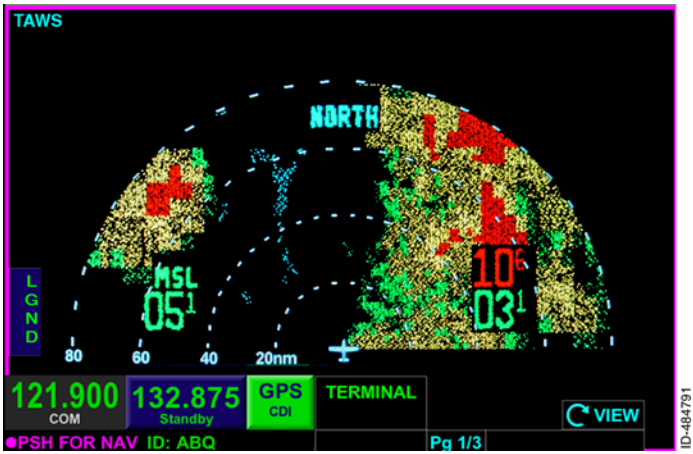


Figure 13-4
No Heading Input Installations - On Ground

Failure Annunciations

If there is a loss of EGPWS data, an amber **NO DATA RECEIVED FROM TAWS** annunciator is displayed, as shown in Figure 13-5.

Figure 13-5
No Data From TAWS

If the heading input is available and there is a TAWS heading failure while on the ground or in the air, an amber **TERR-INOP** is displayed in the lower-right corner of the display, as shown in Figure 13-6.

Figure 13-6
Terrain Inoperative

TAWS Terrain and Obstacle Data

Graphical display of EGPWS terrain and obstacle data is the most important enhancement to situational awareness. This is especially true for lower performance aircraft. In addition to showing terrain ahead of the aircraft, (depending on configuration settings and display types) the KSN 765/770 displays MSL altitude, magnetic track, range in nautical miles, and the elevations of the highest and lowest terrain features shown on the display. The color and intensity of the terrain displayed instantly alerts the pilot to areas of dangerous terrain and conversely to areas of less precipitous terrain.

NOTE: Only reported obstacles are displayed.

The terrain legend, shown in Figure 13-7, is displayed when the **LGND** ***bezel softkey label*** is active.

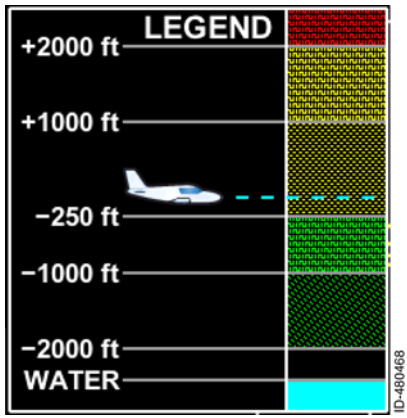


Figure 13-7
Terrain Legend

Figure 13-8 shows the terrain display color patterns when the aircraft is at lower altitudes, with terrain near or above the aircraft altitude for the display range selected by the pilot.

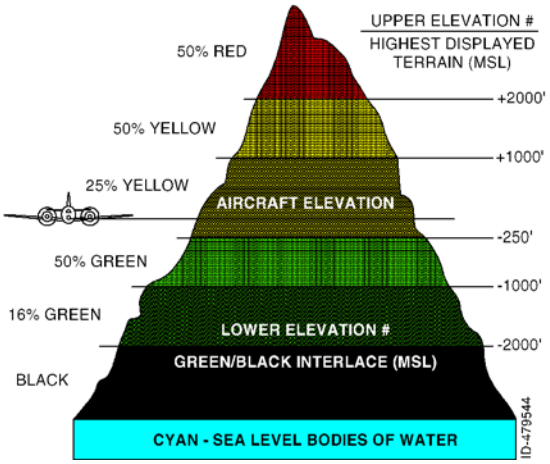


Figure 13-8
Terrain Display - Lower Altitudes

Figure 13-9 shows the terrain display color patterns when the aircraft is at higher altitudes, where terrain is a least 250 feet below the aircraft altitude for the display range selected by the pilot.

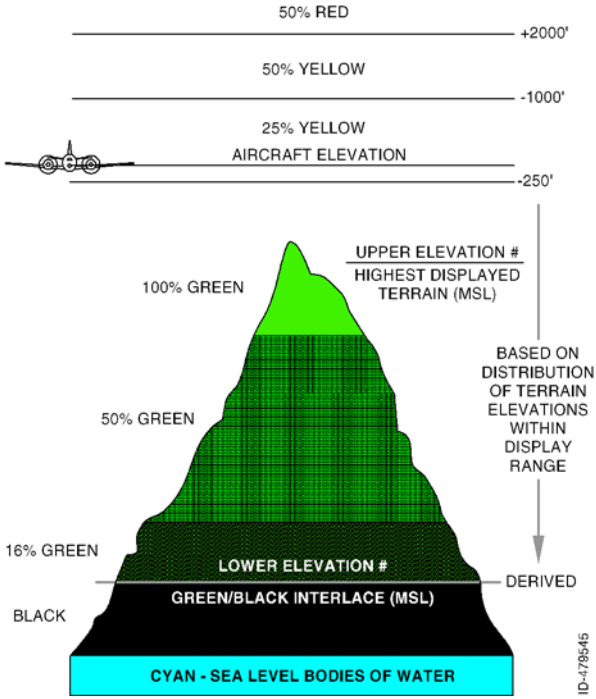


Figure 13-9
Terrain Display - Higher Altitudes

The KSN 765/770 display adjusts colors on the TAWS view automatically as the aircraft altitude changes. In addition, the TAWS view transitions between the lower altitude relative display and the higher altitude peaks display automatically, so no pilot-action is required for system operation.

The most important function of the system is to give the pilot the ability to easily interpret information about terrain/obstacles relative to the aircraft and increase the situational awareness of the pilot.

Table 13-1 lists the colors displayed on the terrain display with descriptions.

Table 13-1
Terrain Display Colors and Descriptions

Color	Description
BLACK	No significant terrain/obstacle.
CYAN	Sea level bodies of water.
GREEN	Terrain/obstacles are below the aircraft altitude. Safe terrain/obstacle clearance is indicated.
YELLOW	Terrain is very near or above the aircraft altitude. THE TERRAIN DOES NOT HAVE SAFE TERRAIN CLEARANCE.
RED	Terrain is at least 2,000 feet higher above the aircraft. THE AIRCRAFT DOES NOT HAVE SAFE TERRAIN CLEARANCE. THE AIRCRAFT MAY NOT BE ABLE TO AVOID THIS TERRAIN.
MAGENTA	Unknown terrain. No terrain data in the database for the magenta areas shown.

NOTE: Green colors indicating terrain/obstacles below the aircraft are not displayed when the aircraft is on the ground, to reduce display clutter and to show only terrain that is significantly higher than the aircraft in the departure area. Green colors are displayed when the aircraft climbs approximately 500 to 800 feet above the elevation of the runway.

TAWS Range Selection

The terrain view has a minimum range marker, a maximum range marker, and two other incremental range markers. Figure 13-1 shows the range markers as **10** , **20** , **30** , and **40** .

Table 13-2 lists the pilot-selectable ranges supported by the KSN 765/770. The range of the TAWS view is controlled by the ***zoom-out/+ and zoom-in/- bezel keys***. The TAWS range selection defaults to the last pilot-selection on power-up.

Table 13-2
TAWS Ranges

TAWS Range (NM) Settings				
Range Setting	**Min. Range Marker**	**Range Marker (R1)**	**Ranger Marker (R2)**	**Max. Range Marker**
1	1	2	3	5
2	2	5	7	10
3	5	10	15	20
4	10	20	30	40
5	20	40	60	80
6	40	80	120	160
7	60	120	180	240
8	80	160	240	320

If the selected TAWS range is not equal to the TAWS active received range, **RNG FLT** is displayed in amber in the bottom-center of the TAWS view.

TAWS Pop-Up Mode

When a TAWS warning occurs, a red **WARNING TERRAIN, TERRAIN** annunciator is displayed in the text data bar and **PUSH CLR MSG•** is displayed in the lower-right corner, as shown in Figure 13-10.

NOTE: When the TAWS warning or caution is no longer valid, the annunciators are removed from the display.

Figure 13-10
TAWS Alert When Not in TAWS View

When a TAWS caution occurs, an amber **CAUTION TERRAIN, CAUTION TERRAIN** annunciator is displayed in the text data bar and **PUSH CLR MSG•** is displayed in the lower-right corner.

The TAWS view can be displayed by normal procedures to change the displayed view. When the TAWS view is selected for display while or after a TAWS warning or caution is active, the range defaults to 10 NM.

NOTE: If a TAWS alert occurs when the menu is displayed, the menu overlay is removed.

14. Course Deviation Indicator (CDI) and Switching View

INTRODUCTION

This section describes the GPS-based CDI and (for the KSN 770) the built-in GPS NAV switching. The ***CDI*** indicates lateral deviation from the centerline of a selected GPS course. The CDI is composed of a green course pointer, segmented needle, and a scale, as shown in Figure 14-1.

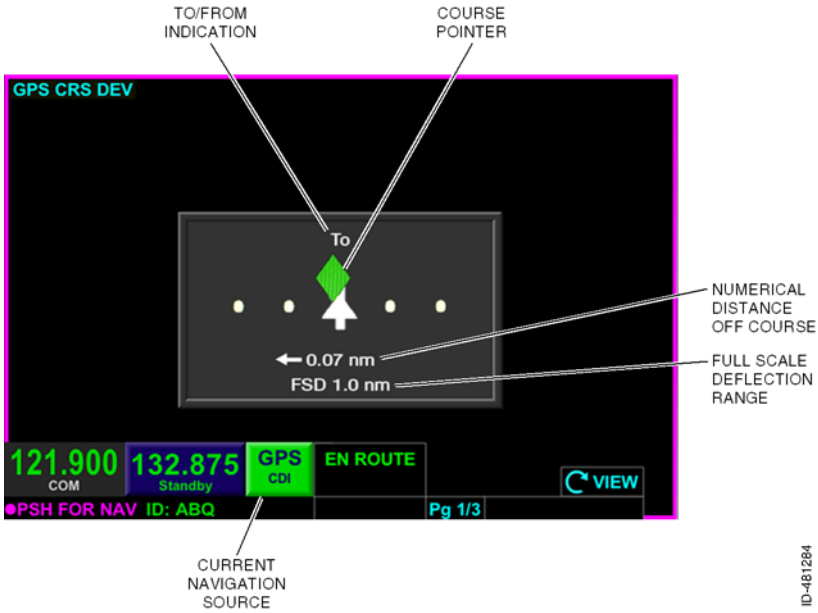


Figure 14-1
Course Deviation Indicator

The ***GPS course deviation indicator view*** is displayed by pushing the ***MFD bezel key*** then pushing the ***VIEW bezel key*** or rotating the ***joystick knob*** until the GPS CRS DEV view is displayed.

The CDI ***touchscreen button*** (current navigation source) is displayed next to the radio tuning and display window at all times to provide an indication of the navigation source.

NOTE: For installations where the ***EFIS*** controls the CDI switching or when the CDI is set to GPS only during installation, the CDI touchscreen button is not displayed.

When GPS is the selected source, the navigation source is displayed as **GPS CDI** , alerting the pilot that the CDI is receiving information from the GPS.

When VLOC is the selected source, the navigation source is displayed as **VLOC CDI** , alerting the pilot that the CDI is receiving information from the VOR or localizer. In addition, the CDI is removed from view, and a **DATA REMOVED VLOC SELECTED** message is displayed in the center of the view.

NOTE: In order to display a non-GPS navigation source on the pilot navigation display horizontal situation indicator/course deviation indicator (HSI/CDI), **VLOC CDI** must be the selected navigation source.

When the CDI source is changed, **CDI CHANGED TO GPS** or **CDI CHANGED TO VLOC** is displayed, as applicable, for 3 seconds to notify the pilot the CDI source has been changed.

The green course pointer indicates course deviation by moving laterally on a scale consisting of four dots, two on the left and two on the right of the center line.

Above the course point is a To/From indication. When To is displayed, an upward triangle is displayed on the centerline. When From is displayed, a downward triangle is displayed on the centerline.

Below the course pointer is the distance the aircraft is off course (crosstrack correction), in addition to the range of full-scale deflection (**FSD**). The crosstrack correction has a resolution of 0.01 NM for the range of 0.01 to 9.99 NM and a resolution of 0.1 NM for the range of 10 to 99.9 NM and a resolution of 1 NM for the range of 100 to 9,999 NM. The FSD has a resolution of 0.1 NM and a range of 1.0 to 2.0 NM.

When the global navigation satellite system (GNSS) (GPS) is providing guidance for an approach, the CDI is removed from view and a **DATA REMOVED GPS APPROACH SELECTED** message is displayed instead.

When the GNSS (GPS) is providing guidance and a loss of integrity (LOI) condition exists while not in the approach phase, the lateral deviation display is shown without the numeric portion of the display.

When the GNSS (GPS) is providing guidance and a loss of navigation condition exists with a valid or invalid GPS position, the lateral deviation indicator, the FSD information, the crosstrack correction distance information, the To/From label, and the upward/downward triangle are all removed from display. The loss of navigation and invalid GPS position condition is shown in Figure 14–2.

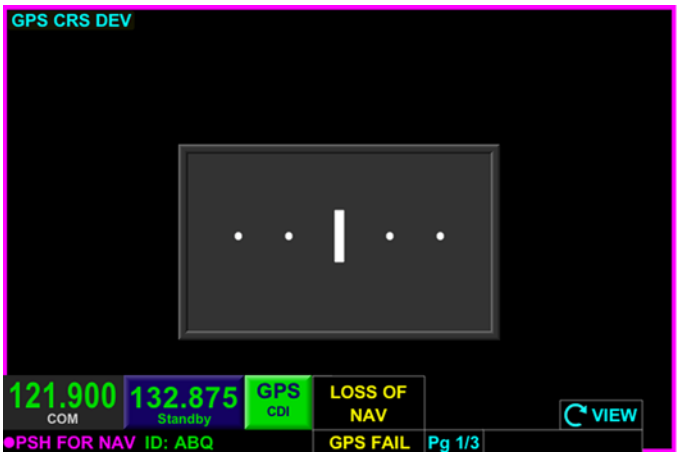


Figure 14-2
LOSS OF NAV and Invalid GPS Position

When the GNSS (GPS) is providing guidance while in dead reckoning, the lateral deviation indicator, the FSD information, the crosstrack correction distance information, the To/From label, and the upward/downward triangle are all removed from display.

When the TO waypoint is a discontinuity, the lateral deviation indicator, the FSD information, the crosstrack correction distance information, the To/From label, and the upward/downward triangle are all removed from display.

CDI Scaling

The green course pointer indicates course deviation by moving laterally on a scale consisting of four dots. Table 14–1 lists the lateral deviation scaling for the different phases of flight.

Table 14-1
Lateral Deviation Display Scaling

Phase of Flight	Definition	Lateral Scaling
Approach	2 NM from final approach waypoint (FAWP)	0.3 NM/2 dots
Terminal	< 30 NM from Departure Airport or <31 NM from Destination Airport (unless using a SID/STAR)	1.0 NM/2 dots
En route	≥ 30 NM from Departure Airport or ≥ 31 NM from Destination Airport	2.0 NM/2 dots
Remote/ Oceanic	> 200 NM from nearest NAVAID	4.0 NM/2dots

NOTE: IFR operation in oceanic mode is not authorized.

CDI Off Scale

When CDI becomes parked on either the left or right side of the deviation display, the course pointer is displayed as a hollow green diamond. When the CDI becomes parked, the distance between the centerline and the pointer no longer represents the deviation from centerline. The actual deviation from centerline is still displayed below the centerline, as shown in Figure 14-3.

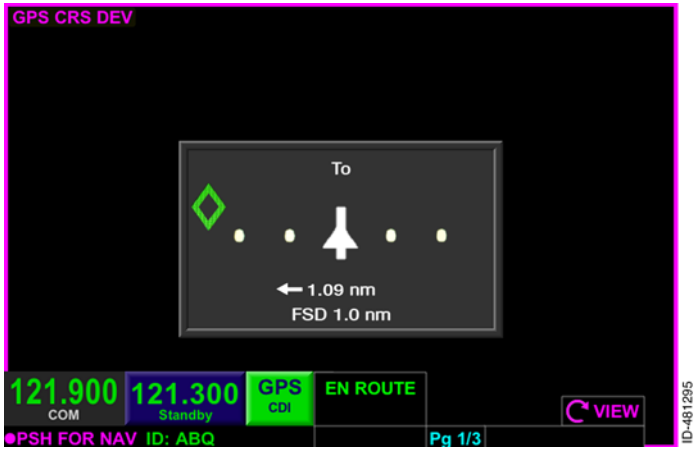


Figure 14-3
CDI Off Scale

GPS NAV Switching (KSN 770 Only)

The current navigation source is displayed next to the radio tuning and display window at all times to provide an indication of the navigation source.

When GPS is the selected source, the navigation source is displayed as **GPS CDI** , alerting the pilot that the external navigation indicator is displaying information from the GPS.

When VLOC is the selected source, then the external navigation source is displayed as **VLOC CDI** , alerting the pilot that the external navigation indicator is receiving information from the VOR or localizer.

Pushing the **GPS CDI** or the **VLOC CDI** touchscreen button manually changes the navigation source output.

If the auto transition capable parameter is turned on during installation, the KSN 770 will automatically switch the CDI source from GPS to VLOC when all of the following conditions are met:

- The MAWP waypoint has not been sequenced
- The phase of flight is APPROACH
- An ILS/LOC, SDF, or LDA approach procedure is active in the flight plan
- Current track is within ±10 degrees of desired track
- A valid signal is received from the ILS/LOC.

15. Flight Management System (FMS)

INTRODUCTION

The FMS provides flight planning capability and navigation information to the flight crew. The FMS manages flight details from takeoff to touchdown. These details encompass standard instrument departures (SIDs), standard terminal arrival routes (STARs), and instrument approach procedures (IAP). The FMS provides predictions regarding estimated time along the entire flight plan.

The KSN provides guidance to the autopilot. Left/right deviations are used by autopilots when in NAV mode. Lateral steering is available for autopilots with GPS Steering (GPSS). When the KSN displays a magenta active leg, both NAV mode and GPSS can be used to track the active leg. When the Nav Map shows a green active leg, only NAV mode can be used to track the active leg.

Legacy Autopilot System Interaction

Many legacy autopilot systems fly the CDI left/right needle without reference to the To/From indicator.

When flying outbound from a fix for a course reversal and the FMS sequences to the inbound leg back to the fix (the CDI changes to **To**), the autopilot NAV mode will fly the left/right needle with reverse sensing until the aircraft is turned inbound. To avoid this situation, fly the outbound using the heading mode.

FMS DATABASE DESCRIPTION

The FMS relies on several database components including the navigation and custom databases. The navigation database consists of airport, navigation aid, and waypoint information used by the FMS to perform navigation functions.

The custom database consists of flight plans and pilot-defined waypoints. The custom database consists of the following information:

- **Custom (Pilot-Defined) Waypoints** - Custom waypoints can be defined by position (latitude and longitude) or bearing and range from a referenced waypoint (referred to as bearing/distance (B/D)).

- **Flight Plans** – Flight plans specify an origin, destination, and route of flight. The memory allocated for flight plans is full when reaching either the maximum permitted number of flight plans or the total permissible number of flight plan waypoints being used in the flight plans.

The following is a compilation of the information contained in the navigation database:

- NAVAIDs
  - IDENT
  - NAVAID type (DME, TACAN, VORTAC, VOR/DME, VOR, NDB)
  - Latitude/longitude
  - Magnetic declination
  - Frequency
  - Elevation
  - Class
  - Country code.
- Airports
  - IDENT
  - Latitude/longitude
  - Elevation
  - Magnetic variation
  - Runway count and associated runways
  - Country code
  - Procedures
  - Transition altitude
  - Airport name.

  NOTE: Airport waypoints are the geographic reference point for the airport.

- Runways
  - Runway number/IDENT
  - Latitude/longitude
  - Length
  - Elevation
  - Bearing
  - Associated ILS
  - Width
  - Displaced threshold distance.

- Airways (high and low), which is a list of fixes on the airway
  - — IDENT

  NOTE: Airways contained in the database include all waypoints (some are unnamed) and only waypoints that define the airway. Some of these defining waypoints do not display on paper charts. Some waypoints on the charts seem to be on an airway but are not defining waypoints for the airway.

- SID/STAR/approach/missed approach procedures

- Named waypoints
  - — IDENT
  - — Latitude/longitude
  - — Type (named intersection, navigation database (NDB), terminal area procedure waypoint)
  - — Country code.

- Unnamed waypoints
  - — Latitude/longitude.

The active navigation database effectivity date range is displayed on the menu next to the green **NAV DB**, shown in Figure 15-1, and also on the acknowledgement confirmation page, described earlier in this guide. The NAV database cycle is changed by selecting the bezel softkey next to the **PUSH TO CHANGE NAV DB CYCLE** label.

Figure 15-1
Navigation Database

The FMS retrieves information from the navigation database about waypoints and procedures used in flight planning. The database, supplied by BendixKing, is updated every 28 days. Two consecutive cycles can be loaded. The database can be updated by the pilot, and data loading procedures are described in detail in Section 16, Data Loading Procedures.

Not yet effective databases are displayed in green font with – NOT YET VALID appended to the cycle date range. Expired databases are displayed in green font with – EXPIRED appending to the cycle date range. The inactive navigation database is selected for use by pushing the ***bezel softkey*** next to the inactive database. When pushed, a caution box is displayed, as shown in Figure 15-2, which states that changing the NAV database will clear the flight plan and pushing the **OK** softkey confirms the change. When the inactive database is selected, the active database becomes inactive.

Figure 15-2
Changing NAV DB Caution

The aircraft operator can load a new navigation database (one that is not yet effective) ahead of time. That database should not be used for navigation until it becomes effective.

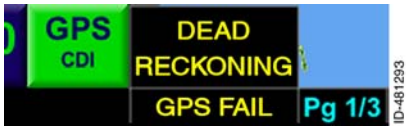
Databases that are loaded ahead of time but not yet effective automatically become the active database when the KSN 765/770 is powered up after 0900 Zulu on the first day of the effective cycle.

Real Time Clock

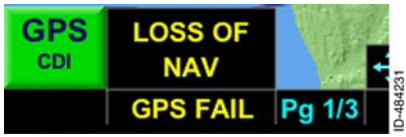
An internal real time clock supplies the time and date for validation of the navigation database cycles. When global positioning system (GPS) time is available, the time and date synchronize to the GPS.

Position Initialization

During power-up, the FMS position is automatically updated to the GPS position when a valid GPS position is available. When no GPS position is available, **GPS FAIL** or **GPS ACQ** is displayed indicating the GPS position is not available.



If GPS position becomes unavailable during flight, the KSN enters dead reckoning (**DEAD RECKONING**) mode for 15 minutes and assumes the pilot will follow the flight plan. When dead reckoning is active and panning is not active, the ownship symbol continues to move across the existing flight plan with the position data provided by the FMS (except when in the ***charts view***).



After 15 minutes of no GPS position, **LOSS OF NAV** is displayed, replacing the **DEAD RECKONING** annunciation. The ownship symbol remains displayed and the active leg in the flight plan is displayed in green when the loss of navigation condition exists with a valid GPS position. The ownship symbol is removed from display and all legs of the active flight plan are displayed in white when both the loss of navigation condition is met and the GPS position is invalid.

WAYPOINT SEQUENCING AND SUSPENDING A FLIGHT PLAN

Passing a waypoint and resulting in the next leg of the flight plan to become active is called sequencing the waypoint. Certain conditions, however, result in sequencing to stop, such as when the aircraft is holding or the end of the flight plan is reached. When any of these conditions occur, the flight plan is suspended.

A suspend condition stops the FMS waypoint sequencing function. While suspend is active, the FMS no longer sequences waypoints in the flight plan. When suspend is active, the **SUSPEND** annunciation replaces the next non-active flight plan waypoint, as shown in Figure 15-3, to alert the pilot to this condition.

Figure 15-3
Suspend

Suspend automatically becomes active when any of the following conditions are met:

- A FLY CRS waypoint is sequenced (described on page 15-82)
- A Direct-To off-route is active (described on page 15-73)
- During a manual hold and not currently exiting (described on page 15-92)
- When a vector to final (VTF) is selected and the difference between the current aircraft track and the desired aircraft track of the final approach segment is greater than 45 degrees for more than 3 seconds (described on page 15-83)
- OBS is active (described on page 15-87)
- When the last waypoint in the flight plan is sequenced
- When crossing the MAWP and the missed approach is not initiated prior to the MAWP (described on page 15-45)
- When an altitude sequence leg is active for installations that do not have an air data input (described on page 15-84)
- When a discontinuity is reached (described on page 15-67).

Suspend is automatically exited when any of the following occurs:

- A Direct–To an active flight plan waypoint is selected
- The FROM leg in the flight plan is activated
- The active flight plan is changed.
- When the aircraft heading intercepts the active leg in the flight plan.

FMS FUNCTION DISPLAY

The ***FMS function*** is displayed by pushing the ***FMS bezel key***. When pushed, the ***page*** 1/3 ***layout*** of the FMS function is displayed, shown in Figure 15–4. Pushing the ***PAGE bezel key*** toggles through the three FMS function layouts.

Figure 15–4
FMS Function Overview

The FMS page display is divided into the following sections:

- FMS home ***window***
- Waypoint list window
- Navigation map window.

The waypoint list window, shown in Figure 15-5, provides a textual representation of the flight plan. The textual presentation combines path definition (course and distance) with performance data (estimated time en route (ETE)). A secondary role of the waypoint list is to support the flight plan map data. The flight plan modifications within the waypoint list are displayed graphically on the NAV MAP.

NOTE: ETE is dashed in all views when on the ground.

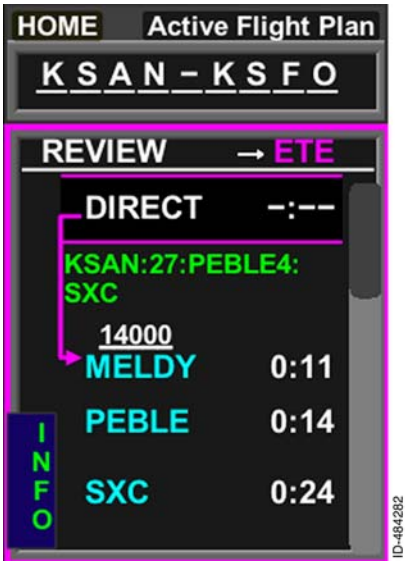


Figure 15-5
Waypoint List Window

FMS Home Window

FMS Home – The mode of the FMS is displayed to the right of the **HOME** annunciator. The displayed mode indicates the current mode the FMS is operating in. The possible FMS modes and description of each mode are as follows:

- **Active Flight Plan** – Displayed when the flight plan is active.
- **Flight Plan Edit** – Displayed when flight plan is in edit mode. The flight plan is in edit mode when the waypoint list window is active and the **EDIT** ***bezel softkey label*** is active.
- **Stored FP List** – Displayed when stored flight plan names are displayed in the waypoint window.
- **FP Store Name** – Displayed when the flight plan name can be modified before being stored.
- **New Flight Plan Edit** – Displayed when a new flight plan is created that can be activated to replace an active or stored flight plan.
- **OBS CRS:** – Displayed when omni bearing selector (OBS) mode is active.

Flight Plan Name – The name of the flight plan is displayed under the **HOME** annunciator. The power-up default flight plan name is the active flight plan in the FMS before a power cycle, or blank if the flight plan was cleared before a power cycle. The flight plan name is automatically created from the first and last waypoint names in the flight plan or from the Stored Route name.

Waypoint List Window

The waypoint list window, shown on the left side of Figure 15-6, is dedicated to the flight plan information. In addition to the waypoint identifier, the ETE, desired track (DTK), and distance-to-go (DTG) can be toggled for display with the joystick knob.

NOTE: The INFO bezel softkey label, shown in 2L in Figure 15-6, is described in detail in Section 6, Navigation Map View.

Figure 15-6
Flight Plan Window

The waypoint list window must have focus (magenta box) to scroll the waypoint list. The waypoint list is scrolled by rotating the ***joystick knob*** or using the touchscreen. The WPT annunciation is displayed in the lower-right corner of the display, as shown in Figure 15-6, indicating when the waypoint list can be scrolled using the joystick knob.

When the flight plan edit function is active (the **EDIT** bezel softkey label is active), the waypoint list header and touchscreen change to assist the pilot to choose between **SELECT** and **INS** (insert) waypoints, as shown in Figure 15-7. Touching the left-half of the waypoint list window selects individual waypoints. Touching the right-half of the waypoint list window defines the location where the pilot desires to insert a waypoint.

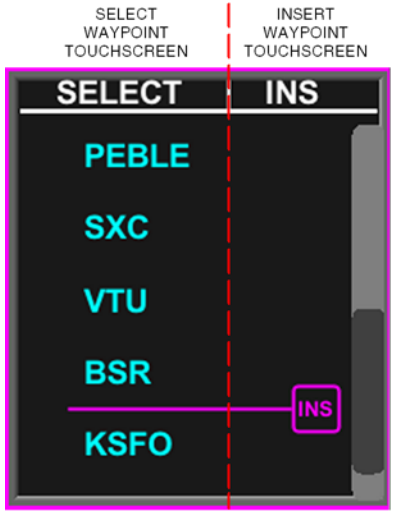


Figure 15-7
SELECT and INS Waypoint List

EXAMPLE FLIGHT PLAN

A typical flight from San Diego International Airport (KSAN) to San Francisco International Airport (KSFO) is used as an example for this section. Table 15-1 lists the details pertaining to the flight.

Table 15-1
Flight Data San Diego to San Francisco

Departure Airport	San Diego International (KSAN)
Destination Airport	San Francisco International (KSFO)
Flight Plan Routing as filed is as following KSAN PEBLE4.SXC V208 VTU V25 DEANO BSR BSR2 KSFO	

Flight Plan Route Entry

The waypoint list window, shown in Figure 15-8, permits the pilot to select, review, and insert departure (SIDs) and arrival procedures (STARs and approaches) from the FMS navigation database.

Figure 15-8
Waypoint List Window

The waypoint window is selected by pushing in the joystick knob to toggle between the three windows on page 1/3 of the FMS function layout or by using the touchscreen to directly select a window. When the waypoint window is selected, a magenta box is displayed around it, as shown in Figure 15-8.

NOTE: When the waypoint window is selected, the auto-range feature on the map display is inactive.

When the waypoint window is selected, EDIT , OBS , and PROC bezel softkey labels are displayed. Selecting the EDIT bezel softkey permits the pilot to edit the flight plan.

When the EDIT bezel softkey label is active, FMS mode changes to Flight Plan Edit and a magenta INS icon is displayed in the waypoint window, as shown in Figure 15-9.

Figure 15-9
Insert Prompt

Other bezel softkey labels displayed when EDIT is selected are insert (INS), clear (CLR), and procedure (PROC).

The pilot can insert a waypoint by either pushing the INS bezel softkey or by pushing the INS icon on the touchscreen.

Selecting the **INS** bezel softkey displays the **INSERT NEW WAYPOINT** pop-up window, shown in Figure 15-10, which permits the pilot to select airports, NAVAIDs, intersections, and user waypoints to add to the flight plan.

Figure 15-10
FMS Pop-Up Window

Pushing the bezel softkey in 1R (shown as **APT** in Figure 15-10) toggles through nearest waypoint lists in the following order:

Airports → NAVAIDs → Intersections → Repeat

The pilot can also directly select the nearest airports, NAVAIDs, or intersections list by using the touchscreen to select the ***touchscreen button*** displayed in the pop-up header.

The pop-up window can be scrolled vertically by rotating the joystick knob or using the touchscreen to highlight the desired waypoint. When the desired waypoint is highlighted, the waypoint is selected by pushing the **OK** bezel softkey, pushing in the joystick knob, or by touching the desired waypoint twice on the touchscreen.

For the example flight plan, KSAN is the desired departure airport and is selected by highlighting KSAN in the pop-up window and pushing the **OK** bezel softkey shown in Figure 15-10. The resulting display is shown in Figure 15-11.

Figure 15-11
Departure Airport Selected

The flight plan name field, shown in Figure 15-11 as **KSAN-KSAN** , defaults to the first and last waypoint in the waypoint list. Since KSAN is the first and last waypoint in the waypoint list, KSAN is displayed as the departure and destination airport. When another waypoint is entered after KSAN, the destination will update automatically in the flight plan name field.

For the example flight plan, KSFO is the desired destination airport. To insert KSFO after KSAN in the FMS flight plan list, ensure the **INS** icon is displayed after KSAN, as shown in Figure 15-11, by rotating the joystick knob.

NOTE: When the **INS** icon is displayed in the waypoint list, the **INS** bezel softkey label is displayed at 2R.

Selecting the INS bezel softkey displays the INSERT NEW WAYPOINT pop-up window. KSFO is the desired destination airport, however it is not displayed in the nearest airports pop-up window. When a desired waypoint is not displayed in the pop-up window, the waypoint can be manually entered by selecting the manual input area just below the INSERT NEW WAYPOINT header, then changing the characters one at a time using the joystick knob. The joystick knob is then toggled left and right between the character fields and the joystick knob is rotated to change the character in each field.

Alternatively, the touchscreen can be used to enter a desired waypoint by selecting the waypoint identifier field, shown in Figure 15-12.

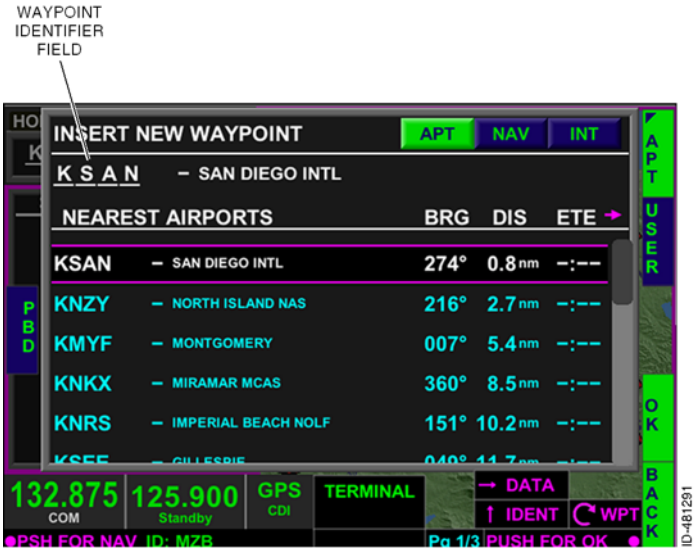


Figure 15-12
Insert New Waypoint Pop-Up Window

When selected, the ***QWERTY keypad*** pop-up window shown in Figure 15-13 is displayed.

Figure 15-13
QWERTY Pop-Up Window

The desired waypoint, KSFO for the example flight plan, is entered using the touchscreen keypad, shown in Figure 15-14. Selecting the **OK** prompt inserts the waypoint into the flight plan. The **BACK** bezel softkey returns to the **INSERT NEW WAYPOINT** display without inserting a new waypoint.

Figure 15-14
KSFO Entered on QWERTY Keypad

For the example flight plan, **OK** is pushed on the touchscreen and KSFO is inserted into the flight plan, as shown in Figure 15-15.

Figure 15-15
KSAN-KSFO Flight Plan

Departure Procedures

A standard instrument departure (SID) procedure can be entered into the FMS flight plan. To enter a SID, the departure airport must previously be entered into the flight plan.

To insert a departure procedure into the flight plan, push the **PROC** bezel softkey, shown in Figure 15-16.

Figure 15-16
Inserting Departure Procedure

When the PROC bezel softkey label is active, the right-side bezel softkey labels change to display available procedures: departure (DEP), arrival (ARR), and approach (APPR), as shown in Figure 15-17. Channel (CH #) is also displayed and is used for entering channel IDs which can be found on RNAV approach procedures charts that contain LPV or LP minimums.

NOTE: The DEP bezel softkey label is not displayed until the first waypoint in the flight plan is an airport. The ARR and APPR bezel softkey labels are not displayed until an airport is highlighted in the waypoint list window.

Figure 15-17
Procedures

For the example flight plan, the Pebble 4 departure for KSAN departing runway 27 is to be entered. Pushing the **DEP** bezel softkey displays the **Select DEPARTURE for:** page, shown in Figure 15-18. Using the joystick knob or touchscreen, highlight the desired departure runway, Runway 27. The runway is selected by pushing in the joystick knob or by touching the runway again on the touchscreen.

NOTE: When the departure airport does not have any published runways in the Honeywell IFR navigation database, **No Procedures Available** is displayed.

Figure 15-18
Select DEPARTURE for Page

When the desired runway is selected, all available departure procedures for the selected runway are displayed. Departure procedures are highlighted using the joystick knob or touchscreen. The departure procedure is selected by pushing in the joystick knob or touching the departure procedure again on the touchscreen. For the example flight plan, PEBLE4 is selected, as shown in Figure 15–19.

Figure 15–19
Departure Procedure for Page

When the departure procedure is selected, available departure transitions are displayed, as shown in Figure 15–20. Departure transitions are highlighted using the joystick knob or touchscreen. The departure transition is selected by pushing in the joystick knob or touching the transition again on the touchscreen.

NOTE: When a departure transition is not available, **No Transitions Press Joystick to Insert Procedure** is displayed.

Figure 15-20
Departure Procedure Transition Page

For the example flight plan, SXC is selected and the departure procedure and transition are inserted into the flight plan. The resulting display is shown in Figure 15–21.

Figure 15–21
SID Inserted Into the Flight Plan

Departure procedure altitude sequenced waypoints and other unnamed waypoints are also inserted into the flight plan.

When a departure procedure is inserted into the flight plan, the flight plans origin (the first waypoint) is changed to the selected runway in the format of RWXX where XX is the selected departure runway.

En Route Waypoints

To insert en route waypoints, the **EDIT** bezel softkey label must be active. When in flight plan edit mode, the joystick knob is rotated until the **INS** icon is displayed between the waypoints where the en route waypoint is to be added, as shown in Figure 15-22.

Figure 15-22
Inserting En Route Waypoints

Alternatively, instead of using the joystick knob to select the insert (**INS**) location in the waypoint list, the touchscreen can be used to select the insert location. While the flight plan edit mode is active, the **INS** header is displayed at the top of the waypoint list. When displayed, touching the right-half of the waypoint list display selects the insert location.

For the example flight plan, the en route portion begins at SXC on Vector 208 to Ventura VOR (V208.VTU). However, before an airway can be loaded, the beginning and ending NAVAID or fix must be entered. To enter VTU into the flight plan list, push the **INS** bezel softkey, shown in Figure 15-22.

When the INS bezel softkey is pushed, the INSERT NEW WAYPOINT pop-up window is displayed. Pushing the APT bezel softkey displays the nearest NAVAIDS list, shown in Figure 15-23.

NOTE: The nearest NAVAIDs waypoint list can also be displayed by pushing the NAV touchscreen button on the top of the pop-up window.

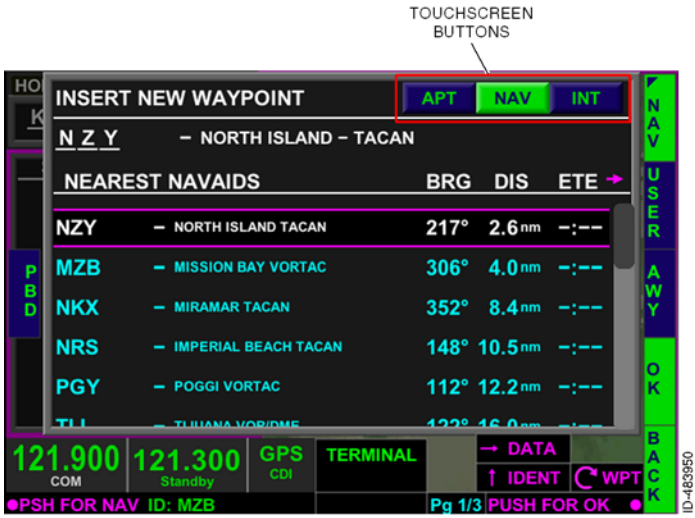


Figure 15-23
Insert VOR Waypoint

VTU is the desired waypoint, however it is not displayed in the nearest NAVAIDS waypoint list. When a waypoint is not found on the pop-up window, the waypoint can be manually entered by rotating and toggling the joystick knob or by using the touchscreen to touch the waypoint identifier displayed just below the INSERT NEW WAYPOINT header (NZY shown in Figure 15-23) twice. For this example, the touchscreen is used to manually enter the waypoint name, as this method is usually faster.

When selected, the QWERTY keypad pop-up window is displayed. For the example flight plan, VTU is manually entered, as shown in Figure 15-24. Selecting **OK** inserts the waypoint into the flight plan.

Figure 15-24
Insert VOR

The resulting display of VTU inserted into the flight plan is shown in Figure 15-25.

Figure 15-25
VOR Inserted Into Flight Plan

When the beginning and end waypoints are inserted into the flight plan, the airway can be inserted. To enter an airway, push the **INS** bezel softkey which displays the **INSERT NEW WAYPOINT** pop-up window shown in Figure 15-26.

Figure 15-26
Insert Airway

Pushing the **AWY** bezel softkey displays the INSERT WAYPOINTS VIA AIRWAY QWERTY keypad. When the QWERTY keypad is displayed, the desired airway can be entered. For the example flight plan, V208 is the desired airway and is entered using the keypad, as shown in Figure 15-27.

Figure 15-27
Insert Waypoints Via Airway

Pushing **OK** or pushing in the joystick knob inserts the airway into the flight plan. All waypoints on the airway that define the route are inserted into the flight plan, as shown in Figure 15-28. The FMS message **AIRWAY ADDED** is displayed.

NOTE: The FMS message **NOT IN DATA BASE** is displayed if an invalid airway is entered.

Figure 15-28
Airway Inserted Into Flight Plan

For the example flight plan, the planned route after VTU is to proceed via Victor 25 to the DEANO intersection (V25.DEANO) and then Victor 27 to the Big Sur VOR (V27.BSR). The Victor airway and waypoint combination for the remainder of the flight are entered into the flight plan as previously described.

Arrival Procedures

Standard terminal arrival routes (STARs) are contained in the NAV database and can be inserted into the flight plan. To insert a STAR into the flight plan, push the PROC bezel softkey, shown in Figure 15–29, while in flight plan edit mode.

NOTE: Some approaches and STARs are not in the database. This is because of the way some procedures are defined by the controlling agency and the limitations of the FMS.

Figure 15-29
Entering Arrival Procedures

The PROC bezel softkey label is displayed when the FMS waypoint list window has focus or when the HOME window has focus on page 1/3 of the FMS bezel softkey labels (described later in this section). When the FMS waypoint list has focus, an airport (or runway) must be highlighted in the waypoint list window to display selectable arrival and approach prompts. Otherwise the ARR and APPR bezel softkey labels are not displayed. When the HOME window has focus, pushing the PROC bezel softkey displays selectable ARR and APPR bezel softkey labels when the destination airport is the last waypoint in the FMS waypoint list.

When the PROC bezel softkey label is active, the right-side bezel softkey labels display available procedures: departure (DEP), arrival (ARR), approach (APPR), and channel (CH #), as shown in Figure 15-30.

Figure 15-30
Available Procedures

For the example flight plan, the Big Sur 2 arrival for KSFO is to be entered. Pushing the **ARR** bezel softkey displays the **Select ARRIVAL for:** page, shown in Figure 15-31. Using the joystick knob or touchscreen, highlight the desired STAR, BSR2. The STAR is selected by pushing in the joystick knob or pushing the desired arrival twice on the touchscreen.

Figure 15-31
Select ARRIVAL for Page

When the desired STAR is selected, available arrival transitions for the selected STAR are displayed (when the selected STAR has a transition). Arrival transitions are highlighted using the joystick knob or touchscreen. For the example flight plan, no transitions are available for the BSR2 arrival. When a STAR does not have a transition, **No Transitions Press Joystick to Insert Procedure** is displayed on the arrival transition page. Pushing in the joystick knob inserts the STAR into the flight plan without a transition. The resulting display is shown in Figure 15–32.

NOTE: Altitude restrictions are not inserted into the flight plan.

Figure 15-32
STAR Inserted Into the Flight Plan

Approach Procedures

The KSN 765/770 meets the requirements of TSO-C146C and AC 20-138C and is a suitable RNAV system as defined in the Aeronautical Information Manual (AIM).

There may be differences between courses displayed on the chart and those on the display. These differences are the result of changes in magnetic variation and are normally less than 2 degrees. Verify possible changes before starting an approach by checking the approach chart against the flight plan.

NOTE: When an ILS, LOC, or LOC BC type approaches are selected with an EFIS 40/50 installed while in GPS mode, the display will show a **X** and not provide any navigation information as a reminder to the pilot to switch to the appropriate navigation source (LOC) on the EFIS 40/50.

USING GPS GUIDANCE ON AN APPROACH

Only approaches with the initials **GPS** in the title can be conducted using the FMS. For example, **RNAV (GPS) RWY 22** or **RNAV (GPS) Y RWY 27** or **VOR or GPS-A** can all be flown using the KSN WAAS GPS. Other approaches, such as **VOR RWY 22** cannot be flown using the GPS as the primary source of navigation, though GPS can be used to monitor the approach. Refer to the AIM Chapter 5 section titled Global Positioning System (GPS) for more information regarding the acceptable use of GPS equipment.

When flying an approach using ground-based equipment, the pilot must transition to navigation using signals from the ground-based equipment at the final approach waypoint (FAWP). For NDB, VOR, or ILS approaches the primary navigation instruments are the ADF needle, the VOR driven ***CDI*** or HSI, or the LOC/GS indications on the CDI or HSI, respectively.

The following paragraphs describe the various approaches that can be flown

- **VOR**, **VOR/DME**, **NDB**, and **NDB/DME** approaches have a GPS overlay in the database that permits monitoring of the approach using GPS. The ground-based VOR or NDB signals must be used for primary approach guidance and the altitude restrictions on the approach must be met. GPS guidance with advisory vertical guidance can only be used to monitor the approach. A prompt to remind the pilot to switch to VLOC on a VOR approach is not provided.

- When an approach has **VOR or GPS** or **NDB or GPS** in the title, GPS can be used for approach guidance. The altitude restrictions must be met. GPS with advisory vertical guidance can be used to monitor the VOR or NDB approach when desired. Lateral deviations are approved for navigation when the **APPROACH** annunciator is displayed prior to the FAWP and the loss of integrity (**LOI**) annunciator is not displayed.

- When a **GPS** or **RNAV (GPS)** approach *without* LNAV/VNAV or LPV minimums is flown, the GPS must be used for approach guidance and the altitude restrictions on the approach must be met. Advisory vertical guidance is provided. Lateral deviations are approved for navigation when the **APPROACH** annunciator is displayed and the loss of integrity (**LOI**) annunciator is not displayed. **LNAV+V** and **LP+V** are examples of annunciations displayed in the approach mode guidance field to indicate the type of approach flown.

- When a **GPS** or **RNAV (GPS)** approach *with* LNAV/VNAV or LPV minimums is flown, the GPS must be used for approach guidance. The vertical guidance is surveyed and is not advisory. Displayed lateral and vertical deviations are approved for navigation when the **APPROACH** annunciator is displayed and the loss of integrity (**LOI**) annunciator is not displayed. **LPV** or **LNAV/VNAV** is displayed in the approach mode guidance field to indicate the type of approach flown. These approaches terminate at the decision altitude (DA) for LPV and LNAV/VNAV minimums.

  The FMS will automatically select LPV if available on an RNAV approach. If the GPS is detected as unfavorable, the system can fail-down to LNAV. The approach annunciation box will identify the approach type, and the pilot should fly to the appropriate minimums.

- When a **LOC**, **LOC (BACK CRS)**, **SDF**, **LDA**, **IGS**, or **TACAN** approach is flown, the ground-based signals must be used for primary approach guidance and the altitude restrictions on the approach must be met. The GPS may be used to monitor the approach. There is no advisory vertical guidance for back course approaches. Auto-tune and auto-switching of the localizer is available when configured. When not configured for auto-switching, a prompt to remind the flight crew to switch to VLOC is not provided.

  NOTE: When configured on installation, the KSN 770 radio will automatically tune the standby NAV frequency and switch the standby NAV frequency to the active NAV frequency at the appropriate time. The system will not automatically switch back to GPS during a missed approach. For a detailed description of the NAV radio autotune feature, see Section 5, KSN 770 Radio.

- When an **ILS** approach is flown, the ground-based signals must be used for primary approach guidance. The GPS may be used to monitor the approach. Advisory vertical guidance is provided. Auto-tune and auto-switching of the localizer is available when configured. When not configured for auto-switching, a prompt to remind the flight crew to switch to VLOC is not provided.

ADVISORY VERTICAL GUIDANCE

Advisory vertical guidance is displayed when permitted by the selected approach and as long as sufficient health and integrity exists within the GPS. Advisory vertical guidance is indicated for some approaches by a **+V** appended to the approach annunciation in the approach mode guidance field. If the vertical integrity degrades, the vertical deviations are flagged invalid.

NOTE: Table 15-2 lists each type of approach supported and if vertical deviations are provided for each approach.

CAUTION

ADVISORY VERTICAL GUIDANCE DEVIATION INFORMATION IS ONLY AN AID TO HELP PILOTS COMPLY WITH ALTITUDE RESTRICTIONS. WHEN USING ADVISORY VERTICAL GUIDANCE, THE PILOT MUST USE THE PRIMARY BAROMETRIC ALTIMETER TO ENSURE COMPLIANCE WITH ALL ALTITUDE RESTRICTIONS, PARTICULARLY DURING INSTRUMENT APPROACH OPERATIONS. ADVISORY VERTICAL GUIDANCE IS REMOVED AT THE MISSED APPROACH POINT.

Uncertified, but FAA-sanctioned, advisory vertical guidance is generally provided by a published vertical descent angle. Sometimes the glide path is computed as a geometric path between two waypoints. These approaches are non-precision and the minimums identified on the approach as minimum descent altitude (MDA). Minimums may be reached prior to the missed approach point. The advisory glide path may not meet every intermediate altitude crossing restriction. The pilot in command is responsible to meet all altitude crossing restrictions.

APPROACH MODE GUIDANCE

Table 15-2 lists a summary of the various approach types and the vertical guidance provided.

Table 15-2
Approach Mode Guidance

Approach Type Engaged	Annunciation	Vertical Deviations Available
WAAS Localizer Performance with Vertical Guidance	LPV	Yes
WAAS Localizer Performance	LP	No
WAAS LP with Advisory Only Vertical Guidance	LP+V	Yes
RNAV Lateral Navigation with Vertical Guidance	LNAV/VNAV	Yes
RNAV Lateral Navigation	LNAV	No
RNAV LNAV with Advisory Only Vertical Guidance	LNAV+V	Yes
Instrument Landing System (ILS)	ILS	Yes
Localizer	LOC	Yes
Localizer Back Course	BACK CRS	No
Simplified Directional Facility	SDF	Yes
Localizer Type Directional Aid	LDA	Yes
Instrument Guidance System	IGS	Yes
NDB or NDB/DME	NDB	Yes
VOR or VOR/DME	VOR	Yes
Tactical Air Navigation	TACAN	Yes
Global Positioning System	GPS+V	Yes
Microwave Landing System, Differential GPS or Flight Management System	(Blank)	No

CIRCLING APPROACHES

Circling approaches are identified with the word **CIRCLE** in place of the runway designation on the **Select APPROACH for:** page. When a circling approach is activated, the approach is constructed with the MAWP followed by the airport waypoint and associated missed approach procedure. A discontinuity is automatically inserted between the MAWP and the airport waypoint. The FMS does not provide guidance for the circling maneuver once the approach is completed (crossing the MAWP, or when the pilot has acquired the airport visually).

NOTE: When the discontinuity is deleted between the MAWP and the airport, the FMS provides guidance to turn to the center of the airport after crossing the MAWP.

When the **MA** bezel softkey is pushed, the discontinuity and airport waypoint are removed from the active flight plan. Also, the missed approach procedure after the MAWP becomes part of the active flight plan.

LOADING AN APPROACH

CAUTION

BEFORE STARTING AN APPROACH TRANSITION OR APPROACH, THE PILOT MUST REVIEW THE PUBLISHED ARRIVAL PROCEDURE AND VERIFY THE FMS WAYPOINTS AND ALTITUDE RESTRICTIONS.

The PROC bezel softkey label is displayed when the FMS waypoint list window has focus or when the HOME window has focus on page 1/3 of the FMS bezel softkey labels (described later in this section). When the FMS waypoint list has focus, an airport (or runway) must be highlighted in the waypoint list window to display selectable arrival and approach prompts. Otherwise, the ARR and APPR bezel softkey labels are not displayed. When the HOME window has focus, pushing the PROC bezel softkey label always displays selectable ARR and APPR prompts for the displayed destination airport.

Activating the PROC bezel softkey label changes the bezel softkey labels to display available procedures: departure (DEP), arrival (ARR), approach (APPR), and channel (CH #), as shown in Figure 15–33.

Figure 15-33
Entering an Approach

For the example flight plan, the ILS 28R approach for KSFO is to be entered. Pushing the **APPR** bezel softkey shown in Figure 15-33, displays the **Select APPROACH for:** page shown in Figure 15-34. Using the touchscreen or joystick knob, the ILS 28R approach is highlighted. The approach is selected by pushing in the joystick knob.

Figure 15-34
Select APPROACH for Page

When the desired approach is selected, all available approach transitions are displayed, as shown in Figure 15-35. Approach transitions are selected by using the joystick knob or touchscreen.

NOTE: An approach transition must be selected even when no approach transition is desired. Any undesired approach transition waypoints must manually be deleted from the flight plan waypoint list.

Figure 15-35
Approach Transition Page

If the approach is loaded and later has to be changed, select the approach in the flight plan list and push **APPR** to bring up the list of approaches. Initially, only the approaches available to the same runway are displayed. To display a complete list of approaches to the same airport, the current approach must be deleted.

For the example flight plan, VECTORS is selected and the approach and transition are inserted into the flight plan. The resulting display is shown in Figure 15-36.

NOTE: Altitude constraints for the approach and associated missed approach are entered into the flight plan.

Figure 15-36
Approach Inserted Into the Flight Plan

FLYING AN APPROACH

Before starting an approach transition that is flown by the FMS, it is important to verify that the transition is cleared by ATC.

NOTE: To avoid autopilot mode confusion, do not select Approach Mode on autopilot until the KSN has transitioned from Terminal to Approach mode.

When using the GPS as the primary source of navigation, the **APPROACH** annunciator will display prior to the final approach fix and remain displayed for the remainder of the approach. This is a positive cue to the flight crew that the sensor configuration is correct and sensor integrity is within limits for the approach. The loss of integrity (**LOI**) annunciator must be off throughout the approach. If the **LOI** annunciator is displayed, the FMS should not be used for the remainder of the approach. The flight crew can continue the approach using raw data (when available on the approach procedure) or perform the missed approach procedure.

CHANNEL ID

Approach charts with an RNAV approach procedure with LPV minimums contain a channel ID code, as shown in Figure 15-37. This code can be entered into the display to quickly load the desired approach procedure.

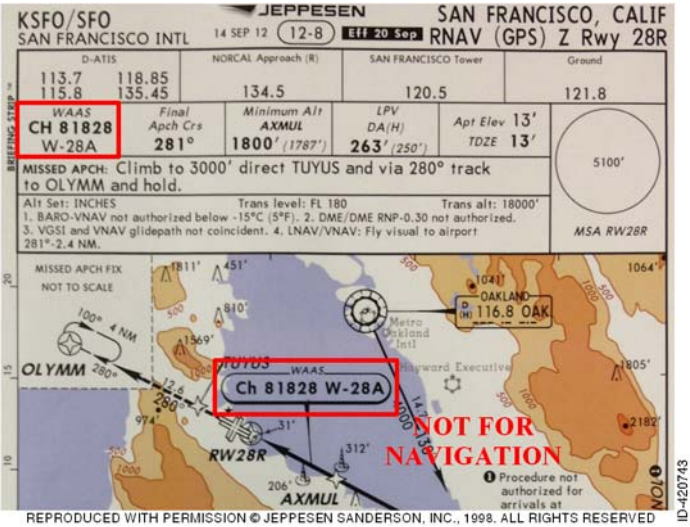


Figure 15-37
Channel ID on Approach Chart

When an approach is loaded from the CH # bezel softkey, it is loaded as a vector to final transition. In order to load the approach with a published transition fix/route, the CH # bezel softkey should not be used. In that case, the approach should be loaded as described previously.

To enter a channel ID, select the **CH #** bezel softkey shown in Figure 15-33. When the **CH #** bezel softkey label is active, the **Channel ID** window shown in Figure 15-38, is displayed.

Figure 15-38
Channel ID

The channel ID is entered using the touchscreen. For the example flight plan, the RNAV (GPS) Z approach to runway 28R is desired and the channel ID for the example approach is 81828. The channel ID is entered using the touchscreen and then pushing **OK** or pushing in the joystick knob. When **OK** is pushed, the select approach transition page is displayed.

When a 5-digit channel number is selected and there is more than one procedure for the selected channel number, the select approach pop-up window is displayed, shown in Figure 15-39.

Figure 15-39
Select Approach Pop-Up Window

The joystick knob can be rotated or the touchscreen can be used to highlight the desired procedure. Pushing in on the joystick knob or double touching the touchscreen select the desired procedure.

The FMS message **NOT IN DATA BASE** is displayed when an invalid channel number is entered.

Missed Approach Procedures

The missed approach procedure is an integral part of the approach procedure. The missed approach procedure begins at the MAWP, and is separated from the approach by a **Missed Approach** header within the waypoint list, as shown in Figure 15-40.

Figure 15-40
Missed Approach Procedure

The missed approach procedure is activated by pushing the **MA** bezel softkey or by pushing the **MA** touchscreen button when the missed approach pop-up window is displayed.

NOTE: Suspend is entered after crossing the MAWP and the missed approach is not initiated prior to the MAWP. The CDI will go to FROM and the outbound course is the same as the inbound course. The flight plan is suspended until the missed approach is selected.

The **MA** bezel softkey label is displayed when the FAWP of the approach procedure is the active To waypoint and either the waypoint list or home field is selected.

NOTE: The **MA** bezel softkey label is not displayed when the NAV MAP window is selected.

The missed approach pop-up window shown in Figure 15-41, is displayed when the missed approach waypoint is reached and the missed approach has not yet been activated by pushing the **MA** bezel softkey. When displayed, the pop-up window requires the pilot to make a decision. Pushing the **MA** touchscreen button or bezel softkey activates the missed approach procedure. Pushing the **CLEAR** touchscreen button or bezel softkey removes the pop-up window and does not activate the missed approach procedure. The FMS remains in Suspend when the **CLEAR** touchscreen button or bezel softkey is pushed.

NOTE: When the **CLEAR** touchscreen button bezel softkey is pushed, the missed approach can be later activated by pushing the FMS bezel key and then the **MA** bezel key.

Figure 15-41
Missed Approach Pop-Up Window

When MA or MA is selected, the missed approach is activated and TERMINAL MISSED APR is displayed in the FMS phase of flight window indicating that the missed approach has been activated. The Missed Approach header is removed from the waypoint list and the missed approach waypoints and are added to the active flight plan, as shown in Figure 15–42.

NOTE: When vectors to final (VTF) is activated and the MA bezel softkey is selected before the FAWP, HDG SEL becomes the active FROM leg and the FAWP becomes the active TO leg.

Figure 15-42
Missed Approach Activation

When the MAWP is sequenced, the missed approach procedure becomes the active leg. The missed approach procedure is flown including the charted holding procedure.

Procedure Turns

Procedure turns are associated with approach procedures. The turns are used for course reversals to align the aircraft with the runway. When an approach procedure contains a procedure turn, the FMS displays the procedure turn as a canted teardrop symbol on the navigation map display and displays **PT** next to the procedure turn waypoint in the waypoint list.

For this example, the ILS approach to runway 8 at KABQ is entered as the approach procedure with the Albuquerque (ABQ) VOR transition. The approach procedure contains a procedure turn at the ABQ VOR. As a result, **PT** is displayed next to the ABQ waypoint in the flight plan list, indicating the procedure turn at ABQ. The procedure turn is also displayed on the navigation map as a canted teardrop symbol, as shown in Figure 15-43.

Figure 15-43
Procedure Turns

Procedure turns are displayed in white when the procedure turn is not the active leg. When the procedure turn is the active leg, the procedure turn is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails. After the aircraft completes the procedure turn by intercepting the inbound leg, the procedure turn is removed from display and the inbound leg is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails.

NOTE: ETE and distance calculations include the estimated time and distance in the procedure turn and not the estimated time and distance directly to the procedure turn fix. The displayed desired track is the calculated desired track in which to fly at any point during the procedure turn.

The procedure turn parameters cannot be modified by the pilot and parameters come from data stored in the navigation database.

Graphical Edit

A waypoint can be inserted into the flight plan using the map display to select where a waypoint is desired (creating a latitude/longitude waypoint) or by selecting a navigation database waypoint displayed on the navigation map. When the FMS mode is Flight Plan Edit (the FMS waypoint list is selected and the **EDIT** bezel softkey label is active), **GRAPHICAL EDIT** is displayed in the upper-left corner of the map display, as shown in Figure 15-44.

NOTES:

1. Panning mode is automatically active when the FMS mode Flight Plan Edit is active. While active, the orientation indicator is always displayed LOCKED, even when selected off in the menu.

2. Graphical edit is inoperative when navigating via the Direct-To mode.

Figure 15-44
Graphical Edit

When **GRAPHICAL EDIT** is displayed, the touchscreen can be used to select the location of the desired waypoint. When the touchscreen is first pushed while not on a flight plan leg, a vertical and horizontal cyan line centers on the location being touched. A cyan dashed line extends from the last waypoint in the flight plan to the location being touched. Course, distance, ETE, and elevation of where the pilot is touching is displayed on the NAV MAP display, as shown in Figure 15-45. The data continuously updates as the touchscreen location changes.

NOTE: When a navigation database waypoint is selected, the waypoint name is displayed under the course, distance, ETE, and elevation field.

Figure 15-45
Graphical Edit Data

When the position on the touchscreen is no longer moving, the data box and horizontal and vertical cyan lines are removed from the display and a cyan octagon is displayed where the touchscreen was last touched, as shown in Figure 15-46. A cyan line remains displayed and is connected to the last waypoint in the flight plan list.

Figure 15-46
Graphical Edit Insert

The selected waypoint or latitude/longitude location is inserted into the flight plan by pushing the **INS** bezel softkey.

When inserted, the waypoint is appended to the end of the flight plan list. When a navigation database waypoint is selected, the waypoint name is inserted into the flight plan. When a location other than a navigation database waypoint is selected, a latitude/longitude waypoint is created and displayed as **LL** followed by a two-digit number (**LLXX**), as shown in Figure 15-47.

Figure 15-47
Graphical Waypoint Inserted

Alternatively, the pilot can choose to graphically edit the flight plan between two existing waypoints. To do this, the pilot uses the touchscreen to touch the line connecting the two existing waypoints on the NAV MAP. When selected, a dashed cyan line extends from the two existing waypoints on the NAV MAP, as shown in Figure 15-48.

Figure 15-48
Graphical Edit Between Two Waypoints

The pilot can select the desired location or navigation waypoint on the NAV MAP for insertion. When the location is found on the NAV MAP, pushing the **INS** bezel softkey inserts the waypoint between the two existing waypoints, as shown in Figure 15-49.

Figure 15-49
Graphically Inserted Waypoint

The pilot can also choose to edit a waypoint graphically. To do this, the pilot uses the touchscreen to touch the waypoint that they want to have changed. When selected, a dashed cyan line extends from the two existing waypoints on either side of the selected waypoint, as shown in Figure 15–50.

Figure 15–50
Change Waypoint Graphically

The pilot can then move the cyan octagon to the desired location or navigation waypoint on the NAV MAP for insertion. When the location on the NAV MAP is found, pushing the **CHNG** bezel softkey changes the selected waypoint, as shown in Figure 15–51.

Figure 15–51
Waypoint Changed

Changing or Deleting an Entered Procedure

A previously entered procedure can be changed or deleted using the **PROC** bezel softkey. To change an arrival, the arrival banner (displayed in green) must be highlighted. To change an approach, the missed approach waypoint or loaded approach procedure banner must be highlighted. To change a departure, no specific waypoint highlight is required.

When the **PROC** bezel softkey is selected, the bezel softkey labels for the various procedures are displayed. To change or delete a previously entered procedure, select the desired bezel softkey. For the example flight plan, the approach to 28R is desired to be changed and the **APPR** bezel softkey is pushed. The resulting display is shown in Figure 15-52.

Figure 15-52
Changing a Procedure

The approach is deleted from the flight plan by selecting the **Delete Active Approach** prompt and pushing in the joystick knob or touching the touchscreen twice. To change the approach to a different approach, to the same runway, select the desired approach from the list and push in the joystick knob. When the joystick knob is pushed in either situation, the changes are made to the flight plan.

NOTE: To change the approach to a different runway, the active approach must first be deleted before a different runway approach can be entered.

The approach is reinserted into the flight plan by selecting the **Reinsert** prompt and pushing in the joystick knob or touchscreen. When pushed, approach waypoints are reinserted into the flight plan. This can be useful when deleted or sequenced approach waypoints are desired again.

A procedure can also be deleted by highlighting the procedure banner in the flight plan waypoint list and enabling **EDIT** , as shown in Figure 15–53, and pushing the **DEL** bezel softkey.

Figure 15-53
Delete Procedure

When **DEL** is pushed, **CONFIRM DEL** is displayed over the procedure banner, as shown in Figure 15-54. Pushing the **OK** bezel softkey removes the procedure from the flight plan. Pushing the **BACK** bezel softkey returns to the previous display.

Figure 15-54
Confirm Delete Procedure

Reviewing FMS Flight Plan Waypoints

CAUTION

BEFORE USING THE FMS FOR NAVIGATION, IT IS IMPORTANT TO CROSS-CHECK THE DISPLAYED WAYPOINTS WITH THOSE OF PRINTED DEPARTURE PROCEDURES, EN ROUTE CHARTS, ARRIVALS, AND APPROACH PROCEDURES.

The FMS flight plan can be reviewed waypoint by waypoint by ensuring the EDIT bezel softkey label is active and using the joystick knob or touchscreen to scroll through the waypoints. When the flight plan is scrolled, the currently selected waypoint is displayed in the center of the NAV MAP display. Figure 15-55 shows ANJEE highlighted in the flight plan list and in the center of the map display.

Figure 15-55
Reviewing FMS Flight Plan

The FMS flight plan can also be reviewed anytime the EDIT bezel softkey label is inactive. The NAV MAP display stays in the current flight orientation and does not move the flight plan waypoints as they are scrolled.

Changing the Destination

A previously entered destination can be changed by inserting a new destination after the previously entered destination in the waypoint list. This can be useful in the event of a diversion.

For the example flight plan, the pilot decides to divert to Sacramento International (KSMF). To change the destination airport, the joystick knob is rotated (in flight plan edit mode) until the **INS** icon is displayed after the original destination (KSFO), as shown in Figure 15-56.

Figure 15-56
Changing Destination Waypoint

When the INS bezel softkey is pushed, the INSERT NEW WAYPOINT pop-up window is displayed. The new destination airport is chosen from the nearest airports list or can be manually entered using the QWERTY keypad. When the waypoint is inserted into the flight plan, KSMF is displayed after KSFO, as shown in Figure 15-57.

Figure 15-57
New Destination Inserted

When the new destination is inserted, the flight plan name is updated to display the new destination airport, shown as KSMF in Figure 15-57. This is an indication to the pilot the arrival and approach procedures for the new destination airport can be loaded using the PROC bezel softkey when the HOME window has focus. When the FMS waypoint list has focus, the desired airport will have to be highlighted in order to load an arrival or approach. The pilot can add waypoints as necessary to the flight plan using normal procedures.

To remove the previous destination and waypoints, a Direct-To can be performed to a waypoint in the flight plan leading to the new destination, or the undesired waypoints can be deleted from the flight plan manually.

Changing Flight Plan Waypoints

A previously entered flight plan waypoint can be changed using the **CHNG** bezel softkey. The desired waypoint must be highlighted using the joystick knob or touchscreen. Activating the **EDIT** bezel softkey label (if not already selected) ensures the FMS mode is **Flight Plan Edit** . For the example flight plan, ATC instructs the pilot after CARME, to fly direct to the Salinas VOR (SNS) instead of ANJEE. Since the ANJEE waypoint needs to be changed, the waypoint is highlighted on the waypoint list, as shown in Figure 15-58.

Figure 15-58
Changing Flight Plan Waypoints

NOTE: While in **Flight Plan Edit** mode, pushing the desired waypoint twice on the touchscreen displays the **CHANGE WAYPOINT** pop-up window.

Pushing the **CHNG** bezel softkey displays the nearest airports waypoint list.

The **CHANGE WAYPOINT** pop-up window is shown in Figure 15-59.

Figure 15-59
Change Current Waypoint

From this page, the pilot can push the bezel softkey in 1R to toggle through the nearest airports, nearest NAVAIDs, and nearest intersections waypoint list. The pilot can also use the touchscreen to select the desired waypoint type in the pop-up window header. Using the touchscreen to touch the airport identifier area displays the QWERTY keypad, which permits the pilot to manually enter any waypoint in the navigation database. Selecting the **USER** bezel softkey displays the **USER WAYPOINTS** pop-up window which allows the pilot to change a flight plan waypoint to a user-defined waypoint.

Selecting the **OK** bezel softkey changes the waypoint in the flight plan.

NOTE: When a waypoint identifier is selected which has the same identifier in multiple instances in the NAV database, the **SEL** bezel softkey label replaces the **OK** bezel softkey label.

For the example flight plan, SNS not in the nearest NAVAID waypoint list and must be manually entered using the QWERTY keypad and then pushing in the joystick knob or **OK** on the touchscreen.

The new waypoint (SNS) is inserted into the flight plan, replacing the old waypoint (ANJEE), as shown in Figure 15-60. The waypoint changes are also displayed on the map display.

Figure 15-60
New Waypoint Inserted

Deleting Flight Plan Waypoints

When necessary, flight plan waypoints can be deleted from the flight plan list. To delete a waypoint, the desired waypoint is highlighted using the joystick knob or touchscreen. Enabling the **EDIT** bezel softkey label (if not already selected) ensures the FMS mode is **Flight Plan Edit** . For the example flight plan, ATC instructs the pilot after SKUNK to fly direct to MENLO. This instruction can be complied with by deleting the BOLDR waypoint. To delete the BOLDR waypoint, BOLDR waypoint is highlighted in the waypoint list, as shown in Figure 15-61.

Figure 15-61
Deleting Flight Plan Waypoints

Selecting the DEL bezel softkey displays a CONFIRM DEL prompt in the waypoint list and OK and BACK bezel softkey labels on the map display, as shown in Figure 15-62. Selecting OK deletes the waypoint and selecting BACK returns to the previous display.

Figure 15-62
CONFIRM DEL Prompt

When a waypoint has a hold, pushing the DEL bezel softkey only deletes the hold and not the hold and waypoint at the same time.

Clearing Flight Plans

When necessary, entire flight plans can be removed from the flight plan waypoint list. A flight plan can be cleared by pushing the FMS bezel key and then pushing the **CLR** bezel softkey. Alternatively, the flight plan can be cleared by enabling the **EDIT** bezel softkey label (which ensures the FMS mode is Flight Plan Edit) and then selecting the **CLR** bezel softkey. When the **CLR** bezel softkey is selected, a caution window is displayed, as shown in Figure 15-63.

Figure 15-63
Clearing Flight Plans

Pushing the **OK** bezel softkey clears the entire flight plan, including the flight plan name. Pushing the **BACK** bezel softkey returns to the previous display and does not remove the flight plan.

Route Discontinuity

A route discontinuity is a lack of lateral navigation information on a specific leg in the flight plan. One common result of a route discontinuity is when an approach is loaded into the flight plan with no defined leg between the last waypoint in the flight plan and the first waypoint of the approach. When reaching a discontinuity in the flight plan, lateral navigation is discontinued and the TO waypoint, DTG, and DTK fields in the text data bar are displayed as dashes.

Lateral navigation is regained by selecting a Direct-To waypoint in the flight plan, or by simply deleting the discontinuity. When the discontinuity is deleted, the waypoint before and after the discontinuity are connected.

NOTE: Suspend is entered when a discontinuity is reached.

When necessary, the discontinuity can be removed. To remove the discontinuity, use the joystick knob or touchscreen to select the discontinuity, displayed as **WPT DISCONNECT Press EDIT/CONN** when highlighted and is shown in Figure 15-64.

Figure 15-64
Route Discontinuity

Activating the **EDIT** bezel softkey label (when not already selected) ensures the FMS mode is **Flight Plan Edit** , as shown in Figure 15-64.

Selecting the **CONN** bezel softkey displays a **CONFIRM CONN** prompt in the waypoint list and **OK** and **BACK** bezel softkey labels on the map display, as shown in Figure 15-65. Selecting **OK** deletes the discontinuity from the waypoint list. Selecting **BACK** returns to the previous display.

Figure 15-65
Confirm Connection

Direct-To and Nearest Function

The FMS provides the ability to use Direct-To to go direct to any waypoint. To perform a Direct-To, push the **Direct-To bezel key**. When pushed, the **DIRECT TO** pop-up window, shown in Figure 15-66, is displayed.

Figure 15-66
Direct-To Pop-Up Window

The **DIRECT TO** pop-up window defaults to display flight plan waypoints and the **FPL** bezel softkey label is active (in header and in 1R).

A waypoint is chosen from the list using the joystick knob or touchscreen to highlight the desired Direct-To waypoint. When the desired Direct-To waypoint is highlighted, the Direct-To is initiated by pushing in the joystick knob or by double tapping the waypoint on the touchscreen.

NOTE: Anytime a Direct-To is performed, the FMS display is automatically displayed, even if the Direct-To was performed while on another screen (i.e., NAV MAP or WX page).

Previous waypoints, nearest airports, nearest NAVAIDs and nearest intersections can also be displayed in the nearest waypoint list. Pushing the bezel softkey at 1R toggles through nearest waypoint groups in the following order:

Flight Plan Waypoint → Previous Waypoints → Airports → NAVAIDs → Intersections → Repeat

The various nearest waypoint lists can also be displayed by touching the touchscreen buttons in the header field in the **DIRECT TO** pop-up window.

Selecting the **PBD** (place/bearing/distance) bezel softkey displays the **TEMP WAYPOINT** window, which permits the pilot to create a temporary waypoint used to perform a Direct-To. Creating a temporary waypoint is described earlier in this section.

Selecting the **USER** bezel softkey, displayed when the Direct-To bezel key is pushed, permits the pilot to perform a Direct-To a user-defined waypoint. When the **USER** bezel softkey is selected, the **USER WAYPOINTS** window, shown in Figure 15-67, is displayed.

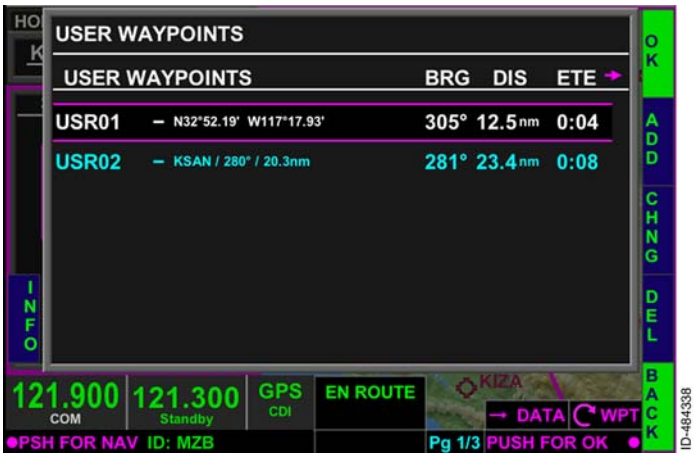


Figure 15-67
User Waypoints

A user-defined waypoint can be selected from the list or the pilot can change or add waypoints to the list. Changing and adding user-defined waypoints is described later in this section.

The **BACK** bezel softkey returns to the previous display without making any changes.

DIRECT-TO UNDO

When a Direct-To is performed to a waypoint that is not part of a published approach procedure and the waypoint has not been sequenced, an **UNDO** bezel softkey label is displayed in 3R, as shown in Figure 15-68, when the Direct-To bezel key is pushed.

Figure 15-68
Direct-To Undo

When the **UNDO** bezel softkey is pushed, the active flight plan is restored to the active flight plan that was available and displayed prior to the selection of the Direct-To function.

DIRECT-TO A WAYPOINT NOT IN THE FLIGHT PLAN

When a Direct-To is performed to a waypoint not contained in the active flight plan (APT, NAV, INT, USER, or PREV waypoint), the remainder of the waypoints in the active flight plan are grayed out, as shown in Figure 15-69.

NOTE: Suspend is entered when a Direct-To off path is performed.

Figure 15-69
Direct-To a Waypoint Not in the Flight Plan

When the aircraft passes over the Direct-To waypoint not in the Flight Plan, the CDI goes to FROM and the outbound track is unchanged from the inbound track.

There are three options to exit suspend:

1. Execute a direct-to a waypoint in the active flight plan.
2. Add more waypoints to the Direct-To a waypoint not in the flight plan.
3. Push the Direct-To bezel key then push **UNDO** .

The flight plan can also be resumed when the flight plan waypoint list window is active with the **EDIT** bezel softkey label active. Using the joystick knob or touchscreen, select a down path waypoint (one of the grayed waypoints) that is the desired FROM waypoint. The **ACTV** bezel softkey label is then displayed along the left-side of the display, as shown in Figure 15-70.

Figure 15-70
ACTV Softkey Label

Pushing the **ACTV** bezel softkey displays **CONFIRM ACTV** over the desired FROM waypoint and the **OK** and **BACK** bezel softkey labels are displayed on the right side of the display, as shown in Figure 15-71.

Figure 15-71
CONFIRM ACTV

Pushing the **OK** bezel softkey activates the selected waypoint as the FROM waypoint, as shown in Figure 15-72. Pushing the **BACK** bezel softkey returns to the previous display without making any changes.

Figure 15-72
FROM Waypoint Activated

Changing the FROM Waypoint

The pilot can choose to make a waypoint in the active flight plan the FROM waypoint by using the ACTV bezel softkey. The ACTV bezel softkey label is displayed on the left-side of the display, as shown in Figure 15-73, when the following conditions are met:

- The flight plan waypoint list has focus
- The EDIT bezel softkey label is active
- A minimum of three waypoints are in the flight plan.

Figure 15-73
Activate FROM Waypoint

Waypoints not permitted to be converted to FROM using the ACTV bezel softkey are:

- The first waypoint in the flight plan list (origin or FROM)
- The last waypoint in the flight plan list (destination)
- Any waypoints between the FAWP and MAWP, including the FAWP and MAWP in a published approach procedure
- Any waypoint in the missed approach
- A runway waypoint
- An INTXX waypoint or part of a procedure turn
- An altitude terminating leg
- A discontinuity.

During the following conditions, the FROM waypoint cannot be changed:

- While on the ground
- During an arc turn
- During a radial turn
- During a procedure turn (procedure turn as FROM).

Pushing the ACTV bezel softkey displays CONFIRM ACTV over the desired FROM waypoint, and the OK and BACK bezel softkey labels are displayed on the right side of the display. Pushing the OK bezel softkey activates the selected waypoint as the FROM waypoint. Pushing the BACK bezel softkey returns to the previous display without making any changes.

Multiple Database Waypoints With Same Identifier

When a waypoint is entered into the flight plan that has the same identifier for multiple published waypoints, the SELECT WAYPOINT pop-up window is displayed, which lists all of the waypoints by name, direct track, distance, and ETE, as shown in Figure 15-74.

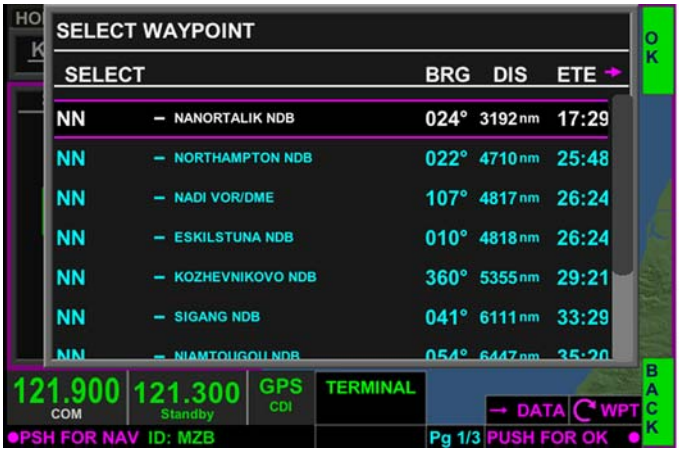


Figure 15-74
Select Waypoint Pop-Up Window

The joystick knob or touchscreen is used by the pilot to selected the intended waypoint. Pushing in the joystick knob or pushing the OK bezel softkey selects the waypoint. Pushing the BACK bezel softkey returns to the previous display without making any changes.

Temporary Waypoint

The TEMP WAYPOINT window is displayed when the **PBD** bezel softkey is pushed (in 1L) from the following pop-up windows:

- Direct-To
- OBS
- Stored Flight Plan Edit
- Change Waypoint
- Insert New Waypoint.

The TEMP WAYPOINT window, shown in Figure 15-75, allows the pilot to create only temporary waypoints and does not allow the pilot to create a waypoint for storage in the NAV database. See Creating a User Waypoint later in this section if a custom waypoint is desired to be created for storage in the NAV database.

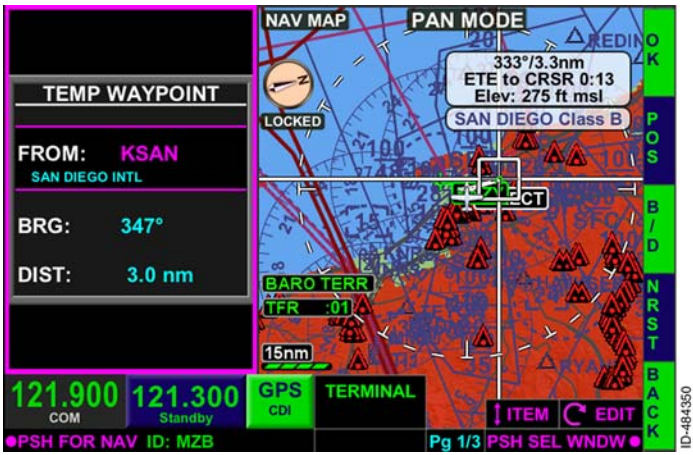


Figure 15-75
TEMP WAYPOINT

The **POS** bezel softkey label shown in 2R allows the pilot to enter latitude and longitude coordinates for the temporary waypoint. The **B/D** bezel softkey label in 3R allows the pilot to enter a bearing/distance from a NAV database waypoint. The position for latitude and longitude and bearing/distance can be entered using the joystick or touchscreen on the NAV MAP. The **NRST** bezel softkey in 4R displays the nearest pop-up window that the user can select the desired FROM waypoint to be used in a temporary bearing/distance waypoint. Pushing the **OK** bezel softkey enters the temporary waypoint into the flight plan with a preceding asterisk (*).

FLIGHT PLAN DATA

To the right of the waypoint column is a data column where FMS data can be alternated for display. Only one column of FMS data can be displayed at a time. The column can alternate display by giving focus to the FMS flight plan list and toggling the joystick knob left or right. Figure 15–76 shows ETE data selected for display.

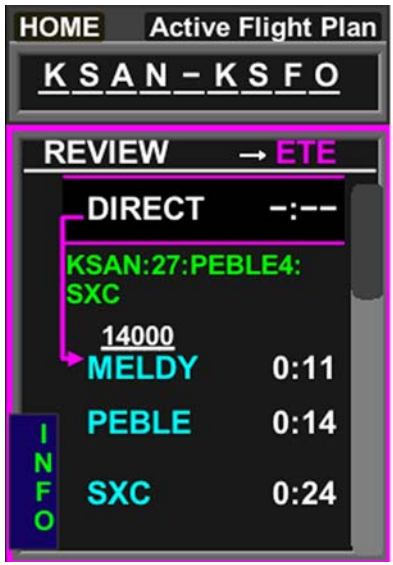


Figure 15–76
FMS Data

When the waypoint list window has focus, pushing the joystick knob left or right toggles through the FMS data display in the following order:

ETE ↔ DTK ↔ DTG

Flight plan data is not alternated for display in a continuous loop. For example, when ETE is selected for display, pushing the joystick knob to the left does not affect the display, however pushing the joystick to the right displays DTK.

NOTE: ETE is dashed while on the ground. ETE, DTK, and DTG are dashed when the flight plan contains a discontinuity from the discontinuity to the end of the flight plan.

Estimated Time En Route (ETE) – The ETE from the current aircraft position to the associated FMS waypoint is displayed in HH:MM format. Performance calculations are based on actual air data when available or a default value of 90 knots.

NOTE: ETE is displayed as dashes while on the ground.

Desired Track (DTK) – The desired track for the waypoint segment is displayed after the associated FMS waypoint.

Distance-To-Go (DTG) – The distance-to-go from the current aircraft position along the path shown to the associated FMS waypoint is displayed in nautical miles (NM).

WAYPOINT LIST SYMBOLS

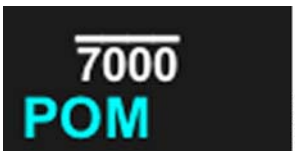
The FMS waypoint list contains symbols for procedures contained in the flight plan. The following paragraphs describe the various symbols displayed in the waypoint list.

Altitude Constraints

Altitude constraints are derived from the navigation database and typically correspond to published altitude limitations for various points in departure and approach procedures.

AT constraints are displayed with a small line above and below the altitude.

AT or ABOVE constraints are displayed with a small line below the altitude.

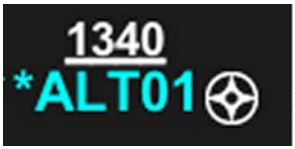


AT or BELOW constraints are displayed with a small line above the altitude.

WINDOW constraints display both the upper and lower constraint. Lower constraints are displayed to the right of the upper constraint.

Pattern Icons

Pattern icons are used to indicate when a pattern exists on a waypoint. Pattern icons include flyover waypoints, holds, arc turns, and procedure turns.



Flyover Waypoint Indication – When a waypoint is a flyover waypoint (rather than the more common fly-by waypoint) and a turn must not be commenced prior to flying over the waypoint, a white star inside of a circle is displayed after the name of the waypoint. Flyover waypoints are derived from navigation database loaded procedures and cannot be entered by the pilot.

Hold Indication – When a hold is associated with a waypoint, **HLD** is displayed after the name of the waypoint.

Arc Turn Indication – When a waypoint defines the beginning or end of an arc turn (for example, a DME arc or a radial to a fix), **ARC** is displayed after the name of the waypoints that define the beginning and end of the arc turn.

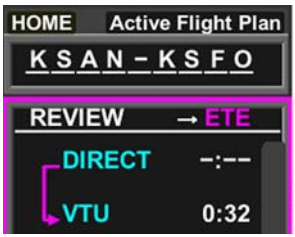
Procedure Turn Indication – When a waypoint requires a procedure turn, **PT** is displayed after the name of the waypoint.

SPECIAL WAYPOINT IDENTIFIERS

Most flight plan legs consist of segments connecting airports, VORs, intersections, or fixes easily and intuitively understood by the pilot because they are straight lines (great circles) between two points.

Some flight plan legs are more complex, particularly sequences of legs that are automatically called up from the navigation database and populated into the waypoint list when a pilot chooses a SID, a STAR, or an instrument approach. These legs are sometimes referred to as special leg types. The following paragraphs describe the display of these types of legs.

Special Leg Type Waypoints



Direct – An arrow pointing to the Direct–To fix is displayed in the waypoint list window when the pilot initiates a Direct–To. The from waypoint is indicated as **DIRECT** .

Fly Course – When a SID or STAR contains a heading after the last fix, FLY CRS is presented in the active flight plan after the last fix in the procedure. Shortly after passing the last fix, FLY CRS will change to SUSPEND. When using GPS Steering (GPSS) for autopilot guidance and after passing the last fix, the KSN guides the autopilot to approximately the procedure heading. GPS Steering disengages when SUSPEND is presented and the autopilot goes to wings–level. The active leg on the KSN changes from magenta to green, meaning that left/right deviations continue to be available for the autopilot (in NAV mode), and GPS Steering is not available. The KSN flies wings level, and awaits one of the following four inputs to proceed further.

1. Fly Direct–To a waypoint in the active flight plan.
2. Activate a leg in the active flight plan and fly to the leg.
3. Change the active flight plan.
4. Push the FMS bezel key to show the HOME window. Then push the **RESM** button on the left–side of the bezel to fly to the next leg in the active flight plan.

   NOTE: The autopilot GPSS becomes available to fly the next leg when any of these inputs are selected and a magenta active leg is shown.

Vectors to Final – The vectors to final selection provides a final approach extension from the FAWP that can be used to orient the flight crew while being vectored to the final approach. Vectors to final leg is indicated in the flight plan list as **FLY VTF** .

The **VTF** bezel softkey label is displayed on the left side of the waypoint list when the waypoint list or home window is selected and the vectors to final approach transition is available. Pushing the **VTF** bezel softkey activates the vectors to final function. Suspend is active when VTF is selected and the difference between the current aircraft track and desired aircraft track of the final approach segment is greater than 45 degrees for more than 3 seconds.

NOTE: To undo vectors to final, reinsert the approach or select a different approach.

Initial Approach, Final Approach, and Missed Approach Waypoints – **IAWP** , **FAWP** , and **MAWP** headings are displayed above the initial approach waypoint, final approach waypoint, and missed approach waypoint, respectively, when an approach procedure is loaded into the flight plan.

Temporary Waypoints – Temporary waypoints are part of a navigation database loaded procedure or can be created by the pilot. The waypoint is assigned a name that describes how it was defined and a number (XX). The name is preceded by an asterisk (*) to indicate a temporary waypoint. Temporary waypoints can occur at a geographically defined latitude/longitude position (LLXX), a place bearing distance (PBDXX), when a course is intercepted (INTXX), or can sequence when a certain altitude is reached (ALTXX).

Altitude Sequence Legs

Waypoints that sequence when a certain altitude is reached are automatically sequenced for installations that have an air data input.

For installations that do not have an air data input, the pilot must manually sequence each altitude leg. During an altitude sequence leg, altitude sequence instructions are displayed in the center of the screen along with the **RESUME** touchscreen button, as shown in Figure 15-77. Selecting the **RESUME** touchscreen button once the displayed altitude has been reached allows the pilot to sequence to the next leg of the flight plan.

NOTE: Suspend is entered during an altitude sequence leg for installations that do not have an air data input until the **RESUME** touchscreen button is selected.

Figure 15-77
Sequence Waypoint

The displayed pop-up window takes over the view and the pilot must select the **RESUME** touchscreen button or bezel softkey to sequence the altitude leg manually. Other touchscreen functions are inactive until the pilot selects the **RESUME** touchscreen button or bezel softkey.

NOTE: When the pop-up window is displayed, standby radio tuning and swapping can be controlled using the ***radio control knob*** and ***frequency swap bezel key***, and the GPS/VLOC NAV source can be changed using the touchscreen button or the **GPS** / **VLOC** bezel softkey. The MENU bezel keys are also available during pop-up annunciations.

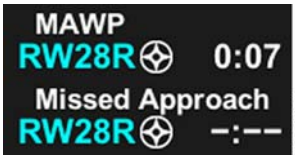
Flight Segments

The following flight segments provide a visual break in the waypoint list for the pilot and make it more obvious where the different phases of flight begin.

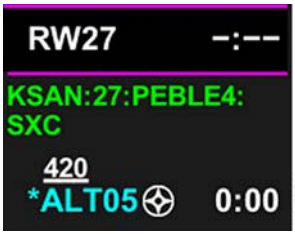
Current Segment – When autopilot GPSS is available, the current segment of the flight plan is indicated with a magenta arrow, which shows the From waypoint and the TO waypoint. Also, the TO waypoint and active leg are displayed in magenta on the map display.

When autopilot GPSS is not available, the current segment of the flight plan is indicated with a green arrow that shows the From waypoint and the To waypoint. Also, the TO waypoint and active leg are displayed in green on the map display.

If the GPS position is invalid, the current segment of the flight plan is indicated with a white arrow. All legs and waypoints on the map display are shown in white.



Missed Approach – The **Missed Approach** header in the waypoint list window is used to separate the flight plan from the missed approach procedure.



Flight Plan Procedure Banner – Loaded procedures in the flight plan are displayed in green text prior to the first waypoint of the procedure in the flight plan list.

When an LPV or LP approach is selected, the reference path identifier is displayed before the airport name.

Notifications

Notifications are used to warn of conditions that may require attention.

DISCONNECT (Discontinuity) – A discontinuity is a segment in the flight plan where no formal connection is between one waypoint and the next. A discontinuity does not necessarily indicate a problem with the flight plan.

FMS HOME WINDOW BEZEL SOFTKEY LABELS

When the FMS window has focus, three pages of bezel softkey labels can be alternated for display along on the right-side of the display. These bezel softkey labels allow the pilot to operate various FMS functions.

Not all bezel softkey labels are displayed at all times. For example, **OFST** is only displayed when an offset is permitted and **LOAD** is only displayed when an off-aircraft flight plan is loaded from the USB port.

Pushing the 1R bezel softkey toggles through the FMS bezel softkey labels in the following order:

1/3 → 2/3 → 3/3 → Repeat

The following paragraphs describe the bezel softkey labels displayed when the FMS home window has focus.

Omni Bearing Selector (OBS)

The omni bearing selector function of the FMS permits the pilot to select a waypoint and define a course based off that waypoint to fly. Pushing the **OBS** bezel softkey displays the **OBS** pop-up window, which the desired waypoint can be selected from, as shown in Figure 15-78.

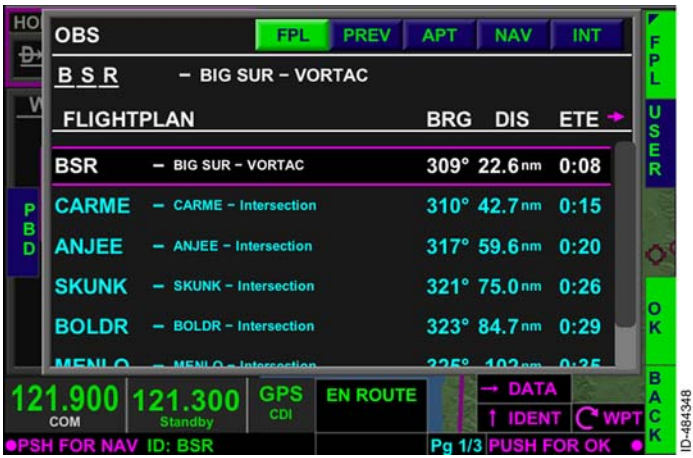


Figure 15-78
OBS Waypoint Window

Bezel softkey labels are displayed along the left- and right-side of the display, which permit the pilot to choose from various types of OBS waypoints. The pilot can push the bezel softkey in 1R to toggle through flight plan waypoints, previous flight plan waypoints, nearest airports, NAVAIDs, and intersections. The touchscreen can also be used to push the associated touchscreen buttons displayed in the header. Temporary waypoints can be selected by pushing the **PBD** bezel softkey. User waypoints can be selected by pushing the **USER** bezel softkey. Flight plan waypoints are displayed by default.

For the example flight plan, an OBS is desired in reference to the Big Sur (BSR) VOR. The joystick knob or touchscreen can be used to select BSR from the flight plan waypoint list. When selected, the **OK** bezel softkey is pushed to activate the OBS function.

When the BSR VOR is selected, the home window has focus and displays **OBS CRS:** followed by the selected course, as shown in Figure 15-79. The OBS course is modified by selecting the home window and rotating the joystick knob. The OBS course range is 1° to 360° with 1° increments. When the course is modified, the course is updated and displayed on the map.

NOTE: When an ***EFIS*** is providing the OBS course, the **OBS CRS:** is displayed in green and is modified when the EFIS course is changed.

Figure 15-79
OBS Bezel Softkey Label

When an EFIS is not providing the OBS course and the home window does not have focus, the **OBS CRS:** field is displayed in cyan.

OBS, the OBS waypoint, the selected course, and the **SUSPEND** annunciation are displayed in the text data field on the top portion of the display, as shown in Figure15-79.

NOTE: Suspend is active when OBS is active.

When OBS is active, all FMS flight plan legs, waypoints, and identifiers are removed from display. The remaining flight plan waypoints in the waypoint list are grayed out, indicating the waypoints will not automatically sequence.

The OBS flight plan leg TO the active waypoint is displayed as a magenta line originating from the active waypoint and extending 500 NM in the direction that is opposite to the desired track. For example, when the OBS course is 360°, the magenta line extends from the waypoint to 500 NM at a bearing of 180°.

The OBS flight plan leg FROM the active waypoint is displayed as a white line originating from the active waypoint and extending 500 NM in the same direction as the desired track. For example, when the OBS course is 360°, the white line extends from the waypoint to 500 NM at a bearing of 360°.

When configured, the KI 209A indicator may be used for control of the KSN 770 when in the OBS mode. Adjusting the KI 209A's OBS knob automatically changes the KSN 770's OBS flight plan leg's orientation relative to the active waypoint. Cancel the KSN 770's OBS mode to return the KI 209A to normal operation.

OBS mode is canceled by selecting the **OBS** bezel softkey and pushing the **UNDO** bezel softkey shown in Figure 15-80.

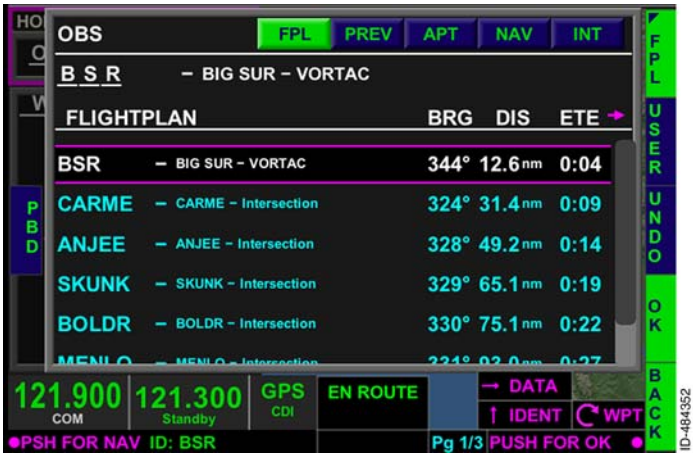


Figure 15-80
Cancel OBS

Global Positioning System/VOR Localizer (GPS/VLOC)

The GPS or VLOC bezel softkey labels are displayed on the right-side of the map display to indicate the GPS or VOR localizer is the navigation source. The power-up default is GPS . The current navigation source is displayed next to the radio tuning window at all times, which continuously displays an indication of the navigation source even when the FMS 1/3 page of bezel softkey labels are not displayed. In Figure 15-81, the current navigation source near the radio tuning window is shown as GPS CDI , which matches the navigation source selector GPS bezel softkey label.

NOTE: For installations where the EFIS controls the CDI switching when the CDI is set to GPS only during installation, the CDI touchscreen button and GPS / VLOC bezel softkeys are not displayed.

Figure 15-81
GPS Navigation Source

Pushing the GPS bezel softkey changes the navigation source output to VOR localizer (VLOC CDI) and the bezel softkey label changes to VLOC , as shown in Figure 15-82. CDI CHANGE TO VLOC is momentarily displaced in the center of the screen when the navigation source output is switched to VOR localizer.

Figure 15-82
VLOC Navigation Source

Pushing the VLOC bezel softkey again changes the bezel softkey label back to GPS . CDI CHANGE TO GPS is momentarily displaced in the center of the screen when the navigation source output is switched to GPS.

Procedures (PROC)

The **PROC** bezel softkey label is displayed when the FMS waypoint list window has focus or when the home window has focus on page **1/3** of the FMS bezel softkey labels. The **PROC** bezel softkey is used to access departure, arrival, approach, and hold procedures. Departure, arrival, and approach procedures are described earlier in this section. Holding procedures are described in the following paragraphs.

When a waypoint in the flight plan (which is not the FROM waypoint) is highlighted and the **PROC** bezel softkey label is active, the **HOLD** bezel softkey label is displayed in 2L, as shown in Figure 15-83.

Figure 15-83
PROC Bezel Softkey Label

Holding

Three types of holding patterns exist within the FMS. The high altitude (HA) holding pattern terminates at a specific altitude. The hold to a manual termination (HM) holding pattern requires a manual termination. The hold to a fix (HF) holding pattern terminates when a single circuit in the hold has been completed, such as a teardrop entry into the hold. The FMS determines the type of hold being executed and is responsible for the proper execution of the holds. The waypoint list displays a white **HLD** for all holding procedures.

NOTE: ETA for waypoints following a hold with a manual termination are calculated based on one turn in holding then continuing on flight plan.

The actual path followed during the hold entry is depicted on the map. The FMS determines the type of entry to use in order to keep the aircraft in the protected area of the hold and minimize aircraft maneuvering during the entry process.

When a teardrop or parallel entry is chosen by the FMS, the aircraft flies over the holding fix and then continues away until reaching the point at which a turn that results in a 45° intercept angle is commenced.

The length of the outbound leg varies based on groundspeed, turn radius required to achieve a 45° intercept angle on completion of the turn, and allowance made for the final turn necessary to intercept the inbound holding course.

A hold must be defined at a navigation database waypoint (including custom waypoints). A hold cannot be defined at a missed approach waypoint (MAWP) or runway waypoint (RWY). When a hold at a flight plan waypoint is desired, the waypoint window must be selected and the desired waypoint highlighted. Figure 15-84 shows the waypoint list window selected and the VTU VOR highlighted.

Figure 15-84
HOLD Bezel Softkey Label

Pushing the **HOLD** bezel softkey displays **ADD** and **BACK** bezel softkey labels, as shown in Figure 15-85.

Figure 15-85
Add a Hold

When the **ADD** bezel softkey is pushed, the **Modify Parameters** window, shown in Figure 15-86, is displayed. When a hold is not published at the selected waypoint, the inbound course defaults to the flight plan course leading to the waypoint.

Figure 15-86
Modify Hold Parameters

The **Modify Parameters** window permits the pilot to define the inbound course of the hold, either the leg time or distance, which direction turns are made, and at what speed the aircraft holds.

When a hold is published at a selected waypoint, the FMS uses information contained in the NAV database to pre-populate the hold parameters with the published hold. The NAV database can contain published hold information for a waypoint such as course, turn direction, leg length, and speed. The **Modify Parameters** window is used to verify these presumed intentions of published holding patterns are correct. The pilot may change any or all of the pre-populated data as desired using the joystick and touchscreen. When published, hold specifications are modified, the **PUB** bezel softkey label is displayed. Pushing the **PUB** bezel softkey populates fields with published values.

The waypoint highlighted in the waypoint list when the **HOLD** bezel softkey is pushed is the waypoint the **Modify Parameters** window is based on. The selected hold waypoint is displayed on the top of the **Modify Parameters** window.

Pushing the **OK** bezel softkey inserts the hold into the flight plan and closes the **Modify Parameters** window. Pushing the **BACK** bezel softkey returns to the previous display without saving any changes.

When a published hold exists, the default values are from the NAV database for the published holding procedure. The **Modify Parameters** window for non-published holds is described in the following paragraphs.

- **Course** – The inbound course to the hold waypoint is displayed and can be modified using the joystick knob.

- **Turn Dir – Left/Right** – The turn direction of the holding pattern is selected here. The default selection is right and can be modified using the joystick knob.

- **Leg Unit – Time/Dist** – The desired hold length can be altered between Time and Dist (distance). The default selection is time. When time is selected, the **Leg Time** header is displayed under the **Leg Unit** header, as shown in Figure 15-86. When distance is selected, the **Leg Dist** header is displayed under the **Leg Unit** header.

- **Leg Time** – The leg time field permits the pilot to input the leg time in minutes. The FMS default value for leg time is 1 minute below 14,000 feet MSL and 1.5 minutes at or above 14,000 feet MSL. The FMS uses the current altitude of the aircraft when determining altitude.

- **Leg Dist** – The leg distance field permits the pilot to input the leg distance in nautical miles. The FMS default value for leg distance is 3.3 NM below 14,000 feet MSL and 5.0 NM at or above 14,000 feet MSL. The FMS uses the current altitude of the aircraft when determining the altitude.

- **Speed** – The speed value field defaults to the current groundspeed when the window is first displayed. The default speed does not continuously update after the window is displayed. When the waypoint has a published speed limit, the upper speed value is not permitted to go higher than the published speed limit. When the waypoint does not have a published speed limit, rotating the joystick knob changes the values in 1–knot increments from 75 knots to 450 knots.

- **Entry** – The entry field displays the initial FMS calculated hold entry when the **Modify Parameters** window is displayed. Possible values are Direct, Parallel, or Teardrop. When turn direction or course are modified, To Be Computed is displayed.

CREATING A HOLD AT A WAYPOINT

To create a hold at a waypoint, the joystick knob or touchscreen is first used to select the waypoint that the hold is based on. For the example flight plan, a hold is desired at the Ventura VOR (VTU). VTU is highlighted in the waypoint list, as shown in Figure 15–87.

Figure 15-87
Creating a Hold

When the **PROC** bezel softkey is pushed, the **HOLD** bezel softkey label is displayed, as shown in Figure 15–88.

Figure 15–88
HOLD Bezel Softkey Label

When the **HOLD** bezel softkey is pushed, the **ADD** bezel softkey label is displayed, as shown in Figure 15–89.

Figure 15–89
ADD Bezel Softkey Label

When the **ADD** bezel softkey is pushed, the **Modify Parameters** window, shown in Figure 15-90, is displayed. In this window, the pilot can modify the hold parameters by toggling the joystick knob up or down to the desired field or using the touchscreen to select the desired field. When the desired field is selected, the joystick knob can be rotated to set the desired parameter. For the example flight plan, an inbound course of 180 degrees, right-hand turns, and 1.5-minute legs is desired.

Figure 15-90
Hold Settings Window

The hold settings are manually changed to set the inbound course to 180 degrees and 1.5-minute legs, as shown in Figure 15-91.

NOTE: All parameters can be changed prior to entering a hold, however only the leg unit, leg time or distance, or speed fields can be changed while the hold is actively being flown.

Figure 15-91
Manually Changed Hold Settings

When the hold settings are set as desired, the **OK** bezel softkey is pushed and the hold is inserted into the flight plan. The waypoint with the hold is displayed in the waypoint list with **HLD** next to it. The hold is displayed on the NAV map display, as shown in Figure 15-92.

NOTE: HLD is also displayed in the text data bar under the holding waypoint identifier. In Figure 15-92 **HLD** is displayed in magenta because VTU is the active TO waypoint and guidance to the waypoint is active.

Figure 15-92
Hold on Map Display

DELETING AND MODIFYING A HOLD

When a hold is in the active flight plan, pushing the HOLD bezel softkey displays the MOD and EXIT bezel softkey labels, as shown in Figure 15-93. Pushing the MOD bezel softkey displays the Modify Parameters window, which permits the pilot to modify the leg distance or time as necessary.

NOTE: The EXIT bezel softkey label is displayed when the estimated time to the hold is less than 1 minute or the hold is being flown. Exiting a hold is described later in this section.

Figure 15-93
Delete or Modify a Hold

NOTE: When a hold has been entered into the flight plan but is not currently being flown, the DEL bezel softkey label is displayed in 1R (not shown in Figure 15-93). Pushing the DEL bezel softkey removes the selected hold from the flight plan before the hold becomes active.

A hold can also be deleted when in flight plan edit mode. Pushing the DEL bezel softkey when the hold waypoint is highlighted deletes only the hold and not the hold and waypoint at the same time.

FLYING AND EXITING A HOLD

The hold and hold entry are displayed in white on the map display when the hold is entered into the flight plan and the hold is not actively being flown, as shown in Figure 15-94.

NOTE: When the home window has focus and the TO waypoint in the waypoint list has a hold, or a hold is currently being flown, the **HOLD** bezel softkey label is displayed in 4L, as shown in Figure 15-94, without having to push the **PROC** bezel softkey.

Figure 15-94
Hold Entry Displayed

When the hold is active, the hold entry is displayed in magenta on the map display when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails. **HOLDING** is displayed in the waypoint list window when the hold entry is actively being flown, as shown in Figure 15-95. Suspend is active during a manual hold and while not currently existing.

NOTE: ETE and distance calculations include the estimated time and distance in the hold and not the estimated time and distance directly to the holding fix. The displayed desired track is the calculated desired track to fly at any point during the hold.

Figure 15-95
Hold Entry Active

When the aircraft is established in the hold, the hold entry is removed from display and the hold is displayed in magenta on the map when guidance to the waypoint is active, as shown in Figure 15-96, green guidance to the waypoint is available but not active, and white if the GPS position fails.

Figure 15-96
Established in Hold

Pushing the **HOLD** bezel softkey while established in the hold displays the **MOD** and **EXIT** bezel softkey labels, shown in Figure 15-97.

Figure 15-97
MOD and EXIT Bezel Softkey Labels

The **EXIT** bezel softkey label is displayed when the estimated time to the holding fix is less than 1 minute or when the hold is being flown.

When the **EXIT** bezel softkey is pushed, the aircraft is less than 1 minute from the holding fix, and the hold is not being flown, the hold on the TO waypoint is deleted and the remainder of the flight plan is flown.

When the **EXIT** bezel softkey is pushed and the aircraft is active in the first turn or the outbound leg, the holding pattern is truncated by shortening the outbound leg. The shortened outbound leg is created long enough to allow for a curved path transition back to the holding fix. The inbound leg of the hold is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails. The rest of the hold is displayed in white, as shown in Figure 15-98.

Figure 15-98
Exiting A Hold

When the aircraft is on turn two of the holding pattern (turning inbound) or on the inbound leg, the holding pattern is unable to be truncated as the most direct path to the holding fix is already active. The aircraft continues on the normal holding pattern path until sequencing the holding fix. The entire holding pattern remains displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails.

The holding pattern is truncated for direct hold entries and established holding patterns. When the **EXIT** bezel softkey is pushed during a teardrop or parallel holding entry, the entry is flown completely and the hold is exited when approaching the holding fix.

When the holding fix is reached, the FMS then continues via the flight plan. **EXIT HOLD** is displayed in the waypoint list window to indicate to the pilot the hold will be exited when the hold waypoint is sequenced.

Pushing the **MOD** bezel softkey during a hold displays the **Modify Parameters** window, which allows the pilot to modify the leg distance or time. When the holding procedure is actively flown, only the hold leg distance or time can be modified. The FMS message **UNABLE HOLD CHANGE** is displayed when anything other than the leg distance or time is attempted to be changed while in the holding pattern.

The **RESM** bezel softkey label is displayed when the aircraft is in the process of exiting the holding pattern. Pushing the **RESM** bezel softkey results in the FMS resuming the holding pattern currently being exited.

The FMS message **EXITING HOLD** is displayed when the hold termination altitude has been reached and the hold is automatically exiting.

Offsets

Offsets permit the pilot to enter a parallel offset course either left or right of the flight plan path. Offsets are entered into the flight plan by selecting the **OFST** bezel softkey on the **2/3** page of the bezel softkeys on the map, shown in Figure 15-99.

Figure 15-99
Offset Bezel Softkey Label

When the **OFST** bezel softkey is selected, the **OFFSET FLIGHT PLAN** window, shown in Figure 15-100, is displayed.

Figure 15-100
Flight Plan Offset

Offset values are entered into the **OFFSET FLIGHT PLAN** window by rotating the joystick knob. Rotating the joystick knob to the left increases offset values to the left of course. Rotating the joystick knob to the right increases offset values to the right of course. Offset values have a valid range of 1 to 30 NM in 1 NM increments. When the desired offset value is displayed, pushing the **OK** bezel softkey enters the offset into the flight plan. Pushing the **BACK** bezel softkey returns to the previous display without entering the offset.

For the example flight plan, an offset is desired 5 NM to the right of course. The joystick knob is rotated to the right until **5 nm Right** is displayed, as shown in Figure 15-101. The offset is entered into the flight plan by pushing the **OK** bezel softkey.

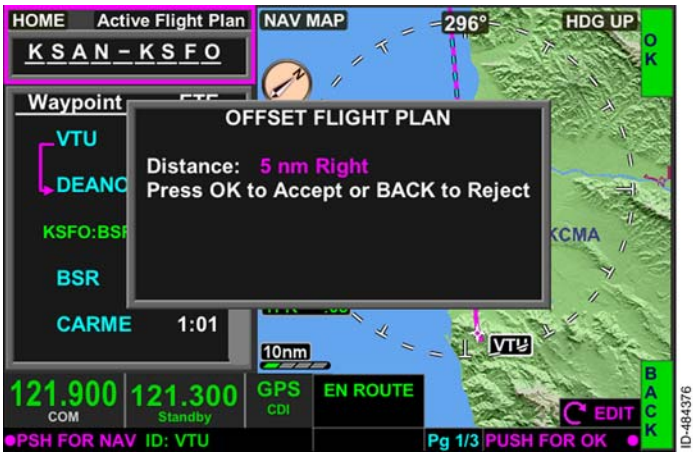


Figure 15-101
Entering Offset Into Flight Plan

When the offset is entered into the flight plan, **OFST** followed by the distance and left or right of course is displayed in the text data bar, as shown in Figure 15-102. The **OFST** annunciation and the **OFST** bezel softkey label being active indicates that an offset is active.

Figure 15-102
FP Offset

The course deviation indicator (CDI) on the FMS track bar in the HSI moves to the right or left (as appropriate) to indicate the aircraft must be flown to the left or right in order to achieve the applied offset. When the CDI becomes centered, the aircraft is offset the desired distance.

The aircraft symbol on the map is then depicted to the right or left (as appropriate) of the active flight plan leg. The offset course is not depicted on the map display.

The offset is removed by pushing the OFST bezel softkey and then the CNCL bezel softkey. The same OFFSET FLIGHT PLAN window is displayed, except when an offset is active, a CNCL bezel softkey label is displayed, as shown in Figure 15–103. The FMS message **OFFSET REMOVED** is displayed when the offset is canceled.

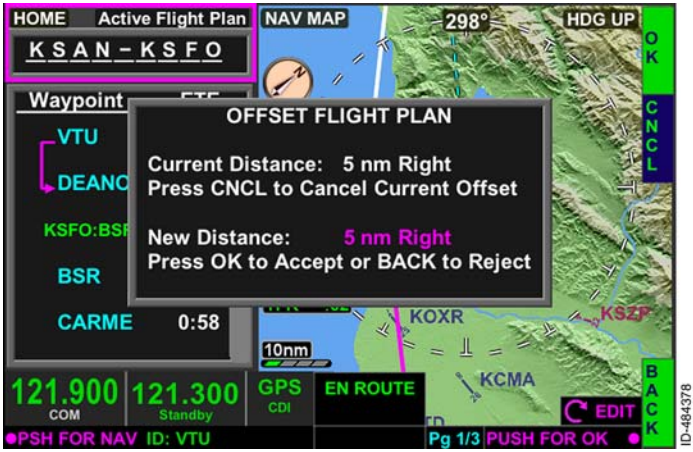


Figure 15-103
Removing an Offset

The offset distance can be modified by rotating the joystick knob when the OFFSET FLIGHT PLAN window is displayed and pushing OK to enter the modification.

Offsets are applied to the flight plan while in the en route, oceanic, or remote phase of flight, however they are not available while flying the following procedures or areas:

- SIDs, STARs, and approaches
- Patterns
- Terminal areas (30 NM from the origin or 31 NM from the destination)
- Polar regions.

NOTE: The OFST bezel softkey label on the 2/3 page is removed from display when an offset is not permitted.

Offsets automatically cancel during the following conditions:

- When the course changes greater than 90 degrees
- On commencing SIDs, STARs, and approaches
- On commencing intercepts.

Search (SRCH)

The search function of the FMS permits the pilot to enter any navigation database waypoint and display the waypoint in the navigation map window. Pushing the SRCH bezel softkey in 3R, shown in Figure 15-104, displays a QWERTY keypad from which the pilot can enter the desired navigation database waypoint.

Figure 15-104
Search Function

The QWERTY keypad is shown in Figure 15-105. For this example flight plan, the pilot wants to display Los Angeles Airport (KLAX) in the ***navigation map view*** and display additional information about the airport. The navigation database waypoint is entered using the joystick knob or touchscreen and pushing in the joystick knob or by pushing **OK** on the QWERTY keypad.

Figure 15-105
QWERTY Search

When entered, the navigation map view is automatically displayed with the selected waypoint in the center of the navigation map, as shown in Figure 15-106.

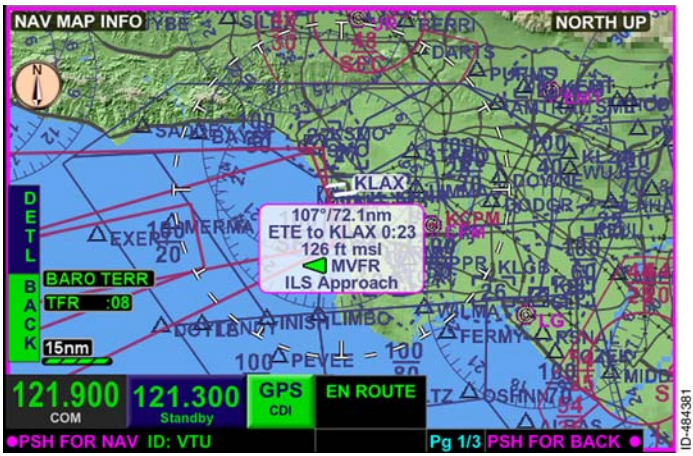


Figure 15-106
Search Navigation Map View

The navigation map view defaults to the barometric terrain overlay, north-up view, and declutter level on high. These defaults cannot be changed by the pilot when in the search navigation map view.

The entered navigation database waypoint is displayed in the center of the navigation map view. A cursor box is displayed below the selected waypoint which is the same cursor box displayed when the **INFO** bezel softkey, described in Section 6, Navigation Map View, is selected. Information such as magnetic course, distance, ETE, elevation, and type of approaches (when available) are displayed.

Pushing the **DETL** bezel softkey displays a detail information box based on the navigation database waypoint. This is the same navigation map detail window described in Section 6, Navigation Map View. Detailed information about the airport, radio communications, runway, weather, and charts are displayed by selecting any of the right-side bezel softkey labels displayed in Figure 15-107.

Figure 15-107
Search Detail

Pushing the **BACK** bezel softkey or pushing in the joystick knob returns to the FMS display window.

Off-Aircraft Created Flight Plan (Future Option)

The pilot has the option to load an off-aircraft created flight plan instead of creating a new flight plan on the aircraft. The flight plans created off-aircraft use a .fpl (flight plan) file extension. Each created flight plan is saved as an individual .fpl file and only one flight plan can be loaded on a USB flash drive at a time.

With the aircraft on the ground, the USB flash drive can be inserted into the USB slot in the front of the unit. When the USB flash drive with a flight plan is inserted, the **LOAD** bezel softkey label at 4R is displayed, shown in Figure 15-108.

Figure 15-108
LOAD Bezel Softkey Label

CAUTION

USE OF THE USB PORT IN FLIGHT IS NOT AUTHORIZED AND CAN CAUSE A RESET.

When the **LOAD** bezel softkey is pushed, **Confirm Load FP** is displayed in the home window along with the **OK** and **BACK** bezel softkey labels displayed in 1R and 5R, as shown in Figure 15-109.

Figure 15-109
Confirm Load FP

Pushing the **OK** bezel softkey loads the off-aircraft created flight plan into the flight plan waypoint list (replacing any existing flight plan) and the flight plan becomes active, as shown in Figure 15-110.

NOTE: **Loading...** is displayed in the home window while the flight plan is loading.

Figure 15-110
Flight Plan Loaded

Creating a User Waypoint

A user-defined waypoint can be created, for example, for the location of a bush airstrip not contained in the navigation database. Possible methods to create a new waypoint include:

- Defining the new waypoint by bearing and distance from an existing waypoint (P/B/D method)
- Defining the new waypoint by latitude and longitude.

User-defined waypoints are entered into the flight plan by selecting the **USER** bezel softkey on the **2/3** page on the map, shown in Figure 15-111.

Figure 15-111
USER Bezel Softkey Label

When the **USER** bezel softkey is pushed, the **USER WAYPOINTS** pop-up window, shown in Figure 15-112, is displayed.

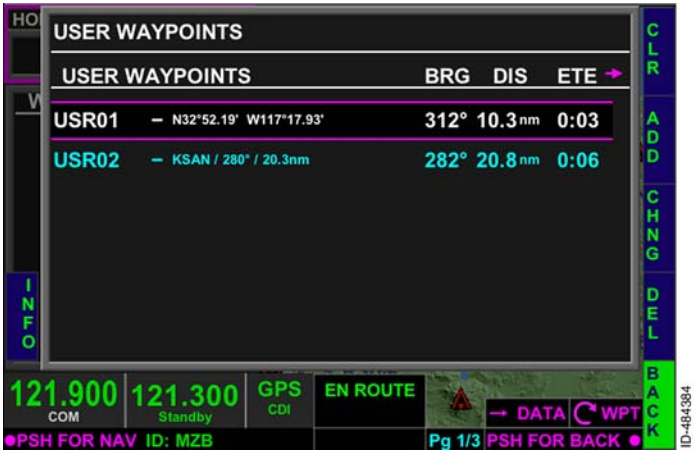


Figure 15-112
USER WAYPOINTS Window

In this window, the pilot can add, change, and delete user waypoints. The pilot can also delete all waypoints contained in the custom database.

NOTE: At least one custom waypoint must be stored for the **CLR** , **CHNG** , or **DEL** bezel softkey labels to be displayed.

A custom user waypoint is added by pushing the **ADD** bezel softkey. When the **ADD** bezel softkey is pushed, a **USER WAYPOINT** window, shown in Figure 15–113, is displayed, which permits the pilot to define the custom waypoint. The pilot can define a custom waypoint by using latitude/longitude or bearing/distance. The default display is latitude/longitude with the current aircraft position.

Figure 15-113
USER WAYPOINT

Any combination of 5 letters and numbers can be used to define a custom waypoint name. The joystick knob can be rotated to change the letters and numbers in the **IDENT** field or the QWERTY keypad can be displayed by touching the **IDENT** field on the touchscreen.

NOTE: When the identifier used to name the new waypoint already exists in the navigation database, the new waypoint is inserted as a custom waypoint, replacing the previously defined waypoint.

Pushing in on the joystick knob toggles to the NAV MAP display. When the NAV MAP has focus, the joystick knob can be used to pan or the touchscreen can be used to select a user waypoint.

For the example flight plan, a custom waypoint is to be defined at 32 degrees, 32 minutes North and 123 degrees, 20 minutes South. MYWPT is the desired custom waypoint name.

The joystick knob or touchscreen can be used to enter the desired waypoint name in the IDENT field. After the custom waypoint name is defined, the cursor can be moved to the latitude field by pushing down on the joystick knob or using the touchscreen. The joystick knob can then be rotated and pushed left or right until the desired latitude is defined or the touchscreen can be used to select the desired location on the map display. Figure 15-114 shows the data entered for the example flight plan.

NOTE: The waypoint name is displayed on the map display.

Figure 15-114
Custom User Waypoint

The **PPOS** bezel softkey can be used to enter the present aircraft position in the LAT and LON fields to be used as a user waypoint.

When the desired waypoint name and latitude/longitude are entered in the **USER WAYPOINT** field, as shown in Figure 15-114, the waypoint is entered into the custom waypoint list by pushing the **OK** bezel softkey. Pushing the **BACK** bezel softkey returns to the previous page without saving any waypoint data.

When entered, the **USER WAYPOINTS** pop-up window is displayed with the newly defined waypoint displayed, as shown in Figure 15-115. Since the new waypoint was defined using latitude/longitude, the coordinates are displayed next to the waypoint name.

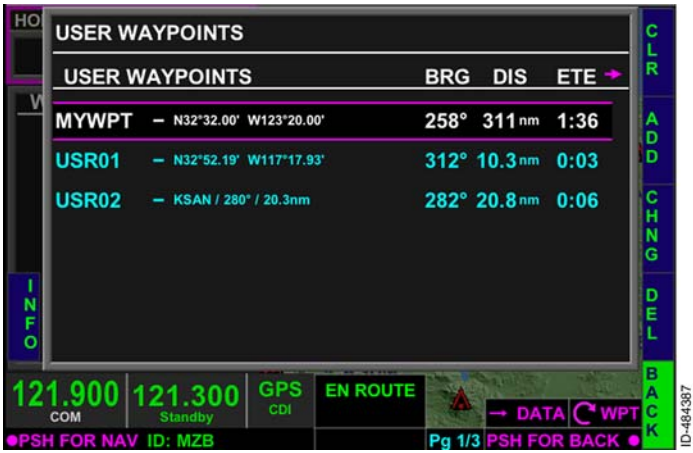


Figure 15-115
New User Waypoint

The new waypoint can now be used as any other waypoint contained in the navigation database.

A custom waypoint can also be created using bearing/distance from a database waypoint. When the **USER WAYPOINTS** window is displayed, select the **B/D** bezel softkey, shown in 3R in Figure 15–116.

Figure 15–116
Bearing/Distance

When the **B/D** bezel softkey label is active, the **USER WAYPOINT** window data fields change from **LAT** and **LON** to **FROM** , **BRG** , and **DIST** , as shown in Figure 15–117.

Figure 15–117
FROM/BRG/DIST

By default, the **FROM** field displays the nearest airport from the present position.

For the example flight plan, a custom waypoint is to be defined from the Mission Bay VOR (MZB) at a bearing of 270 degrees and a distance of 20.0 NM. The name used to define this custom waypoint is USR04. The joystick knob is rotated or the touchscreen can be used to change the letters and numbers in the IDENT field. The joystick knob is pushed left, right, up, and down to move the location of the cursor, or the touchscreen can be used. The joystick knob is rotated to change the data fields as desired, or the touchscreen can be used to select the desired location. The example custom waypoint is entered, as shown in Figure 15-118.

Figure 15-118
Bearing/Distance Waypoint

The waypoint is entered into the custom waypoint list by pushing the **OK** bezel softkey. The waypoint is displayed in the **USER WAYPOINTS** pop-up window. Since the waypoint was defined using waypoint/course/distance, the defining values are displayed next to the custom waypoint name, as shown in Figure 15-119.

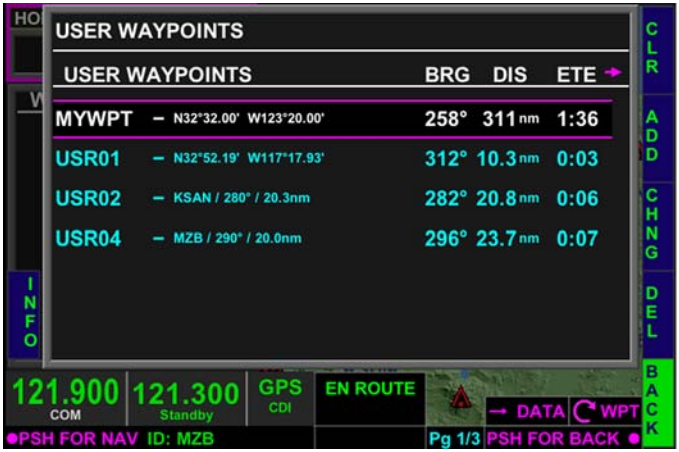


Figure 15-119
Custom Bearing/Distance Entered

A custom user waypoint is changed by using the joystick knob or touchscreen to highlight the desired waypoint and then pushing the **CHNG** bezel softkey in 3R.

A single custom user waypoint is deleted by using the joystick knob or touchscreen to highlight the desired waypoint and then pushing the **DEL** bezel softkey. When **DEL** is pushed, the **CONFIRM DELETE** prompt is displayed, as shown in Figure 15-120. Pushing the **OK** bezel softkey deletes the user waypoint. Pushing the **BACK** bezel softkey returns to the previous display.

Figure 15-120
Delete a User Waypoint

The entire custom waypoint database can be deleted by pushing the **CLR** bezel softkey. When the **CLR** bezel softkey is pushed, a caution window is displayed, which instructs the pilot to push and hold the **OK** bezel softkey for 3 seconds to clear the custom waypoint database, as shown in Figure 15–121.

Figure 15-121
Deleting Custom Waypoint Database

When the **OK** bezel softkey is pushed for 3 seconds, all waypoints in the **USER WAYPOINTS** list are removed.

Storing Flight Plans

An entered flight plan can be stored for future use. To store a flight plan, navigate to the 3/3 page of bezel softkey labels on map. The STOR bezel softkey label is displayed at 2R, as shown in Figure 15-122, as long as at least two waypoints are contained in the flight plan.

Figure 15-122
Store a Flight Plan

When the **STOR** bezel softkey is selected, additional bezel softkey labels are displayed along the ride-side of the display, shown in Figure 15-123, which permit the pilot to modify the flight plan name and store the flight plan when desired.

Figure 15-123
Store Flight Plan Bezel Softkey Labels

The flight plan name defaults to the departure-destination airport format (KSAN-KSFO for example). The flight plan name can be changed to any combination of 6 to 10 letters and numbers. The joystick knob or touchscreen can be used to modify the flight plan name as desired. The flight plan name field can be touched to display the QWERTY keypad to permit quicker flight plan name entry.

Pushing the **CLR** bezel softkey clears the entire flight plan name. Pushing the **BKSP** bezel softkey backspaces the cursor one location and deletes the prior identifier. Pushing the **DEL** bezel softkey (not shown in Figure 15-123) deletes the identifiers at the current cursor position. Pushing the **BACK** bezel softkey returns to the previous display without saving any changes.

NOTE: SIDs, STARs, approaches, and temporary waypoints are not saved in a stored flight plan. Published airports, NAVAIDs, intersections, custom user waypoints, waypoints that are not part of a published procedure with non-published holds, waypoints that are not part of a published procedure with published holds with one altitude constraint, are saved in a stored flight plan.

Pushing the **OK** bezel softkey stores the flight plan with the displayed name. When the same flight plan name already exists, an overwrite window is displayed, as shown in Figure 15-124, which the pilot can select **OK** to overwrite the previously stored flight plan or push **BACK** and choose another name to store the flight plan.

Figure 15-124
Overwrite Flight Plan

RECALLING STORED FLIGHT PLANS

To display stored flight plans, navigate to the 3/3 page of bezel softkey labels on the map display and select the LIST bezel softkey displayed in 5R, shown in Figure 15–125.

NOTE: The LIST bezel softkey label is removed from display when the stored flight plan list is cleared.

Figure 15-125
Stored Flight Plans

When the **LIST** bezel softkey is selected, **SEL** , **INV** , **CLR** , **DEL** , and **BACK** bezel softkey labels are displayed and **Stored FP List** is displayed in the FMS home window, as shown in Figure 15–126.

Figure 15-126
Select a Stored Flight Plan

To activate a stored flight plan, use the joystick knob or touchscreen to highlight the desired flight plan name in the stored flight plan list and push the **SEL** bezel softkey. When the **SEL** bezel softkey is pushed, the right-side bezel softkey labels change, as shown in Figure 15–127.

Figure 15-127
Activate a Stored Flight Plan

The following paragraphs describe the bezel softkey labels displayed on this page:

- The **ACTV** bezel softkey activates the stored flight plan displayed in the waypoint list window.
- The **CHNG** bezel softkey is displayed when any waypoint other than the origin is selected and permits the pilot to change any of the en route or destination waypoints before activating the flight plan.
- The **DEL** bezel softkey is displayed when any waypoint other than the origin is selected and permits the pilot to delete any of the displayed waypoints before activating the flight plan.
- The **INS** bezel softkey (not shown in Figure 15-127) is displayed when the cursor is not on a displayed waypoint.
- The **CLR** bezel softkey permits the pilot to clear the entire stored flight plan waypoint list.
- The **PROC** bezel softkey permits the pilot to add a desired procedure before activating the flight plan.
- The **STOR** bezel softkey moves the cursor to the flight plan name field, which permits the pilot to modify the flight plan name and store the flight plan when desired.

When the **ACTV** bezel softkey is selected, the FMS mode changes from **New Flight Plan Edit** to **Active Flight Plan** , as shown in Figure 15-128. The stored flight plan is now active in the flight plan list.

Figure 15-128
Stored Flight Plan Activated

INVERT A STORED FLIGHT PLAN

Using the invert feature, the pilot can select a previously stored route and navigate the flight plan waypoints in the opposite direction in which they are stored. A stored flight plan can be inverted by navigating to the 3/3 of bezel softkey labels on the map display and selecting the LIST bezel softkey in 5R, shown in Figure 15-129.

NOTE: Inverting a stored flight plan that contains a large number of waypoints may take a few minutes for the KSN to resolve.

Figure 15-129
LIST Bezel Softkey Label

The desired flight plan is highlighted using the joystick knob or touchscreen. For the example flight plan, a return trip from KSFO to KSAN is desired and the previously stored flight plan from KSAN–KSFO is highlighted, as shown in Figure 15–130.

Figure 15–130
Invert Flight Plan

After the desired flight plan is highlighted, the INV bezel softkey is selected. When selected, the INV bezel softkey label changes to INV , as shown in Figure 15–131.

Figure 15–131
INV Bezel Softkey Label

The flight plan is selected by pushing the SEL bezel softkey. When selected, the waypoint list displays the stored flight plan waypoints (including departure and arrival airports) in reverse order, as shown in Figure 15-132.

NOTE: SIDs, STARs, and approaches are not saved in the stored flight plan.

Figure 15-132
Activate Prompt

The following paragraphs describe the bezel softkey labels displayed on this page:

- The ACTV bezel softkey activates the stored flight plan displayed in the waypoint list window.
- The CHNG bezel softkey label is displayed when any waypoint other than the origin is selected and permits the pilot to change any of the en route or destination waypoints before activating the flight plan.
- The DEL bezel softkey label is displayed when any waypoint other than the origin is selected and permits the pilot to delete any of the displayed waypoints before activating the flight plan.
- The INS bezel softkey label (not shown in Figure 15-132) is displayed when the cursor is not on a displayed waypoint.
- The CLR bezel softkey permits the pilot to clear the entire stored flight plan waypoint list.

- The **PROC** bezel softkey permits the pilot to add a desired procedure before activating the flight plan.

- The **STOR** bezel softkey moves the cursor to the flight plan name field, which permits the pilot to modify the flight plan name and store the flight plan when desired.

When the **ACTV** bezel softkey is selected, the FMS mode changes from **New Flight Plan Edit** to **Flight Plan Active** , as shown in Figure 15-133.

NOTE: The flight plan name field updates to display the new departure and arrival airports.

Figure 15-133
Invert Flight Plan Active

CLEARING STORED FLIGHT PLAN DATABASE

The entire stored flight plan database can be cleared by pushing the CLR bezel softkey, shown in Figure 15-134.

Figure 15-134
CLR Bezel Softkey Label

When the CLR bezel softkey is pushed, a caution window is displayed, which instructs the pilot to push and hold the OK bezel softkey for 3 seconds to clear the stored flight plan database, as shown in Figure 15-135.

Figure 15-135
Deleting Stored Flight Plan Database

When the OK bezel softkey in 1R is pushed for 3 seconds, all stored flight plans are cleared.

DELETING STORED FLIGHT PLANS

To delete a stored flight plan, navigate to the 3/3 page of bezel softkey labels on the map display and select the LIST bezel softkey. Use the joystick knob or touchscreen to select the desired flight plan. For the example flight plan, CACOAST is selected to be deleted and is highlighted, as shown in Figure 15-136.

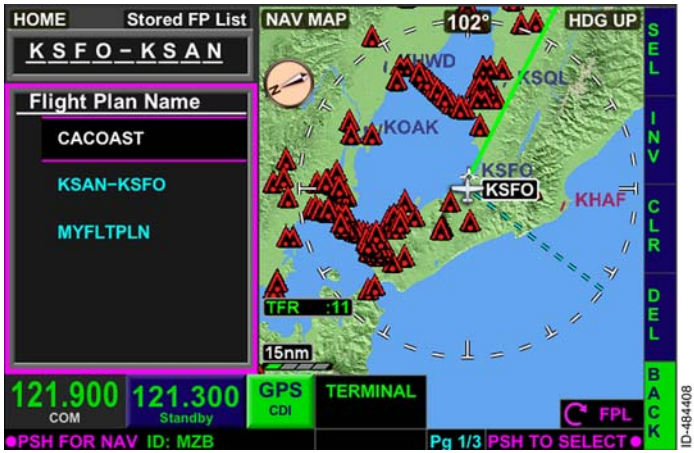


Figure 15-136
Delete a Stored Flight Plan

Selecting the **DEL** bezel softkey displays **CONFIRM DEL** over the selected flight plan and **OK** and **BACK** bezel softkey labels on the right side of the display, as shown in Figure 15-137. Selecting the **OK** bezel softkey deletes the flight plan from the stored flight plan list. Selecting the **BACK** bezel softkey returns to the previous display without making any changes.

Figure 15-137
Confirm Deletion

Copying Flight Plans

The copy flight plan function is used to copy the active flight plan and make changes to it before storing or activating it. The copy flight plan function is accessed by pushing the COPY bezel softkey in 3R, shown in Figure 15-138.

NOTE: The COPY bezel softkey label is removed from display when the active flight plan is cleared.

Figure 15-138
Copy Flight Plan

When the **COPY** bezel softkey is pushed, the active flight plan is copied to a new flight plan and the FMS mode changes to **New Flight Plan Edit** , as shown in Figure 15-139.

Figure 15-139
New Flight Plan Edit

The following paragraphs describe the bezel softkey labels displayed on this page:

- The **PBD** bezel softkey displays the **TEMP WAYPOINT** window, which permits the pilot to define a custom waypoint used to create a new waypoint in the flight plan.

- The **STOR** bezel softkey moves the cursor to the flight plan name field, which permits the pilot to modify the flight plan name and store the flight plan when desired.

- The **ACTV** bezel softkey activates the stored flight plan displayed in the waypoint list window.

- The **INS** bezel softkey label is displayed when the cursor is not on a displayed waypoint.

- The **DEL** bezel softkey label (not shown in Figure 15-139) is displayed when any waypoint other than the origin is selected and permits the pilot to delete any of the displayed waypoints before activating the flight plan.

- The **PROC** bezel softkey permits the pilot to add a desired procedure before activating the flight plan.

FMS FLIGHT PLAN MAP DATA

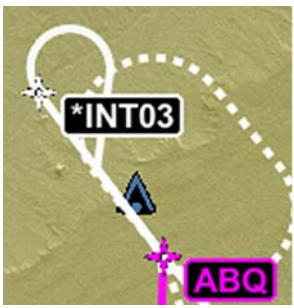
Lines and curves are displayed on the map to connect successive waypoints, transition onto a waypoint, display holding patterns and holding pattern entries, and display procedure turns on the map.

Flight Plan Segments – The flight plan segments are solid white lines ( ). The currently active segment (segment to the TO waypoint) is a magenta line ( ) when LNAV is captured and a green line ( ) when LNAV is not captured.

Holding Patterns – Holding patterns are represented by a symmetrical oval racetrack symbol. Holding pattern entries are displayed when the FMS recommends a teardrop or parallel hold entry.

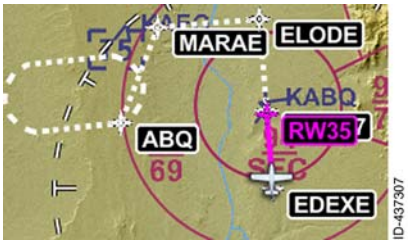
The hold entry and pattern is displayed in white when the hold is not active. When the hold entry is active, the holding pattern is displayed in white and the hold entry is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails. After the aircraft completes the hold entry by flying over the holding fix, the holding pattern entry is removed and only the holding pattern is displayed. The holding pattern is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails.

NOTE: Holding pattern entries are approximate.



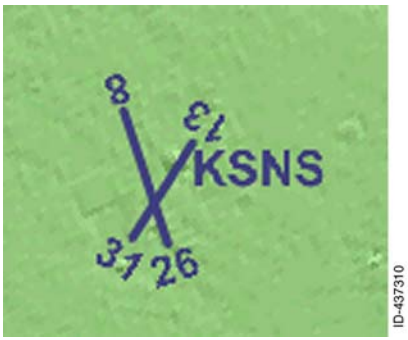
Procedure Turns – Procedure turns are represented by a canted teardrop symbol on the navigation map display. Procedure turns are displayed in white when the procedure turn is not the active leg. When the procedure turn is the active leg, the procedure turn is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails. After the aircraft completes the procedure turn by intercepting the inbound leg, the procedure turn is removed from display and the inbound leg is displayed in magenta when guidance to the waypoint is active, green when guidance to the waypoint is available but not active, and white if the GPS position fails.

Arc Turns – Arc turns are represented by a curved line between the two waypoints that define the beginning and the end of the arc turn.



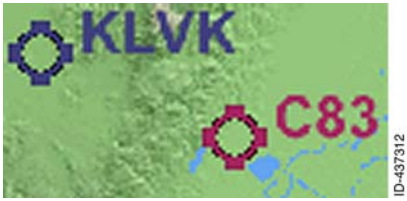
Missed Approach Procedures – The missed approach procedure is displayed as white dashes until the missed approach is activated. When activated, the missed approach procedure is displayed as normal flight plan legs.

Waypoint Symbol – A white waypoint symbol is displayed with the waypoint identifier located in the lower–right quadrant when the waypoint is not the active To waypoint. When the waypoint is the active To waypoint, the waypoint symbol and identifier are displayed in magenta when LNAV is captured and green when LNAV is not captured. The To waypoint is displayed in white if the GPS position is invalid.

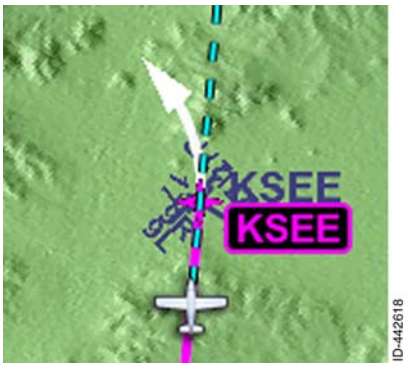


Airport Symbol – Display of airport symbols vary depending on the size of the airport and the range selected. Larger airports display runway layout and identifiers when the range is 10 NM or less.

Larger airports are displayed as a cyan runway when the range is between 15 and 30 NM.



Larger airports are displayed as a cyan hollow circle with tick marks. Smaller airports are displayed as a magenta hollow circle with tick marks.



Guidance Arrow – When the active flight plan has two consecutive legs and the desired track of the second leg has a large change, a white arrow is displayed from the first leg to provide pilot-awareness to the direction the FMS is providing guidance.

FMS PHASE OF FLIGHT

The FMS phase of flight field is displayed at a fixed location on the bottom of the map display. Figure 15-140 shows the current phase of flight as **EN ROUTE** . The phase of flight annunciations are displayed in green.

NOTE: The phase of flight annunciations are removed from display when in loss of navigation, loss of integrity, or dead reckoning mode and replaced with a failure/status annunciation.

Figure 15-140
FMS Phase of Flight

Table 15-3 lists the maximum scale values for the CDI based on the phase of flight as determined by the FMS.

Table 15-3
Lateral Deviation Display Scaling

Phase of Flight	Definition	Lateral Scaling
Approach	2 NM from FAWP	0.3 NM/2 dots
Terminal	< 30 NM from Departure Airport or < 31 NM from Destination Airport (unless using a SID/STAR)	1.0 NM/2 dots

Table 15-3 (cont)
Lateral Deviation Display Scaling

Phase of Flight	Definition	Lateral Scaling
En Route	≥ 30 NM from Departure Airport or ≥ 31 NM from Destination Airport	2.0 NM/2 dots
Remote/ Oceanic	> 200 NM from nearest NAVAID	4.0 NM/2 dots

NOTE: IFR operation in oceanic mode is not authorized.

FMS MESSAGES

FMS message are displayed in the text data bar. Any message already shown is placed in a stack. The number of messages in the stack is indicated to the right of the FMS message field, shown as **MSG 1 of 2** in Figure 15-141. Pushing in the joystick knob clears a message and shows the next message or entry from the stack. Rotating the joystick knob cycles through the messages displayed one at a time.

Figure 15-141
FMS Message Field

PUSH CLR MSG ● is displayed in the lower-right corner of the display when an FMS message is displayed in the same text and background color of the currently displayed message.

NOTE: The joystick is not available for other functions until the messages are cleared.

Messages are displayed as black text in a white background box. Flashing messages are displayed as an alternating black and white reverse video (**FMS MESSAGE** / **FMS MESSAGE**) until acknowledged with the joystick knob. Messages are removed from the stack when the condition triggering the message is either manually or automatically resolved.

Table 15-4 lists each FMS message with a description.

Table 15-4
FMS Messages

Message	Type	Description
AIRWAY ADDED	Alerting	Indicates a successful addition of an airway.
<appr1> UNAVAIL - USE <appr2> MINIMA	Alerting	Indicates during an LPV or LP approach, within 5 NM of the FAWP, a valid SBAS approach window is predicated to not exist for the time to alarm (6 seconds). Also displayed when not in degrade mode (dead reckoning), GPS has been acquired, and an attempt is made to activate an LPV/LP approach and there is either a provider ID mismatch, a channel number mismatch, or the FAS datablock cannot be successfully loaded to the GPS receiver. <appr1> is either LP or LPV and <appr2> is next available approach (i.e., LNAV or LNAV/VNAV).

Table 15-4 (cont)
FMS Messages

Message	Type	Description
BRG/CRS MUST BE IN TRUE	Alerting	Indicates the bearing entry must be followed by a T (for True) because the referenced waypoint is outside the coverage of the magnetic variation table.
DB INVALID - USER WPT/FPL DB ERASED	Alerting	Displayed when the integrity check for the custom waypoint file or the custom flight plan file fails.
DUPLICATE DB WPT - RENAME	Alerting	Indicates the entered USER waypoint identifier is a duplicate identifier within the NAV database.
ENTERING POLAR REGION	Alerting	Displayed when the aircraft goes above North 89° or below South 89°.
EXITING HOLD	Alerting	Displayed when all of the following conditions are met: • The altitude hold (HA) leg is the next leg (the leg after the TO) • The aircraft exceeds the termination altitude of the HA leg • The ETE to the hold fix is less than 1 minute. The message is removed when the HA leg is sequenced.
EXITING POLAR REGION	Alerting	Displayed when the aircraft goes below North 88° or above South 88°.

Table 15-4 (cont)
FMS Messages

Message	Type	Description
FLIGHT PLAN CLEARED	Alerting	Indicates the active flight plan was created using a different NAV database than the current selected NAV database, the active flight plan is cleared, or when a flight complete event occurs.
HDG CHANGED TO MAG NORTH	Alerting	Displayed when the system automatically switches to magnetic heading reference (going out of a key-hole region).
HDG CHANGED TO TRUE NORTH	Alerting	Displayed when the system automatically switches from magnetic heading reference to true heading reference (entering a key-hole region).
INVALID ENTRY	Alerting	Indicates the entry is not in the correct format and/or range.
INVALID FPL OPERATION	Alerting	Indicates the operation/request is not valid.
NO PRESENT POSITION	Alerting	Indicates an action was requested that required the present position.
NOT IN DATA BASE	Alerting	Indicates the airway or channel ID entered for retrieval from the NAV database was not found.
OFFSET REMOVED	Alerting	Indicates the offset has been canceled.
TIMER EXPIRED	Alerting	Indicates the timer alert set in the flight timers utility page has expired.

Table 15-4 (cont)
FMS Messages

Message	Type	Description
UNABLE ADD WPT(S) - FPL FULL	Alerting	Displayed when the pilot attempts to enter more than 101 waypoints in a single flight plan.
UNABLE <appr>	Alerting	Indicates the FAS datablock for the approach fails CRC or unable to load. <appr1> is the approach selected (i.e., LP or LPV).
UNABLE APPROACH MODIFICATION	Alerting	Indicates an attempt is made to create an OBS to the FAWP or MAWP waypoints.
UNABLE DEL - USED BY ACTIVE FPL	Alerting	Indicates the pilot attempted to delete from storage a waypoint that is used in the active flight plan.
UNABLE HOLD CHANGE	Alerting	Indicates an attempt to change the course, turn direction, or the holding quadrant of the hold while actively flying the hold. Also displayed when the hold leg is defined by time and an attempt to change to distance is made, or vice versa.
UNABLE FPL LOAD - INVALID WPT(s)	Alerting	Indicates a stored flight plan insertion request is received and a waypoint in the stored flight plan does not exist in the NAV database or custom database.
UNABLE OFFSET	Alerting	Indicates an attempt to insert an offset during holding, a pattern, or a terminal area procedure.

Table 15-4 (cont)
FMS Messages

Message	Type	Description
UNABLE STORE - FPL STORAGE FULL	Alerting	Indicates attempt to store active flight plan will exceed maximum of 99 stored flight plans in the custom database or more than 500 user defined waypoints.
UNABLE STORE - WPT STORAGE FULL	Alerting	Indicates the storage area for pilot-defined waypoints is full.
WPT	Alerting	Indicates a discontinuity or last waypoint in the flight plan.
WPT CRS XXX°	Alerting	Indicates the start of a turn. XXX indicates the next course or turn in degrees magnetic or true.
WPT HOLD next	Alerting/ Flashing	Indicates an impending hold. Note there is no message at the start of the hold.
WPT next CRS XXX°	Alerting/ Flashing	Indicates an impending turn or when the final waypoint in the flight plan is the active waypoint and the unit has automatically switched to a FROM operation at the active waypoint. Also for direct to fix, arc to fix, and radius to fix leg types. XXX indicates the next course or turn in degrees magnetic or true.
WPT PROC TURN	Alerting	Indicates the start of a procedure turn.
WPT PROC TURN next	Alerting/ Flashing	Indicates an impending procedure turn.

WAYPOINT DETAIL PAGE (2/3)

The waypoint detail page 2/3, shown in Figure 15-142, is displayed by pushing the ***PAGE bezel key*** when FMS page 1/3 is displayed. The waypoint detail page provides an expanded view of the waypoint list window. The waypoint detail page functions the same way as the waypoint window on page 1/3. The benefit of the waypoint detail page is all three columns of flight plan data are displayed at a time instead of only one.

Figure 15-142
Waypoint Detail Page 2/3

An additional column is provided next to the waypoint names, which identifies each type of fix or latitude/longitude coordinates.

Focus can be given to either the waypoint list window, shown in Figure 15–142, or the home window, shown in Figure 15–143, by pushing in the joystick knob or using the touchscreen. Both windows display the same bezel softkey labels previously described when FMS page 1/3 is displayed.

Figure 15-143
Waypoint Detail Page – Home

UTILITY PAGE

The UTILITY page, shown in Figure 15-144, is displayed by pushing the PAGE bezel key when FMS page 2/3 is displayed. The UTILITY page has seven touchscreen softkeys which permit access to various pages that provide FMS functions such as calculations and predictions for informational purposes during the flight.

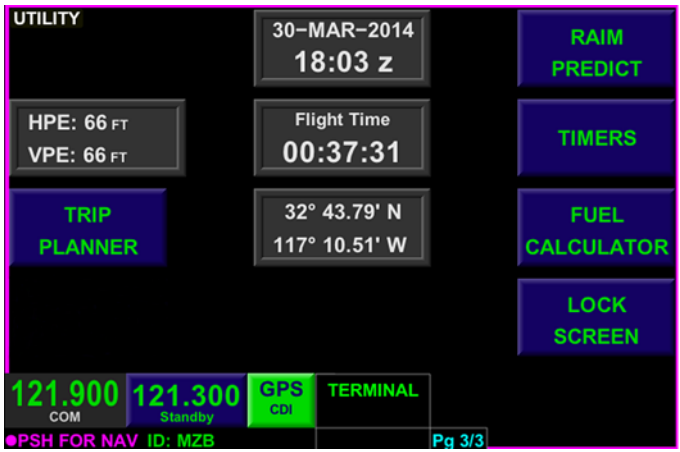


Figure 15-144
UTILITY Page

Embossed touchscreen softkeys displayed in cyan are selectable to either access another sub-page or to input data required for calculations. Gray boxes are not selectable and are used for display purposes only.

The GPS 95% confidence horizontal and vertical accuracy is displayed in feet next to the HPE and VPE labels. When the GPS 95% confidence horizontal or vertical accuracy is greater than 7,500 meters, the displayed values are replaced with dashes (----).

The GPS date and time in UTC at the top-middle of the page. The flight time is displayed and is the same flight time displayed on the flight timers page. When the GPS position is valid or FMS dead reckoning mode is active, the aircraft present position is displayed in latitude/longitude format in the center of the screen. When the GPS position is invalid and FMS dead reckoning mode is active, the latitude/longitude values are removed from display and replaced with dashes (--°--.--′).

Trip Planner

The Trip Planner page, shown in Figure 15-145, is displayed by pushing the TRIP PLANNER touchscreen softkey. The Trip Planner page is used to display sunrise/sunset times, distance, direct track, ETE, and ETA at the destination.

Figure 15-145
Trip Planner Page

The following paragraphs describe the Trip Planner page fields.

Distance - The distance between the flight legs or waypoints entered in the origin and destination field, is displayed in this field.

Origin Wpt/Flight Plan/Latitude and Longitude - The touchscreen softkey displayed in this field changes depending on what is selected in the MODE field. When the Origin Wpt touchscreen softkey is displayed, the origin waypoint can be manually entered by the pilot. When the Flight Plan touchscreen softkey is displayed, the pilot can select from a list of stored flight plans to use for origin and destination calculations. When the present position latitude and longitude is displayed in cyan, the present position is used as the origin waypoint. When the last valid GPS position is displayed in gray, last valid GPS position is used as the origin waypoint.

Mode - Possible modes are WPT , FLT PLAN , and PPOS (or LAST POS). When the mode is WPT , the Origin Wpt touchscreen softkey is displayed in 1L which permits the pilot to define the origin and destination waypoint.

When the mode is FLT PLAN , the Flight Plan touchscreen softkey is displayed in 1L which permits the pilot to choose from stored flight plans to use for origin and destination calculations. In addition, Flight Leg is displayed in the center of the page and to the right of the Flight Plan touchscreen softkey, as shown in Figure 15-145. The flight leg function permits the pilot view trip planner on a leg-by-leg basis. The flight legs are changed by using the interactive touchscreen to push the PREV or NEXT touchscreen softkey or by rotating the joystick knob as indicated by FLT LEG displayed in the lower-right corner.

Present position is selectable when the current GPS position is valid. When the mode is PPOS , the present position latitude and longitude are displayed in cyan in 1L, which uses the present aircraft position as the origin waypoint. When the current GPS position is not valid, last know GPS position is selectable. When the mode is LAST POS , the last valid GPS position is displayed in 1L and used for calculations.

Sunrise/Sunset - The sunrise and sunset times at the destination are displayed in this field.

DTK - The desired track from the origin waypoint to the destination is displayed in this field when the mode key in 2L is WPT . The desired track from the present position (or last GPS position) to the destination is displayed in this field when the mode key in 2L is PPOS (or LAST POS). The desired track from the selected flight plan leg is displayed in this field when the mode key in 2L is FLT PLAN and a valid flight plan exists.

ETE - The estimated time en route to the destination in HH:MM:SS (hours:minutes:seconds) format is displayed in this field.

ETA - The estimated time of arrival at the destination is displayed in Zulu in this field.

Date - The date is entered by selecting the Date touchscreen softkey.

Ground Speed - The planned groundspeed is entered in knots by selecting the Ground Speed touchscreen softkey.

Destination - The Destination touchscreen softkey is displayed when the mode in 4L is either WPT or PPOS. The pilot can manually define the destination waypoint in this mode. The STORED/ACTIVE touchscreen softkey is displayed when the mode in 2L is FLT PLAN. The pushing the STORED/ACTIVE touchscreen softkey toggles the destination from the stored flight plan or the active flight plan destination.

Departure – The departure time is entered in Zulu by selecting the Departure touchscreen softkey.

Back – Pushing the BACK bezel softkey displays the UTILITY page.

RAIM Prediction

The RAIM prediction page, shown in Figure 15–146, is displayed by pushing the RAIM Predict touchscreen softkey. The RAIM prediction page is used to predict RAIM availability at the entered waypoint and time.

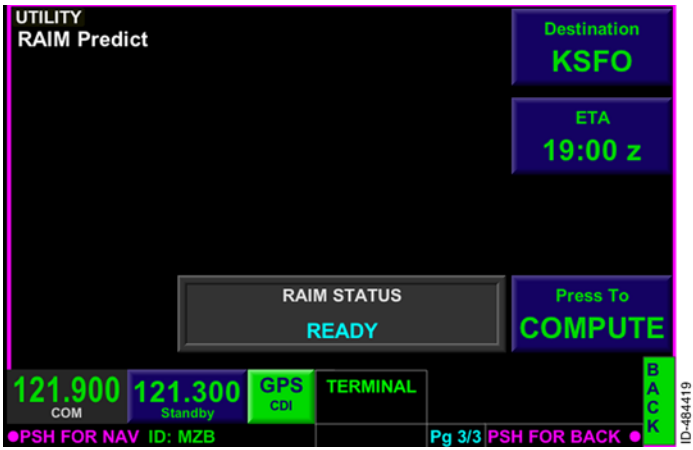


Figure 15-146
RAIM Predict

The following paragraphs describe the RAIM prediction page fields.

Destination – The Destination field defaults to green dashes (------). The pilot can enter any International Civil Aviation Organization (ICAO) airport or FMS waypoint to compute a predictive RAIM solution. When the Destination touchscreen softkey is pushed, a QWERTY keypad is displayed that permits the pilot to enter the desired waypoint to compute RAIM availability.

ETA – The ETA field defaults to 00:00 z . The pilot can enter any time (within 24 hours of the current time) to compute a predictive RAIM solution. The time is entered in Zulu time, as indicated by the z after the time.

When the ETA touchscreen softkey is pushed, a window is displayed that permits the pilot to enter the ETA time in Zulu using the interactive touchscreen. The entry range is 0 to 2359 and in 1–minute increments.

Press To – The Press To field defaults to green dashes (----). When a waypoint is entered, the field changes to COMPUTE . When the COMPUTE touchscreen softkey is pushed, the field changes to CANCEL , which permits the pilot to cancel the current RAIM computations.

The ETA or waypoint data fields can be changed to initiate a new request for computation of RAIM information, provided both the ETA and waypoint information are entered. The entered waypoint is retained when the window is closed such that the data is redisplayed on any subsequent access to the page, however the ETA field is blanked and must be re-entered each time.

RAIM STATUS – The RAIM status field displays the status of RAIM predictions at the entered waypoint and arrival time. The following are possible status messages displayed in this field and the associated meaning.

- ENTER DESTINATION – ETA – A waypoint and valid ETA must be entered in the waypoint fields before any predictions can be made.
- READY – RAIM status can be computed by pushing the Press To COMPUTE touchscreen softkey displayed in 4R.
- COMPUTING – RAIM computation is in progress.
- COMPUTE TIMED OUT – RAIM prediction response from the FMS has not been received within 45 seconds.
- COMPUTE FAILED – RAIM prediction response from the FMS indicates that the computation failed.
- AVAILABLE – RAIM prediction response from the FMS indicates that the computation succeeded and RAIM is available.
- NOT AVAILABLE – RAIM prediction response from the FMS indicates that the computation succeeded and RAIM is not available.

Back – Pushing the BACK bezel softkey displays the UTILITY page.

Flight Timers

The flight timers page, shown in Figure 15-147, is displayed by pushing the **TIMERS** touchscreen softkey. The flight timers page is used to keep track of various flight times.

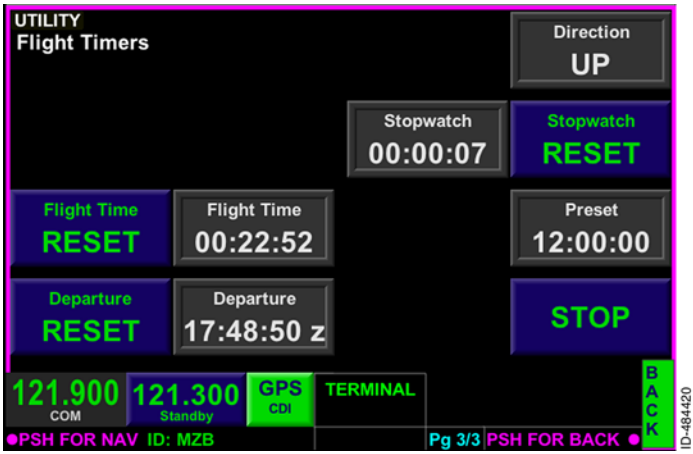


Figure 15-147
Flight Timers Page

The following paragraphs describe the flight timers page.

Flight Time – The flight time is a counter of elapsed time since the unit was powered on, manually reset, or has been in air. When configured on the Menu, the Flight Time clock is automatically started after takeoff and stopped on landing. When the **Flight Time RESET** touchscreen softkey is pushed, the timer field (displayed in gray to the right of the **Flight Time** field) resets back to 00:00:00 and begins the flight timer again.

Departure – The departure field permits the pilot to keep track of the departure time. The departure time is automatically registered after takeoff when the menu setting is enabled. When the **Departure RESET** touchscreen softkey is pushed, the timer field (displayed in gray to the right of the **Departure** field) resets back to to the current Zulu time.

Direction – The direction field permits the pilot to change the direction of the stopwatch clock (displayed in 2R) from counting up or counting down. When **UP** is selected, the stopwatch in 2R starts at 00:00:00 and counts up when the clock is started. When **DOWN** is selected, the stopwatch in 2R counts down from the desired preset start value (displayed in 3R). The **UP** and **DOWN** touchscreen softkeys are alternated by pushing the 1R key.

Stopwatch RESET – The stopwatch reset touchscreen softkey permits the pilot to reset the stopwatch timer back to the original value. The stopwatch counter is displayed to the left of the RESET touchscreen softkey.

Preset – The Preset touchscreen softkey controls and displays the preset value. How the preset value is used when the RESET touchscreen softkey is selected depends on the stopwatch direction (displayed in 1R). The preset value is always displayed when the direction is DOWN , but toggles between cleared and displayed when the direction is up.

When the direction key displays DOWN and the Preset touchscreen softkey is pushed, the stopwatch alert is deactivated and a window is displayed that permits the pilot to enter the desired stopwatch start value.

When the direction key displays UP , pushing the Preset touchscreen softkey clears the preset value and deactivates the stopwatch alert. When the preset value is cleared and the direction touchscreen softkey displays UP , pushing the Preset touchscreen softkey displays a window which permits the pilot to enter the desired stopwatch alert value.

When a preset time is reached on the stopwatch, the FMS message **TIMER EXPIRED** is displayed.

START/**STOP** – The START touchscreen softkey permits the pilot to start the timer in 2R. The START touchscreen softkey changes to STOP when selected. The STOP touchscreen softkey permits the pilot to stop the timer in 2R. The STOP touchscreen softkey changes to START when selected.

NOTE: When STOP is displayed, the direction in 1R and preset value in 3R are not selectable until the stopwatch is stopped.

Back – Pushing the BACK bezel softkey displays the Utility page.

Fuel Calculator

CAUTION

THE FMS FUEL CALCULATOR DATA IS ADVISORY INFORMATION ONLY. THE FMS FUEL CALCULATOR DATA MUST NOT BE USED IN LIEU OF THE PRIMARY FUEL INDICATION DISPLAYS ON THE AIRCRAFT. ACTUAL FUEL FLOW IS NOT CALCULATED. ACCURACY DEPENDS ON THE DATA PROVIDED BY THE PILOT.

The fuel calculator page, shown in Figure 15-148, is displayed by pushing the FUEL CALCULATOR touchscreen softkey. The fuel calculator page provides advisory fuel calculations and should be used for planning purposes only.

Figure 15-148
Fuel Calculator Page

All FMS calculation fields default to dashes (------) until the required parameters are entered by the pilot.

NOTE: Pilot-entered fuel parameters are not stored after a power cycle.

The following paragraphs describe the fuel calculator page.

Fuel to - The amount of fuel to get from the origin waypoint in 1L to the destination waypoint in 3R or the active waypoint is displayed with a resolution of 0.1 gallons. This is a display-only field and pilot-entry is not permitted.

Origin Wpt/Flight Plan/Latitude and Longitude – The touchscreen softkey displayed in this field changes depending on the selected mode in 2L. When the Origin Wpt touchscreen softkey is displayed, the origin waypoint can be manually entered by the pilot using the QWERTY keypad. When the Flight Plan touchscreen softkey is displayed, the pilot can select from a list of stored flight plans to use for origin and destination waypoints. When the latitude and longitude is displayed, the present position (or last valid position) is used as the origin waypoint. The power-up default is green dashes (------).

Mode – Possible modes are WPT , FLT PLAN , and PPOS (or LAST POS). When the mode is WPT , the Origin Wpt touchscreen softkey is displayed in 1L, which permits the pilot to define the origin and destination waypoint using the QWERTY keypad.

When the mode is FLT PLAN , the Flight Plan touchscreen softkey is displayed in 1L, which permits the pilot to choose from stored flight plans to use for origin and destination calculations. In addition, Flight Leg is displayed in the center of the page and to the right of the Flight Plan touchscreen softkey, as shown in Figure 15-149. The flight leg function permits the pilot to view fuel calculations on a leg-by-leg basis. The flight legs are changed by using the interactive touchscreen to push the PREV or NEXT touchscreen softkey or by rotating the joystick knob as indicated by FLT LEG , displayed in the lower-right corner.

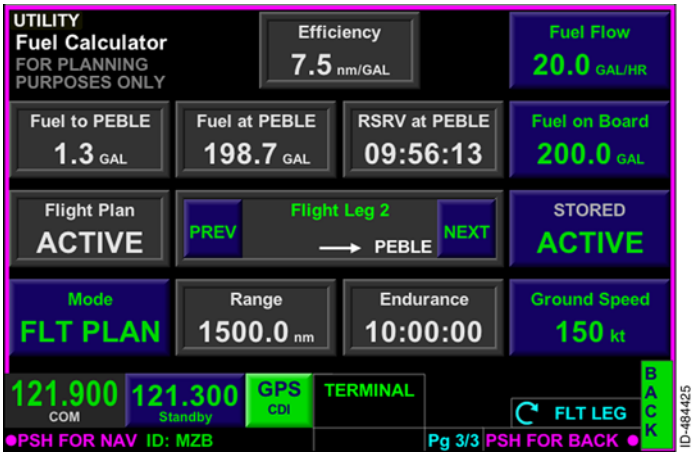


Figure 15-149
Flight Leg

Present position is selectable when the current GPS position is valid. When the mode is PPOS , the present position latitude and longitude are displayed in cyan in 1L, which uses the present aircraft position as the origin waypoint. When the current GPS position is not valid, last know GPS position is selectable. When the mode is LAST POS , the last valid GPS position is displayed in 1L and used for calculations.

The power-up default is WPT.

Efficiency - The FMS calculated fuel efficiency is displayed in this field with a resolution of 0.1 NM per gallon.

Fuel at - The FMS calculated amount of fuel at the destination waypoint is displayed in this field with a resolution of 0.1 gallon.

Range - The FMS calculated range is displayed in this field with a resolution of 0.1 NM.

RSRV at - The FMS calculated reserves of fuel remaining at the destination is displayed in this field in HH:MM:SS format.

Endurance - The FMS calculated endurance is displayed in this field in HH:MM:SS format.

Fuel Flow - The fuel flow is entered in this field with a resolution of 0.1 gallon per hour. The power-up default is 0.0 GAL/HR .

Fuel on Board - The amount of fuel-on-board is entered in this field. The power-up default is 0.0 GAL . The amount of fuel on board is entered with a resolution of 0.1 gallon. When fuel is added to the aircraft, the pilot must manually update the fuel quantity.

Destination - The Destination touchscreen softkey is displayed when the mode in 4L is either WPT or PPOS. The pilot can manually define the destination waypoint in this mode. The STORED/ACTIVE touchscreen softkey toggles the destination from the stored flight plan or the active flight plan destination. When ACTIVE is selected, the Flight Plan touchscreen softkey in 1L becomes grayed out and displays ACTIVE . The power-up default is green dashes (-----).

Ground Speed - The groundspeed is entered in this field in knots. The power-up default is 00 KT .

Back - Pushing the BACK bezel softkey displays the UTILITY page.

Lock Screen

The lock screen page, shown in Figure 15-150, is displayed by pushing the LOCK SCREEN touchscreen softkey. The lock screen page provides the ability to lock the screen permitting the screen to be cleaned without accidently pushing an unintended touchscreen softkey. When the screen is locked, UNLK is displayed in 5R. Pushing the UNLK bezel softkey in 5R or any other bezel softkey unlocks the screen for normal use.

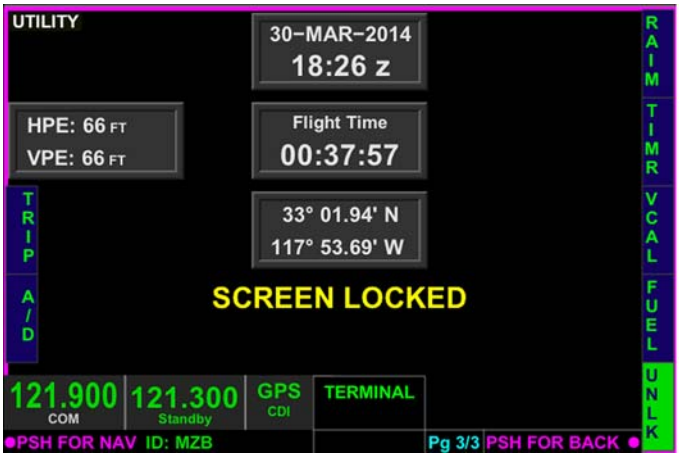


Figure 15-150
Lock Screen Display

When the screen is locked, SCREEN LOCKED is displayed along with the GPS date and time, flight time, and the current GPS position in latitude/longitude format in the center of the screen. When the GPS position is valid or FMS dead reckoning mode is active, the latitude/longitude values are displayed in white. When the GPS position is invalid and FMS dead reckoning mode is active, the latitude/longitude values are removed from display and replaced with dashes (--°--.--').

The touchscreen softkeys displayed on the left- and right-side of the display are shortcuts to the appropriate UTILITY page.

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16. Database Loading Procedures

INTRODUCTION

This section describes how to update the various databases installed on the KSN 765/770.

DATABASE LOADING OVERVIEW

Database updates are downloaded from the internet and installed using a USB drive and port on the front of the unit. Instructional videos and databases can be downloaded from the following website:

https://wingmanservices.bendixking.com/wingman/ksn.do

Database updates require a subscription. The database subscription is paired with the unit during installation. The paired USB memory stick is provided by the installer to the operator for performing database updates. The database subscription can be purchased for the Americas Region or International Region.

Database updates must be downloaded to a USB drive which is at least 8 GB in size. A USB thumb drive uniquely formatted for use with the KSN 765/770 is supplied with the unit. Ensure the KSN 765/770 is powered off before beginning any database updates.

The USB port is located on the front of the bezel on the bottom left side and accepts a standard sized USB memory stick (thumb drive). The USB port has a cover which should be kept on until the USB port is required for use.

CAUTION

USE OF THE USB PORT IN FLIGHT IS NOT AUTHORIZED AND CAN CAUSE A RESET.

With the unit powered off, insert the USB drive into the USB port in the front of the unit. When power is applied to the KSN 765/770, a database loading page is displayed, as shown in Figure 16-1. On this page, the installer can choose which databases are to be installed and see how much time each database installation will take.

NOTE: The KSN 765/770 does not have a power button. The unit powers-on with the aircraft avionics.

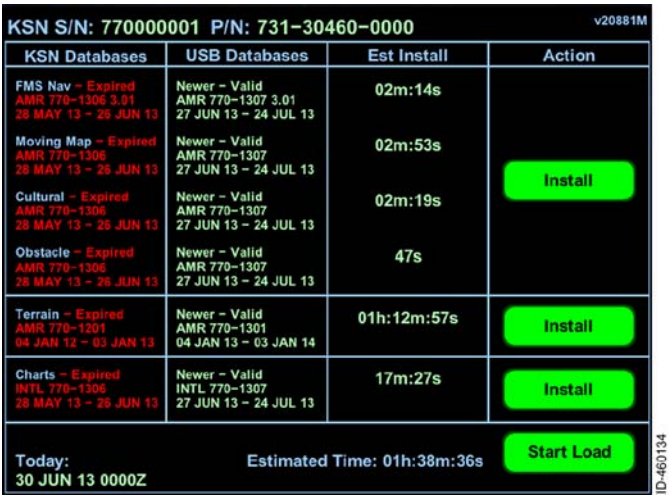

Figure 16-1
Database Loading Page

The KSN Databases column displays the currently installed databases and version numbers. The installed databases are FMS Nav, Moving Map, Cultural, Obstacle, Terrain, and Charts. The database version number, start date, and status (**Valid** , **Expired** , or **Early**) is displayed for each database.

Chart databases are provided directly by Seattle Avionics by accessing the following website:

http://www.seattleavionics.com/ChartData/Default.aspx?TargetDevice=KSN

The USB Databases column lists each database as the same, newer, older, or not present on the USB drive. The database version number and start date are displayed for each database. When the installed database and the USB database are the same, **Same** is displayed above the version number. When the USB database is newer than the installed database, **Newer** is displayed above the version number. When the USB database is older than the installed database, **Older** is displayed above the version number. When an installed database is not contained on the USB drive, **Not Present** is displayed.

The Est Install column displays the estimated time to install each database in hours, minutes, and seconds format.

The Action column displays an **Install** or **Do Not Install** touchscreen softkey for each of the three groups of databases. When at least one of the databases in each of the three groups is out of date, **Install** is the default for that group. When all of the databases in a group are up to date, **Do Not Install** is the default for the group. The Action column can be alternated using the interactive touchscreen display to alternate between **Install** and **Do Not Install** .

When any database is expired, the database version is displayed in red text along with **Expired** .

The current date and time is displayed in the lower-left corner of the display. The total estimated time to load all of the selected databases is displayed in hours, minutes, and seconds format.

When all desired databases are selected for **Install** , pushing the **Start Load** touchscreen softkey begins the data loading process. Once database loading has started, the previously installed databases will be erased. During the data loading process, Progress replaces the Est Install column, as shown in Figure 16-2.

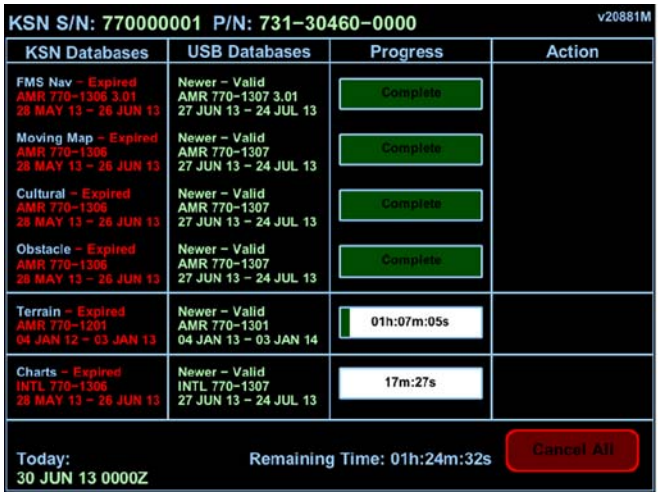

Figure 16-2
Data Loading in Progress

The progress of each database selected for installation is displayed in the Progress column. The time remaining is displayed for each remaining database to be loaded.

Dataloading can be canceled by pushing the **Cancel All** touchscreen softkey.

NOTE: If the **Cancel All** touchscreen softkey is pushed, no databases will be loaded onto the KSN until database loading is completed successfully.

Canceling the dataloading process can have severe adverse effects, such as corrupting the databases and software. Dataloading should not be canceled during the dataloading process.

When dataloading for a database is complete, **Complete** is displayed next to the database. When the loading of all databases is complete, **Return** is displayed in the lower-right corner, as shown in Figure 16-3.

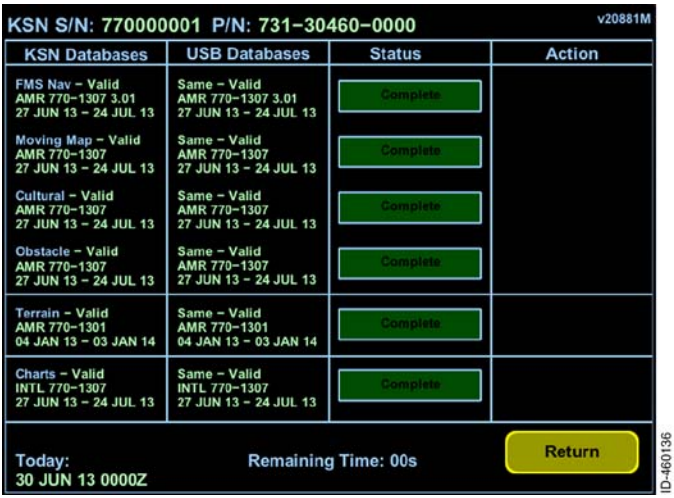

Figure 16-3
Database Loading Complete

Pushing the **Return** touchscreen softkey returns to the original database loading page. When dataloading is complete, remove the USB stick and cycle power on the KSN 765/770.

Dataloading Errors

Table 16-1 lists possible error messages encountered during the dataloading process and the associated corrective action.

Table 16-1
Dataloading Errors

Message	Splash Screen	KSN Databases	USB Databases	Criteria	Corrective Action
Check Internal SD Card	X			Missing or corrupt internal SD card	Replace the internal SD card
Not Present		X	X	If the database is not present on the device	KSN Databases: Download databases from the Web Portal and load onto the KSN USB Databases: Download databases from the Web Portal
Same			X	If the database currently on the USB is the same as the database in the KSN	No action required
Newer			X	If the database currently on the USB is newer than the database in the KSN	Download the newer database onto the KSN

Table 16-1 (cont)
Dataloading Errors

Message	Splash Screen	KSN Databases	USB Databases	Criteria	Corrective Action
Older			X	If the database currently on the USB is older than the database in the KSN	If desired, load the older database onto the KSN (not recommended)
Expired		X	X	If the database is expired	KSN Database: Download a valid database from the Web Portal and load onto the KSN. USB Databases: Only load an expired database onto the KSN if there is no database on the KSN or if the USB database is newer.
Dif Region			X	The Region is different between the KSN database and the USB database	Load the new region information onto the KSN if desired
Not Authorized					

Table 16-1 (cont)
Dataloading Errors

Message	Splash Screen	KSN Databases	USB Databases	Criteria	Corrective Action
Reg Update Consumed			X	If the database on the USB is a registration database and the KSN has already used the free registration database	Download a new database from the Web Portal for loading onto a KSN
Wrong Serial Number SN:xxxxxxxxx			X	If the database on the USB is for a different serial number than the current KSN and the USB serial number is listed	Load the databases onto the correct SN KSN or download a new database from the Web Portal for the SN KSN desired

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Acronyms and Abbreviations

Acronyms and abbreviations used in this guide are defined as follows:

TERMS	DEFINITION
ABV	above
ACQ	acquisition
ACTV	activate
ADIZ	air defense identification zone
AGL	above ground level
AIM	Aeronautical Information Manual
AIRMET	Airmen's Meteorological Information
ANT	antenna
APD	airport diagram
APPR	approach
APT	airport
ARINC	Aeronautical Radio Incorporated
ARR	arrival
ARWY	airway
ASOS	automated surface observing system
ATC	air traffic control
ATIS	automatic terminal information service
AWOS	automatic weather observing/reporting system
AWY	airway
B/D	bearing/distance
Baro	barometric
BKSP	backspace
BLW	below
BRG	bearing
CDI	course deviation indicator
CFIT	controlled flight into terrain
CH	channel
CHG, CHNG	change
CHRT	chart
CLR	clear
CNCL	cancel
CONV	convective
CRS	course

TERMS	DEFINITION
DA	decision altitude
DB	database
DCLT	declutter
DEP	departure
DEST	destination
DETL	detail
DEV	deviation
Dir	direction
Dist	distance
DP	departure procedure
DTG	distance-to-go
DTK	desired track
EGPWS	enhanced ground proximity warning system
Est	estimated
ETA	estimated time of arrival
ETE	estimated time en route
FAA	Federal Aviation Administration
FAF	final approach fix
FAWP	final approach waypoint
FLT	flight
FMS	flight management system
FSD	full-scale deflection
GAL	gallon
GNSS	global navigation satellite system
GPS	global positioning system
GPSS	global positioning system steering
GS	groundspeed
HA	high altitude
HDG	heading
HF	hold to a fix
HH:MM	hours:minutes
HH:MM:SS	hours:minutes:seconds
HLD	hold
HM	hold to a manual termination
HORZ	horizontal

TERMS	DEFINITION
HSI	horizontal situation indicator
IAP	instrument approach procedure
IAWP	initial approach waypoint
ICAO	International Civil Aviation Organization
ICNG	icing
IFR	instrument flight rule
IMC	Instrument Meteorological Conditions
IN	inches
INFO, Info	information
INIT	initialization
INOP	inoperable, inoperative
INS	insert
INT	intersection
INV	inverter
JMP	jumper
kHz	kilohertz
Kts	knots
LB	pound
LGND	legend
LL	latitude/longitude
LNAV	lateral navigation
LOI	loss of integrity
LPV	localizer performance with vertical guidance
LTNG	lightning
MAWP	missed approach waypoint
mB	millibars
METAR	Aviation Routine Weather Report
MFD	multifunction display
MHz	megahertz
MIC	microphone
MIN	minimum
MOA	military operating area
MSL	mean sea level

TERMS	DEFINITION
NACO	National Aeronautical Charting Office
NDB	non-directional beacon
NEXRAD	next generation radar
NM	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOTAM	notice to airmen
NRM	normal
NRST	nearest
NWS	National Weather Service
NXRD	next generation radar
OAT	outside air temperature
OBS	omni bearing selector
ODP	obstacle departure procedure
OEM	original equipment manufacturer
OFST	offset
P/B/D	place/bearing/distance
PROC	procedure
PSH	push
PSH SQ	push squelch
PT	procedure turn
R	receiving
RESM	resume
RMVD	removed
RNG	range
RTRN	return
SEL	select
SID	standard instrument departure
SIG, SIGMET	Significant Meteorological Information
SQ	squelch
SRCH	search
STAR	standard terminal arrival route
STBY	standby
STOR	store
STRK	strike

TERMS	DEFINITION
SUA	special use airspace
T	transmitting
TA	traffic advisory
TACAN	tactical air navigation system
TAF	terminal aerodrome forecast
TAWS	terrain awareness and warning system
TCAS	traffic alert and collision avoidance system
TERR	terrain
TFCA	traffic above
TFCB	traffic below
TFCN	traffic normal
TFCU	traffic unrestricted
TFR	temporary flight restriction
TIS	traffic information system
TRFC	traffic
TRK	track
TSA	terminal service area
TURB	turbulence
UNLK	unlock
UNR	unrestricted
USB	universal serial bus
VFR	visual flight rules
VHF	very high frequency
VLOC	VOR localizer
VNAV	vertical navigation
VOR	very high frequency omni-directional radio range
VORTAC	combined VOR and TACAN stations
VTF	vectors to final
Wpt	waypoint
WX	weather

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Glossary

The following is a list of technical and operational terms, acronyms, and abbreviations with explanations in alphabetical order.

BEZEL SOFTKEY – A key (button) on the bezel surrounding the KSN display that is used to perform multiple functions (software configurable). A bezel softkey can perform different functions, depending on the bezel softkey label.

BEZEL SOFTKEY LABEL – A label on the KSN display immediately adjacent to a bezel softkey that identifies the functions of the softkey (button). The label function changes depending on which window on the display is being controlled. The window on the display with the magenta border is the one being controlled.

CDI – Course deviation indicator.

CHARTS VIEW – Displays pre-composed terminal procedures.

DEDICATED BEZEL KEY – A key (button) on the bezel surrounding the KSN display that has a label printed on it, such as FMS, MFD, and MENU. A dedicated bezel key only performs a single function.

DATALINK WEATHER VIEW – A graphical depiction of NEXRAD, Lightning, METARs, Echo Tops, Cloud Tops, AIRMETs/SIGMETs, TFRs, and Winds Aloft.

DIRECT-TO – The path from the aircraft's present position to the selected waypoint

DIRECT-TO BEZEL KEY () – Displays the Direct-To overlay.

EFIS – Electronic flight instrument system.

FMS BEZEL KEY – Selects the FMS home page with the home window as focus.

FMS FUNCTION – The navigation function of the KSN.

FOCUS – The window on the display bound by magenta. The bezel softkeys controls functions on the focused window

FREQUENCY SWAP BEZEL KEY () – Changes the standby frequency to the active frequency and the active frequency to the standby frequency.

GPS COURSE DEVIATION INDICATOR VIEW – Shows the lateral deviation from the center line of a selected GPS course.

JOYSTICK KNOB – Contains a rotation function, push function, and toggle function for panning, scrolling, data input, and selecting items.

KEY – A button.

KSN – The KSN 765/770 integrated communication navigation display.

LAYOUT – The physical arrangement of windows on a page.

LEG – A line between two waypoints in the flight plan list.

LIGHTNING DETECTION VIEW – Displays Stormscope® Series II weather mapping sensor information.

MENU BEZEL KEY – Activates the menu, which contains several pages of selections to configure the KSN.

MFD – Multifunction display.

MFD BEZEL KEY – Selects the MFD function.

MFD FUNCTION – Enables the pilot to display a variety of navigation and weather information, terrain and obstacle data, and traffic information.

NAVIGATION MAP VIEW – A configurable moving map that displays aviation data, topographic information, boundaries, and GPS flight plan information.

NUMERIC KEYPAD – Touchscreen keys arranged in a 3x3 matrix with a zero at the bottom.

PAGE – Information arranged on the screen. Push the PAGE bezel key to change the page.

PAGE BEZEL KEY – Changes the page on the screen.

POP-UP ALERTS – An alert on the touchscreen. Often the pilot can choose a response, such as CLEAR or MISSED APPROACH.

QWERTY KEYPAD – Touchscreen keys arranged in a standard QWERTY keyboard layout.

RADIO CONTROL KNOB – Contains an outer and inner rotation function for selecting frequencies and a push function to toggle between the COM and NAV frequencies.

SEQUENCE – When the aircraft crosses a waypoint and the next leg of the flight plan becomes active.

SOFTKEY – A key that performs a function based on the screen label adjacent to it.

SUSPEND – When the aircraft crosses a waypoint and there is no next leg of the flight plan

TAWS VIEW – A graphical depiction of threatening terrain near the aircraft.

TERRAIN VIEW – A graphical depiction of colorized terrain and obstacle information based on the aircraft's proximity to terrain and obstacles.

TOUCHSCREEN BUTTON – A button on the touchscreen display.

TRAFFIC VIEW – A graphical depiction of aircraft relative to the nose of the aircraft.

VIEW – A certain section on an MFD page framed in magenta. Pushing the VIEW bezel key changes the section framed in magenta. The VIEW bezel key has no function in the FMS function.

VLOC CDI – A button on the screen that indicates that the VOR or localizer is driving the CDI. The button alternates with the GPS CDI.

VOLUME KNOB – Contains a rotation function that changes the volume of the selected radio and a push function that turns the squelch on or off.

VOLUME OVERLAY CONTROLS – Allows the volume to be adjusted and the squelch/ID to be turned on or off using the touchscreen.

VOLUME TOUCHSCREEN BUTTON – Selects the volume overlay controls.

WAYPOINT – A navigation fix in a flight plan.

WEATHER RADAR VIEW – A graphical depiction of the strength and type of precipitation (i.e., rain and snow).

WINDOW – A section on the screen that responds to events from the user or the KSN system.

WX-500 LIGHTNING DETECTION VIEW – A graphical depiction of electrical discharges (associated with thunderstorms) that are detected by the Stormscope®.

ZOOM–IN/+ BEZEL KEY – Increases the range, when the view within the selected window contains an adjustable range.

ZOOM–OUT/– BEZEL KEY – Decreases the range, when the view within the selected window contains an adjustable range.

Index

Numbers

A

B

C

Index (cont)

D

Index (cont)

E

F

Index (cont)

Index (cont)

G

H

I

J

K

Index (cont)

L

M

N

Index (cont)

O

P

R

Index (cont)

S

Index (cont)

T

U

Index (cont)

V

W

Index (cont)

X

Blank Page