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SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the G1000 are designed to aid situational awareness and provide advisory information with regard to potential hazards to flight safety associated with weather, terrain, and air traffic.

Weather

- GDL 69A XM WX Satellite Weather (Optional)
- GSR 56 Garmin Flight Data Services (GFDS) Worldwide Weather (Optional)
- GDL 90 Flight Information Service - Broadcast Weather (Optional)
- L-3 STORMSCOPE® WX-500 Series II Weather Mapping Sensor (Optional)

Terrain Avoidance

- Terrain Proximity
- Terrain-SVS (Standard with SVS Option)
- Terrain Awareness and Warning System-Class B (TAWS-B) (Optional)

Traffic

- Traffic Information Service (TIS)
- Garmin GTS 800 Traffic Advisory System (TAS) (Optional)
- Honeywell® KTA 870 Traffic Advisory System (TAS) (Optional)
- Automatic Dependent Surveillance - Broadcast (ADS-B) Traffic (Optional)

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6.1 XM WX SATELLITE WEATHER

> ✔ **NOTE:** *XM WX Satellite Weather data provides information for avoiding hazardous weather. Do not use XM WX information to penetrate hazardous weather.*

XM WX Satellite Weather is provided through the GDL 69A, a remote-mounted data-link satellite receiver. Received graphical weather information and associated text is displayed on the Multi Function Display (MFD) and the Primary Flight Display (PFD) Inset Map. The GDL 69A can also receive SiriusXM Satellite Radio entertainment services. Both weather data and entertainment programming operate in the S-band frequency range to provide continuous reception capabilities at any altitude throughout North America.

Services from SiriusXM are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SERVICES

Before XM WX Satellite Weather can be used, the service must be activated. Service is activated by providing SiriusXM with coded IDs unique to the installed GDL 69A. SiriusXM Satellite Radio (audio) and XM WX Satellite Weather (data) services each have coded IDs. The Data and Audio Radio IDs must be provided to XM Satellite Radio to activate the weather service and entertainment subscriptions, respectively. These IDs are located on:

- The label on the back of the Data Link Receiver
- The XM Information Page on the MFD (Figure 6-1)
- The XM Satellite Radio Activation Instructions included with the unit (available at www.garmin.com, P/N 190-00355-04)

Contact the installer if the Audio and Data Radio IDs cannot be located.

SiriusXM uses the coded IDs to send an activation signal that allows the system to display weather data and/or entertainment programming provided through the GDL 69A.

Activating XM WX Satellite Weather and SiriusXM Satellite Radio services:

1) Contact SiriusXM Satellite Radio customer service using the phone number listed on the website. Follow the instructions provided by SiriusXM customer service.
2) Select the XM page in the Auxiliary Page Group.
3) Press the **INFO** Softkey to display the XM Information Page.
4) Verify that the desired services are activated.
5) Press the **LOCK** Softkey.
6) Turn the large **FMS** Knob to highlight 'YES'.
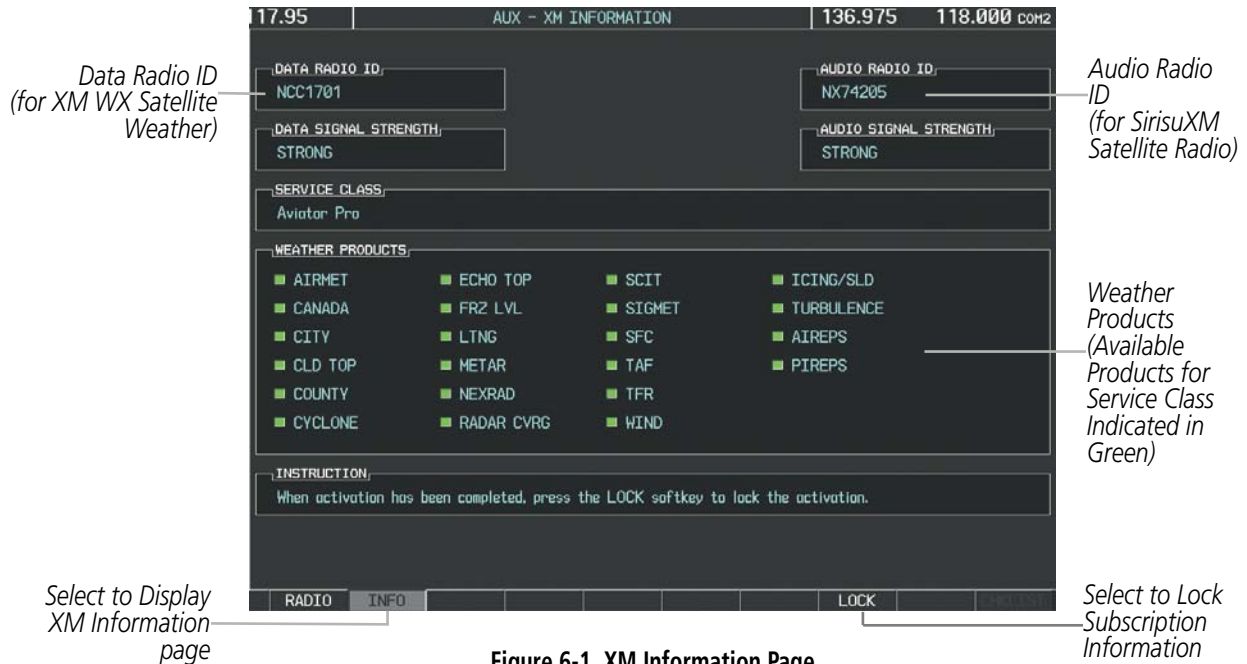7) To complete activation, press the **ENT** Key.

Data Radio ID (for XM WX Satellite Weather)

Audio Radio ID (for SirisuXM Satellite Radio)

Weather Products (Available Products for Service Class Indicated in Green)

Select to Display XM Information page

Select to Lock Subscription Information

Figure 6-1 XM Information Page

USING XM WX SATELLITE WEATHER PRODUCTS

   The principal map for viewing XM WX Satellite Weather data is the Weather Data Link (XM) Page in the Map Page Group. This is the only G1000 map display capable of showing information for all available XM WX products.

Viewing the Weather Data Link (XM) Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Weather Data Link (XM, FIS-B, or GFDS) Page.

3) If the page title displays a weather datalink source other than 'XM', such as 'FIS-B' or 'GFDS', proceed to the following steps to change the weather datalink source.

4) Press the **MENU** Key.

5) Turn the small **FMS** Knob to select 'Display XM Weather' and press the **ENT** Key. The page title will display 'MAP - WEATHER DATA LINK (XM)' to indicate XM is now the selected weather datalink source.

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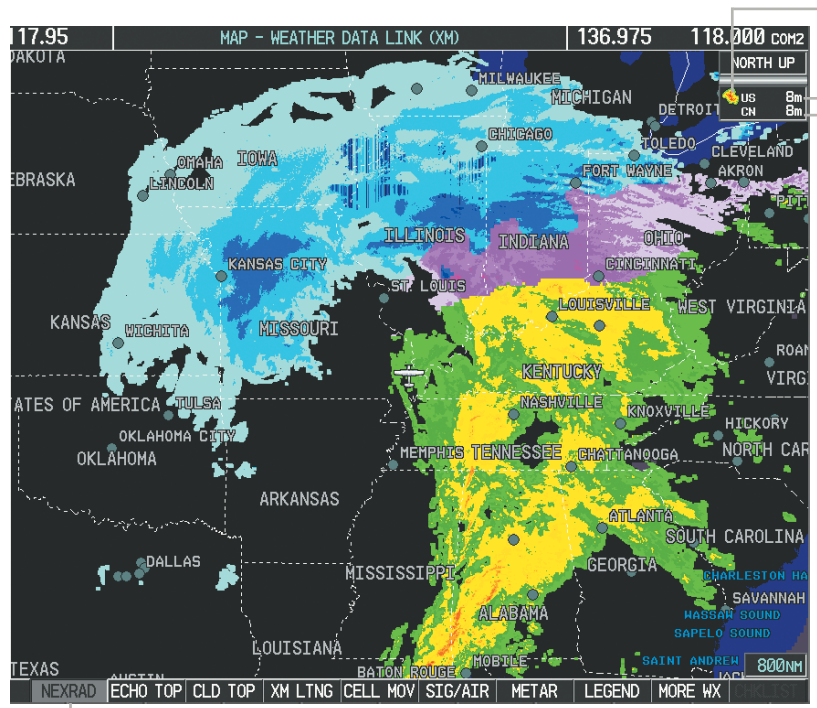
NEXRAD Weather Product Symbol

NEXRAD Weather Product Ages (US & Canada)

NEXRAD Weather Product Selected for Display

Figure 6-2 Weather Data Link (XM) Page

When an XM WX product is active on a MFD map, the age of the data is displayed on the screen to the right of the product symbol (Figure 6-2). The age of the product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are refreshed at specific intervals (defined in the **Refresh Rate** column in Table 6-1).

If for any reason, a weather product is not refreshed within the **Expiration Time** intervals (see Table 6-1), the data is considered expired and is removed from the display. This ensures the displayed data is consistent with the data XM WX services is currently transmitting. If more than half of the expiration time has elapsed, the color of the product age displayed changes to yellow. If no data is available for a weather product, 'N/A' is displayed next to the weather product symbol. If a weather product age is invalid, the system displays dashes next to the product symbol instead of a product age.

Table 6-1 shows the weather product symbols, the expiration times and the refresh rates. The refresh rate represents the interval at which XM WX services provides new signals that may or may not contain new weather data. It does not represent the rate at which weather data is updated or new content is received by the Data Link Receiver. Weather data is updated at intervals that are defined and controlled by SiriusXM and its data providers, and are subject to change.

XM WX Satellite Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
Next-generation Radar (NEXRAD)		30	5 (U.S.) 10 (Canada)
Cloud Top (CLD TOP)		60	15
Echo Top (ECHO TOP)		30	7.5
XM Lightning (LTNG)		30	5
Cell Movement (CELL MOV)		30	12
SIGMETs/AIRMETs (SIG/AIR)		60	12
Meteorological Aerodrome Report (METARs)		90	12
City Forecast (CITY)		60	12
Surface Analysis (SFC)		60	12
Freezing Levels (FRZ LVL)		60	12
Winds Aloft (WIND)		60	12
County Warnings (COUNTY)		60	5
Cyclone Warnings (CYCLONE)		60	12
Icing Potential (CIP and SLD) (ICNG)		90	22
Pilot Weather Report (PIREPs)		90	12
Air Report (AIREPs)		90	12
Turbulence (TURB)		180	12
Radar Coverage (RADAR CVRG)	no product image	30	5
Temporary Flight Restrictions (TFRs)	no product image	60	12
Terminal Aerodrome Reports (TAFs)	no product image	60	12

Table 6-1 XM WX Satellite Weather Product Symbols and Data Timing

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Table 6-2 shows which XM WX products can be displayed (indicated with a '+' symbol) on specific maps.

XM WX Satellite Weather Product	PFD Inset Map	Navigation Map Page	Weather Data Link (XM) Page	Weather Information Page	AUX - Trip Planning Page	AUX - Video Page	Nearest Page Group	Flight Plan Pages
NEXRAD	+	+	+		+	+	+	+
Cloud Top (CLD TOP)			+					
Echo Top (ECHO TOP)			+					
XM Lightning (LTNG)	+	+	+		+	+	+	+
Cell Movement (CELL MOV)	+	+	+		+		+	+
SIGMETs/AIRMETs (SIG/AIR)			+					
METARs	+	+	+	+	+	+	+	+
City Forecast (CITY)			+					
Surface Analysis (SFC)			+					
Freezing Levels (FRZ LVL)			+					
Winds Aloft (WIND)		+*	+					
County Warnings (COUNTY)			+					
Cyclone Warnings (CYCLONE)			+					
Icing Potential (ICNG)			+					
PIREPs			+	+				
AIREPs			+	+				
Turbulence (TURB)			+					
Radar Coverage		+	+					
TFRs	+	+	+	+	+	+	+	+
TAFs			+	+				

Winds Aloft Data displayed inside Profile View on the Navigation Map Page.
Table 6-2 Weather Product Display Maps

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Softkeys control the display of weather information on most MFD pages and the PFD Inset Map. Figure 6-3 shows the weather product softkeys for the Weather Data Link (XM) Page. When a weather product is selected for display, the corresponding softkey label changes to gray to indicate the product is enabled.
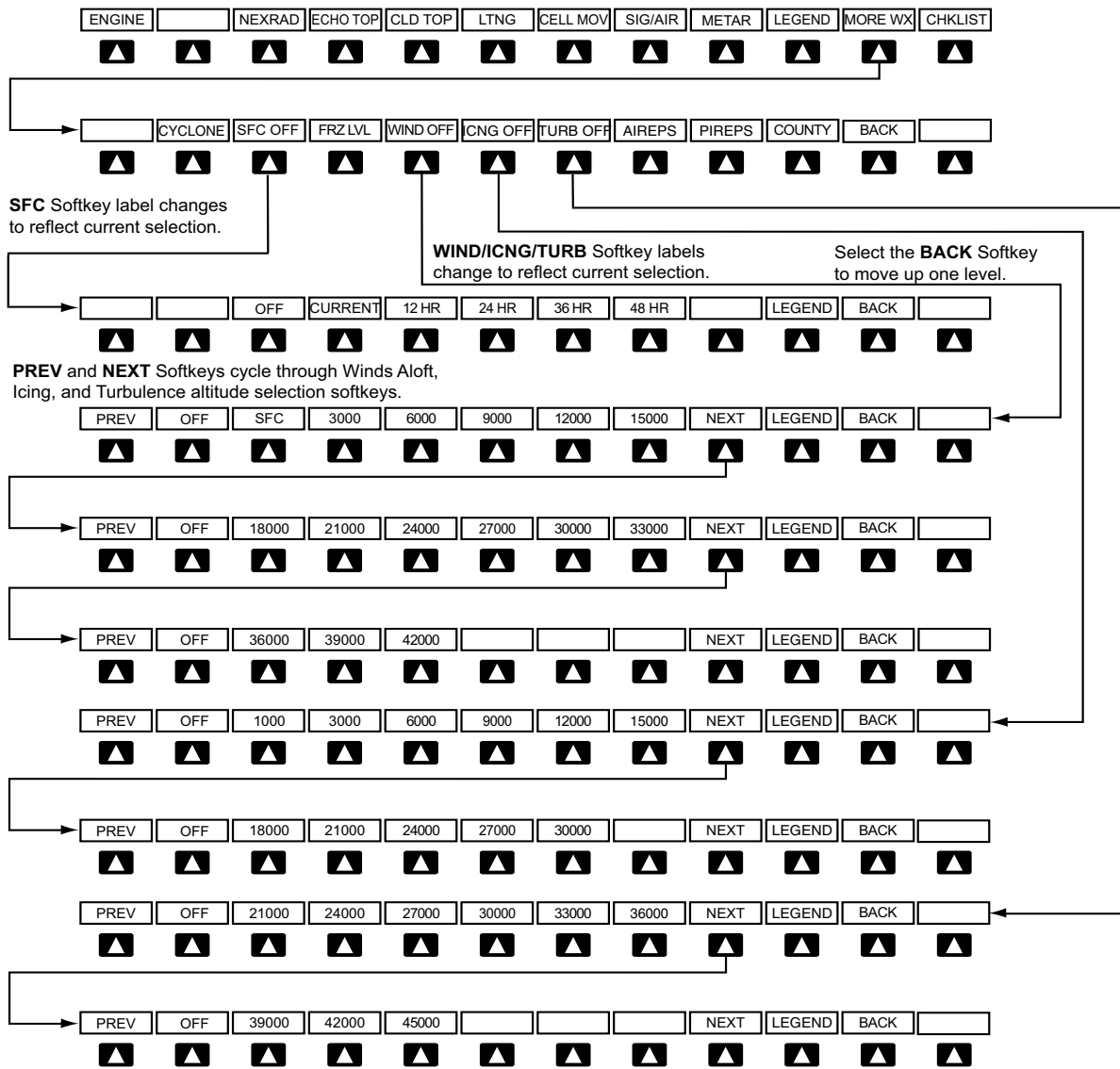

Figure 6-3 Weather Data Link (XM) Weather Product Softkeys

The setup menus for the Navigation Map Page and the Weather Data Link (XM) Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The menus also provide a means in addition to the softkeys for enabling/disabling display of weather products.

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Setting up and customizing the Weather Data Link (XM) Page:

1) Select the Weather Data Link (XM) Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key (Figure 6-4).

4) Turn the small **FMS** Knob to select 'PRODUCT GROUP 1' or 'PRODUCT GROUP 2', and press the **ENT** Key (Figure 6-5).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link (XM) Page with the changed settings.

Figure 6-4 Weather Data Link (XM) Page Menu
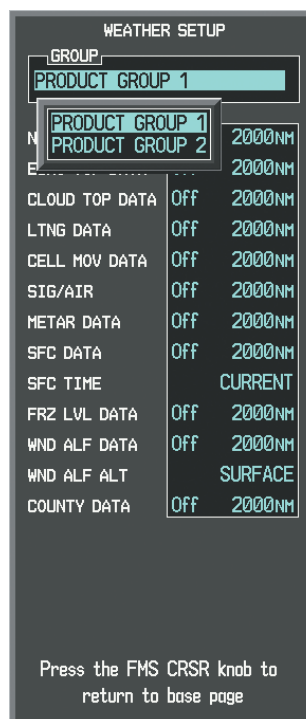
Figure 6-5 Weather Data Link Page Setup Menu

If optional GSR 56 Garmin Flight Data Services (GFDS) Worldwide Weather or GDL 90 Flight Information Service - Broadcast weather data has also been enabled, customizing the display settings for the corresponding weather products shown in Table 6-3 will result in identical settings for all services.

XM WX Satellite Weather Product	GFDS Worldwide Weather Product	FIS-B Weather Product
Next-generation Radar (NEXRAD)	Precipitation (PRECIP)	Precipitation (PRECIP)
Cloud Top (CLD TOP)	Infrared Satellite (IR SAT)	Not Available
XM Lightning (XM LTNG)	GFDS Lightning (DL LTNG)	Not Available
SIGMETs/AIRMETs (SIG/AIR)	SIGMETs/AIRMETs (SIG/AIR)	Not Available
Meteorological Aerodrome Report (METARs)	Meteorological Aerodrome Report (METARs)	Meteorological Aerodrome Report (METARs)
Winds Aloft (WIND)	Winds Aloft (WIND)	Not Available
Pilot Weather Report (PIREPs)	Pilot Weather Report (PIREPs)	Not Available

Table 6-3   Weather Datalink Settings Shared for Multiple Datalink Sources

Restoring default Weather Data Link (XM) Page settings:

1) Select the Weather Data Link (XM) Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key.

4) Press the **MENU** Key.

5) Highlight the desired option to restore defaults (for all or for selection), and press the **ENT** Key.

Weather displayed on Pages other than the Weather Data Link Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing weather data for the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-6).

4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key (Figure 6-7).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-8).

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

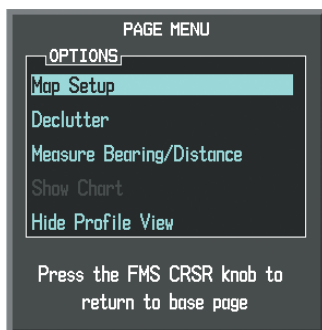8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
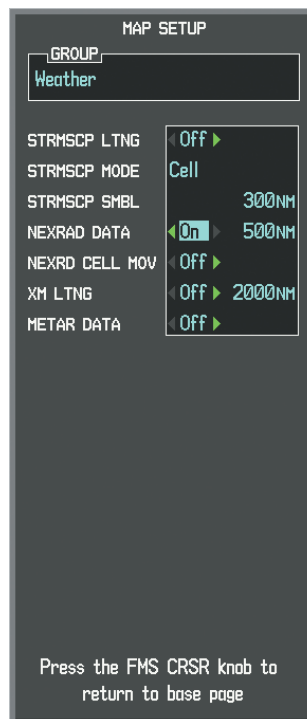
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Figure 6-6 Navigation Map Page Menu

Figure 6-7 Navigation Map Page Setup Menu

Figure 6-8 Navigation Map Page Setup Menu, Weather Group

When an XM WX product is enabled for display on the PFD Inset Map, the weather product information box (with the product icon and age) can be displayed inside the PFD Inset Map.

Viewing the weather product information box on the PFD Inset Map:

1) On the PFD, press the **INSET** Softkey.

2) Press the **WX LGND** Softkey.

3) To remove the weather product information box, press the **WX LGND** Softkey again.

Each active weather product has an associated legend which can be displayed on the Weather Data Link (XM) Page.

Viewing legends for displayed weather products (on the Weather Data Link (XM) Page):

1) Select the Weather Data Link (XM) Page.

2) Press the **LEGEND** Softkey to display the legends for the displayed weather products.

   Or:

   a) Press the **MENU** Key.

   b) Select 'Weather Legend' and press the **ENT** Key.

3) Turn the **FMS** Knob to scroll through the legends.

4) To remove the Legend Window, press the **LEGEND** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Viewing legends for displayed weather products (on the Navigation Map Page):

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **LEGEND** Softkey (available if one or more XM WX products are enabled for display).

4) To remove the Legend Window, press the **LEGEND** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about the following can be displayed by panning over the display on the map:

- Echo Tops
- Cell Movement
- SIGMETs
- AIRMETs
- METARs
- County Warnings
- TFRs
- PIREPs
- AIREPs

The map panning feature is enabled by pressing the **RANGE** Knob. The map range is adjusted by turning the **RANGE** Knob. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.
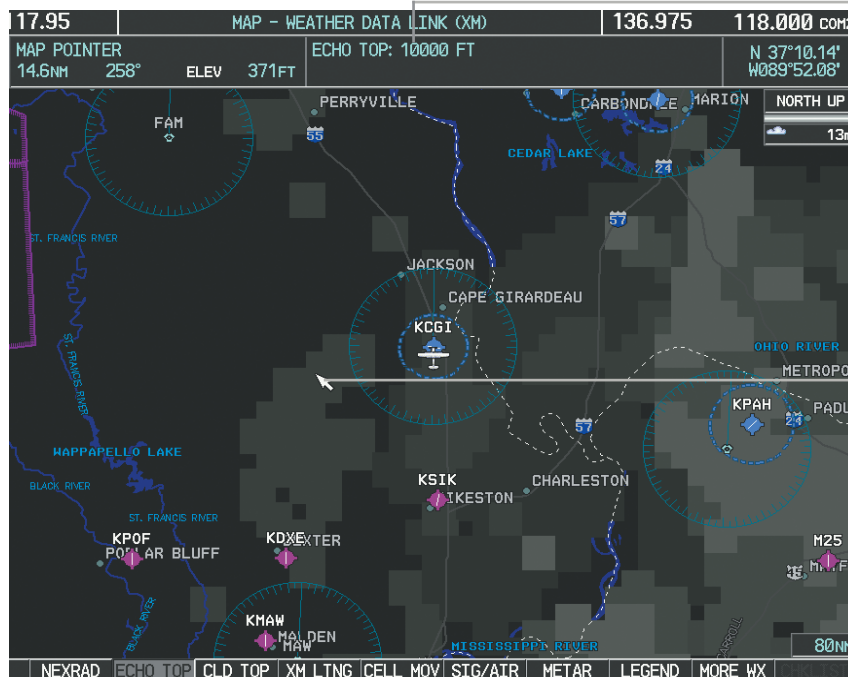
Additional Information on Weather Feature Selected with Map Pointer

Echo Top Data Selected with Map Pointer

Figure 6-9 Panning on the Weather Data Link Page

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NEXRAD

> **NOTE:** NEXRAD data cannot be displayed at the same time as terrain, echo tops, turbulence, or icing data, is displayed.

WSR-88D, or NEXRAD (NEXt-generation RADar), is a network of 158 high-resolution Doppler radar systems that are operated by the National Weather Service (NWS). NEXRAD data provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD radar site is 250 nm. In addition to a wide array of services, the NEXRAD network provides important information about severe weather and air traffic safety.

NEXRAD data is not real-time. The lapsed time between collection, processing, and dissemination of NEXRAD images can be significant and may not reflect the current radar synopsis. Due to the inherent delays and the relative age of the data, it should be used for long-range planning purposes only. Never use NEXRAD data or any radar data to penetrate hazardous weather. Rather, use it in an early-warning capacity of pre-departure and enroute evaluation.
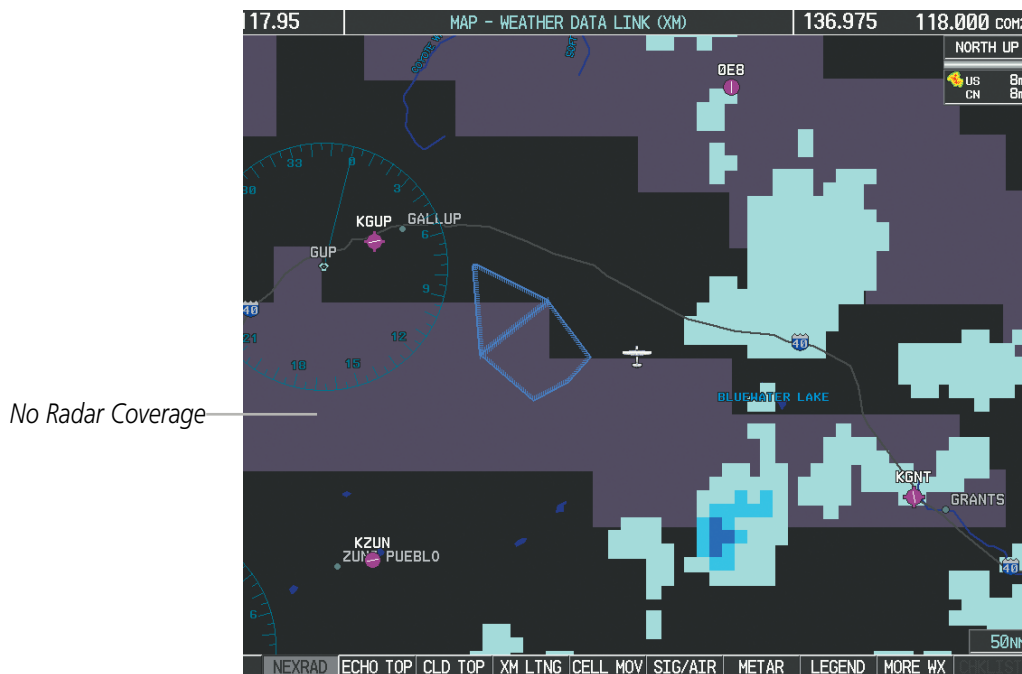
Figure 6-10 NEXRAD Data on the Weather Data Link Page

NEXRAD data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link Page
- Airport Information Page

- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying NEXRAD weather information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the Weather Data Link (XM) Page.

2) Press the **NEXRAD** Softkey.

Composite data from all the NEXRAD radar sites in the United States is shown. This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the Weather Data Link (XM) Page. For the NEXRAD legend (Figure 6-11), press the **LEGEND** Softkey when NEXRAD is selected for display.
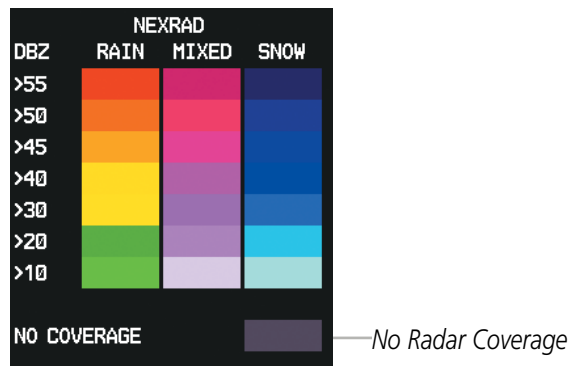
Figure 6-11 NEXRAD Data with Legend

The display of no radar coverage is always active when either NEXRAD or Echo Coverage is selected. Areas where NEXRAD radar coverage and Echo Tops information is not currently available or is not being collected are indicated in a gray shade of purple (Figure 6-11).

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- NEXRAD base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.

- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.

- When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers. The intensity level reflected by each square represents the *highest* level of NEXRAD data sampled within the area (Figure 6-12).

- Unknown precipitation occurring below 52ºN is displayed as rain.
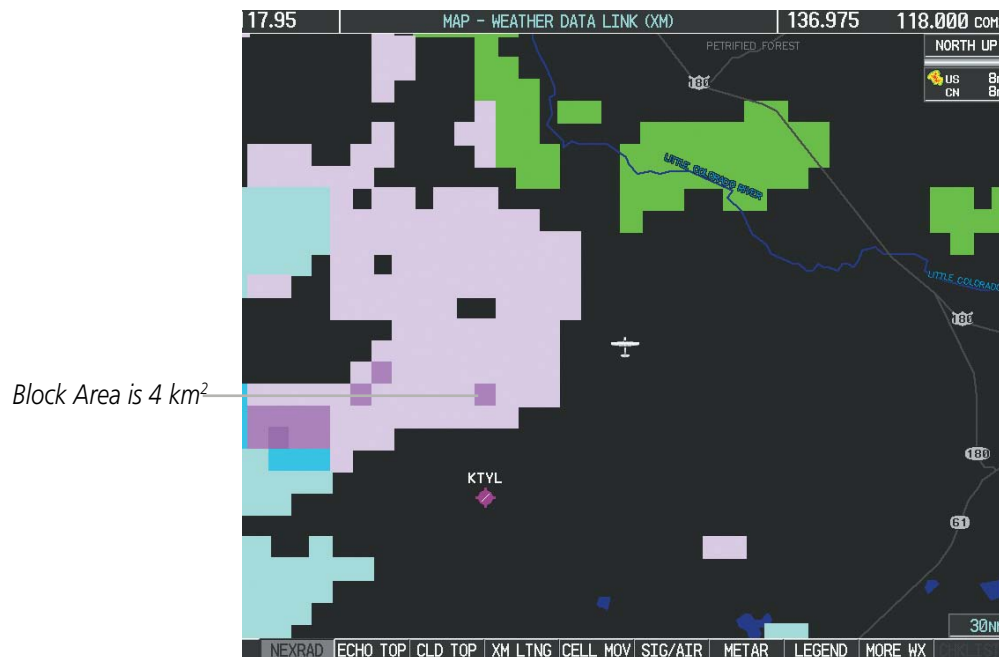
Figure 6-12 NEXRAD Data - Zoomed

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust from military aircraft, which can cause alterations in radar scans

NEXRAD Limitations (Canada)

- Radar coverage extends to 55ºN.

- Any precipitation displayed between 52ºN and 55ºN is shown as mixed precipitation, regardless of precipitation type.
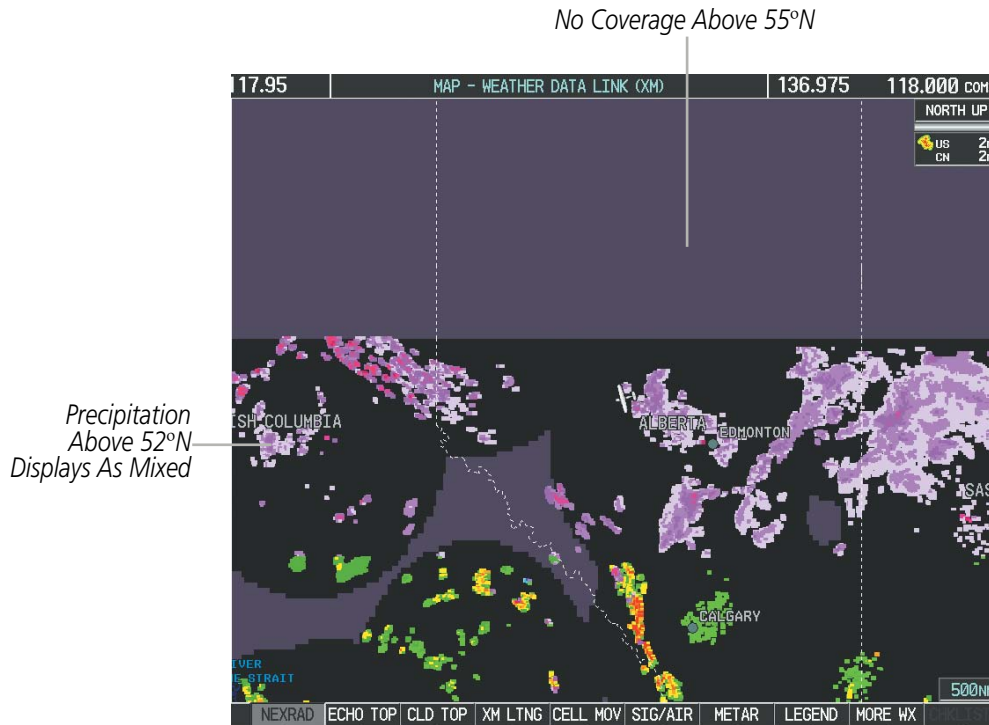
No Coverage Above 55ºN

Precipitation Above 52ºN Displays As Mixed

Figure 6-13 NEXRAD Data - Canada

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ECHO TOPS

> **NOTE:** *Echo Tops cannot be displayed with Cloud Tops or NEXRAD data.*

Echo Tops data (Figure 6-14) shows the location, elevation, and direction of the highest radar echo. The highest radar echo does not indicate the top of a storm or clouds; rather it indicates the highest altitude at which precipitation is detected. Information is derived from NEXRAD data.
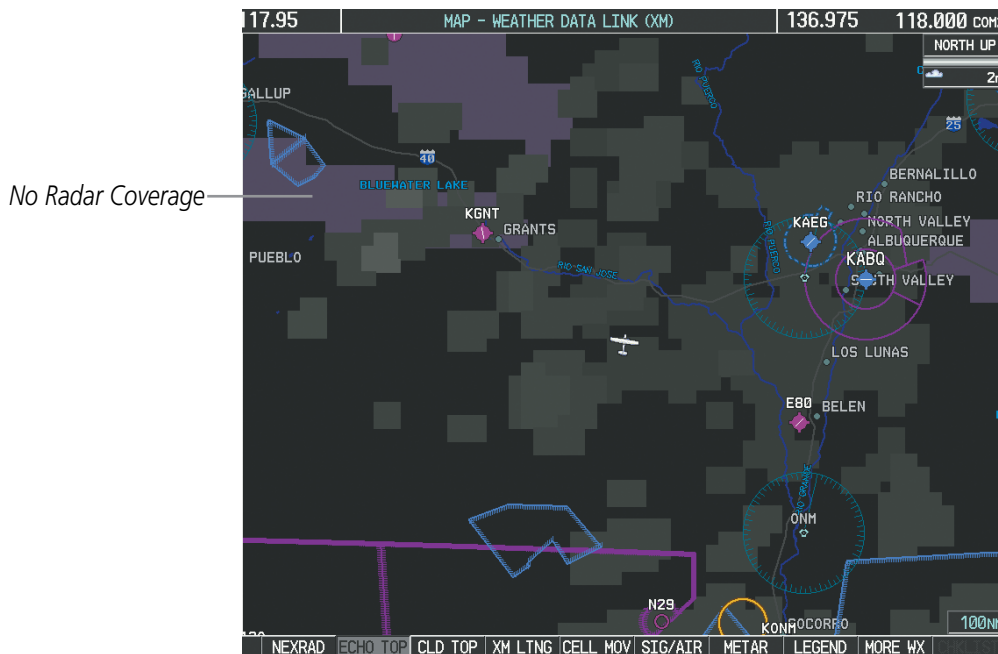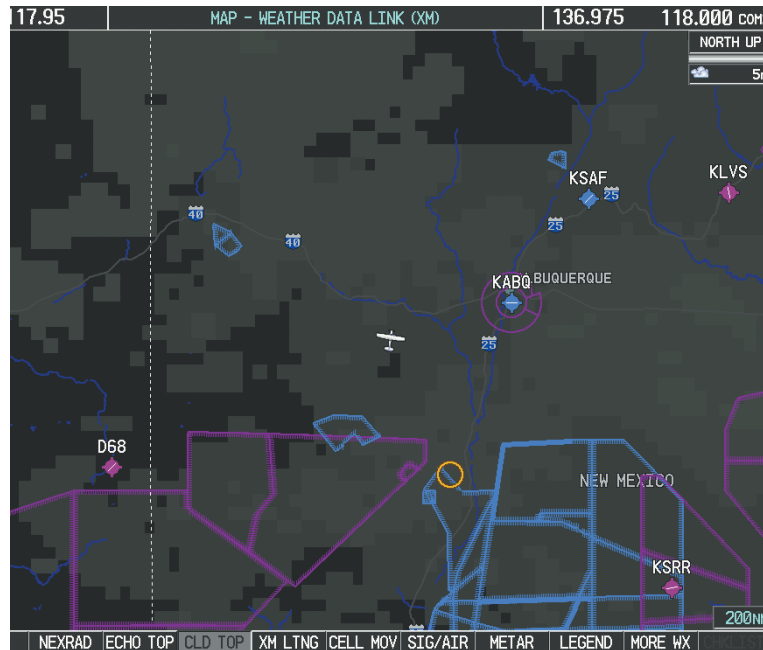

Figure 6-14 Echo Tops Data

Displaying Echo Tops information:

1) Select the Weather Data Link (XM) Page.

2) Press the **ECHO TOP** Softkey.

To display the Echo Tops legend (Figure 6-15), press the **LEGEND** Softkey when Echo Tops is selected for display. Since Echo Tops and Cloud Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Echo Tops is activated, NEXRAD and Cloud Tops data are removed.
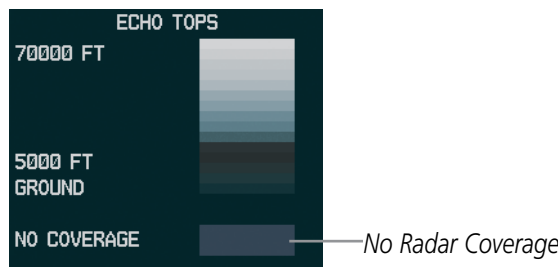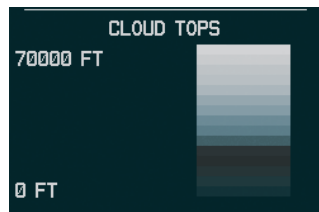

Figure 6-15 Echo Tops Legend

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The display of radar coverage is always active when either NEXRAD or Echo Tops is selected. Areas where NEXRAD radar coverage and Echo Tops information is not currently available or is not being collected are indicated in gray shade of purple (Figure 6-15).

CLOUD TOPS

✓ **NOTE:** *Cloud Tops and Echo Tops cannot be displayed at the same time.*

Cloud Tops data (Figure 6-16) depicts cloud top altitudes as determined from satellite imagery.

Figure 6-16 Cloud Tops Data

Displaying Cloud Tops information:

1) Select the Weather Data Link (XM) Page.

2) Press the **CLD TOP** Softkey.

To display the Cloud Tops legend (Figure 6-17), press the **LEGEND** Softkey when Cloud Tops is selected for display.   Since Cloud Tops and Echo Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Cloud Tops is activated, Echo Tops data is removed.

Figure 6-17 Cloud Tops Legend

XM LIGHTNING

> **NOTE:** XM Lightning cannot be displayed at the same time as optional Stormscope® lightning data.

Lightning data (Figure 6-18) shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike that has occurred within a two-kilometer region. The exact location of the lightning strike is not displayed.
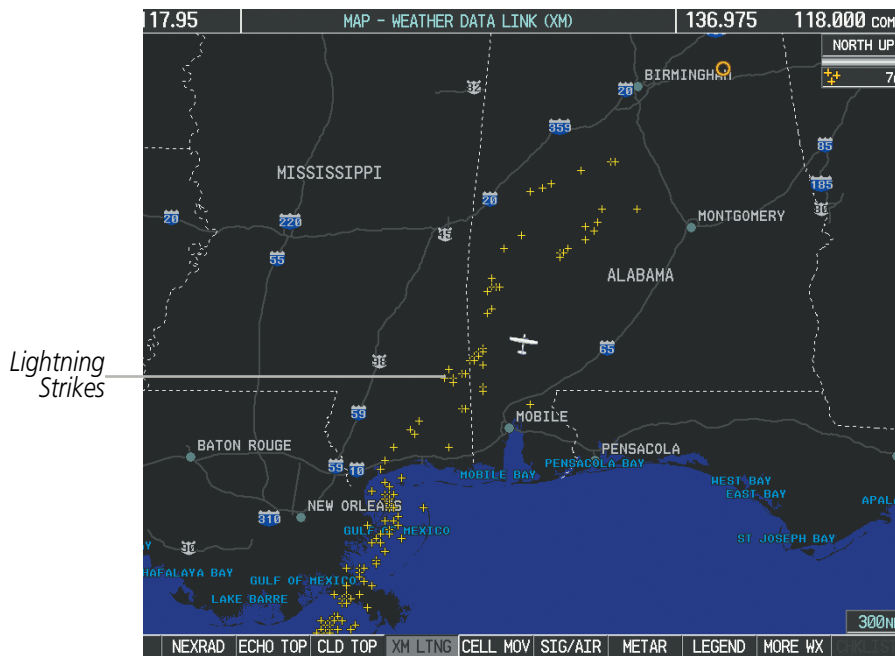

Figure 6-18 Lightning Data

XM Lightning data displays on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying XM Lightning information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the Weather Data Link (XM) Page.

2) Press the **XM LTNG** Softkey (**LTNG** Softkey on the Weather Data Link (XM) Page).

To display the XM Lightning legend on the Weather Data Link (XM) Page (Figure 6-19), press the **LEGEND** Softkey when XM Lightning is selected for display.
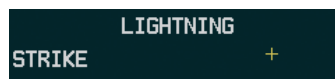

Figure 6-19 Lightning Legend

CELL MOVEMENT

Cell Movement data (Figure 6-20) shows the location and movement of storm cells as identified by the ground-based system. Cells are represented by yellow squares, with direction of movement indicated with short, orange arrows.

Storm Cells

Figure 6-20 Cell Movement Data

On most applicable maps, Cell Movement data is selected for display along with NEXRAD. On the Weather Data Link (XM) Page, Cell Movement data can be selected independently. Cell Movement data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map
- AUX - Trip Planning Page
- Nearest Pages

Displaying Cell Movement information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the Weather Data Link (XM) Page.

2) Press the **NEXRAD** Softkey (**CEL MOV** Softkey on the Weather Data Link (XM) Page). For Cell Movement to be displayed on maps other than the Weather Data Link (XM) Page, Cell Movement must be turned on in the Navigation Map Setup Menu (see "Setting Up XM Satellite Weather").

To display the Cell Movement legend on the Weather Data Link (XM) Page, (Figure 6-21), press the **LEGEND** Softkey when Cell Movement is selected for display.
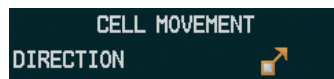

Figure 6-21 Cell Movement Legend

SIGMETS AND AIRMETS

SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) are broadcast for potentially hazardous weather. A Convective SIGMET is issued for hazardous convective weather. A localized SIGMET is a significant weather condition occurring at a localized geographical position.
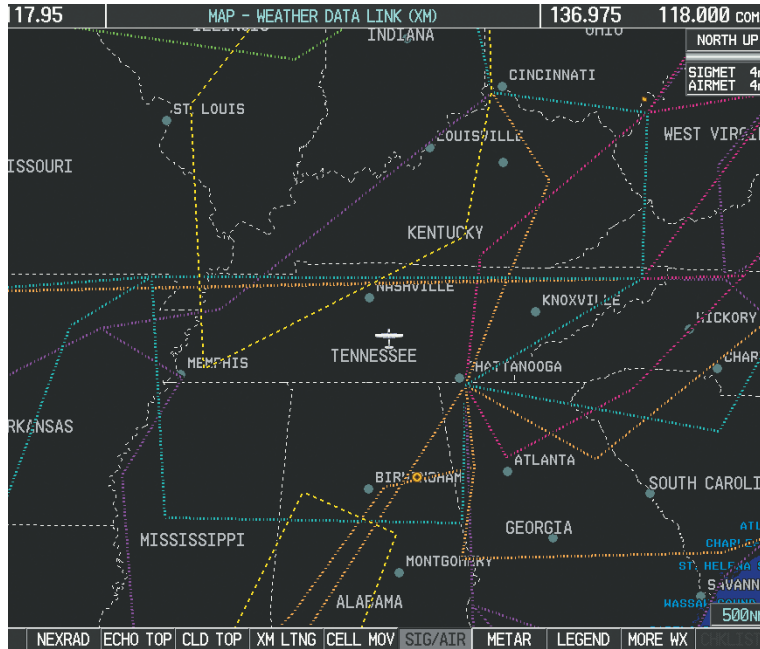

Figure 6-22 SIGMET/AIRMET Data

Displaying SIGMETs and AIRMETs:

1) Select the Weather Data Link (XM) Page.

2) Press the **SIG/AIR** Softkey.

3) To view the text of the SIGMET or AIRMET, press the **RANGE** Knob and move the Map Pointer over the icon.

4) Press the **ENT** key. Figure 6-23 shows sample SIGMET text.

To display the SIGMET and AIRMET legend (Figure 6-24), press the **LEGEND** Softkey when SIGMETs and AIRMETs are selected for display.
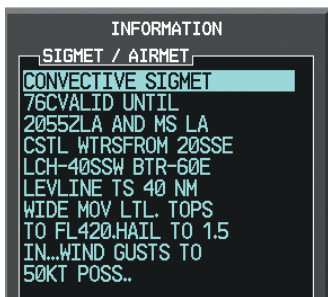

Figure 6-23 Sample SIGMET Text

Figure 6-24 SIGMET/AIRMET Legend

METARS AND TAFS

✓ **NOTE:** *Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.*

✓ **NOTE:** *METAR information is only displayed within the installed navigation database service area.*

METARs (METeorological Aerodrome Reports) typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect hourly observations; non-routine updates include the code "SPECI" in the report. METARs are shown as colored flags at airports that provide them.
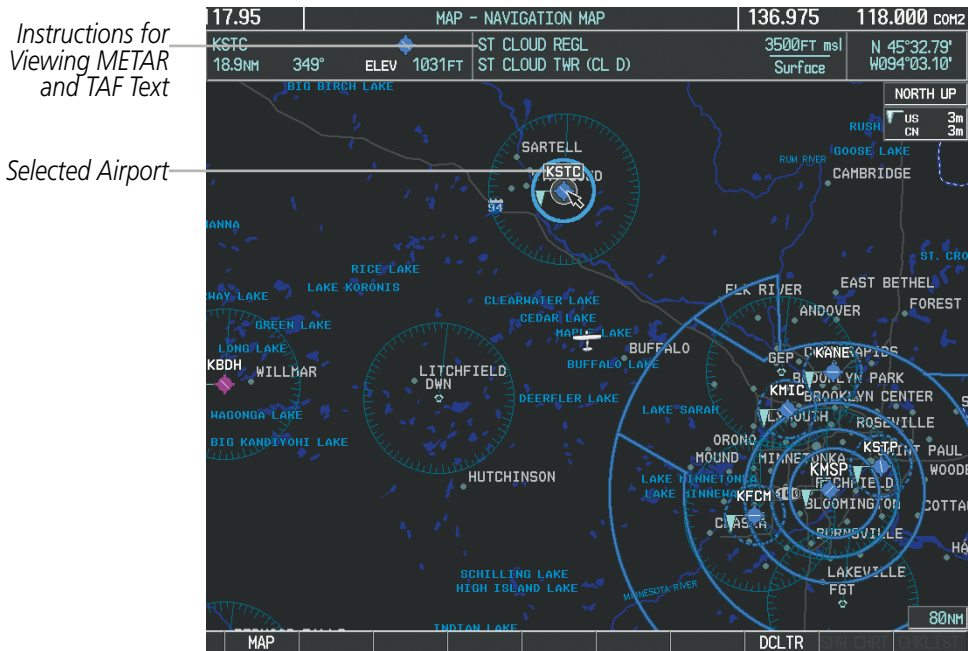

Figure 6-25 METAR Flags on the Weather Data Link Page

TAFs (Terminal Aerodrome Forecasts) are weather predictions for specific airports within a 24- hour period, and may span up to 36 hours. TAFs typically include forecast wind, visibility, weather phenomena, and sky conditions using METAR codes.

METAR and TAF text are displayed on the Weather Information Page. METAR data is displayed first in a decoded fashion, then as raw text. TAF information is displayed only in its raw form when it is available

Displaying METAR and TAF text:

1) On the Weather Data Link (XM) Page, press the **METAR** Softkey.

2) Press the **RANGE** Knob and pan to the desired airport.

3) Press the **ENT** Key. The Weather Information Page is shown with METAR and TAF text.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. METAR text must be completely scrolled through before scrolling through the TAF text.

5) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (XM) Page.

   Or:

1) Select the Weather Information Page.

   a) Turn the large **FMS** Knob to select the Waypoint Page Group.

   b) Press the **WX** Softkey to select the Weather Information Page.

2) Press the **FMS** Knob to display the cursor.

3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.
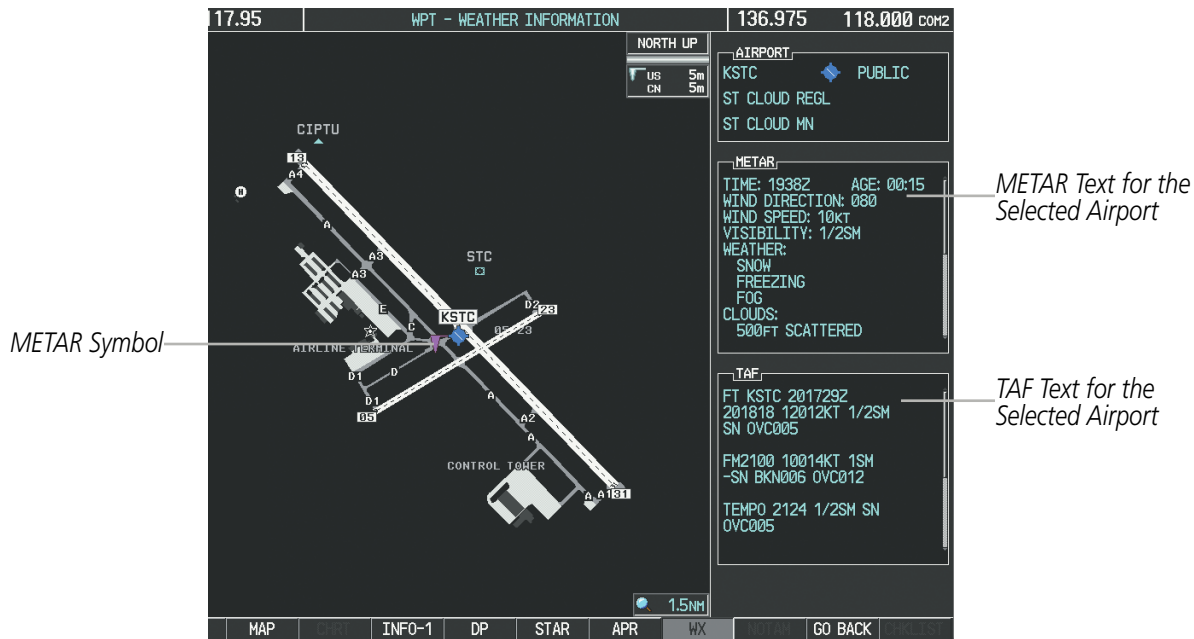

Figure 6-26 METAR and TAF Text on the Weather Information Page

To display the METAR legend on the Weather Data Link (XM) Page (Figure 6-27), press the **LEGEND** Softkey when METARs are selected for display.

The METAR flag color is determined by the information in the METAR text. A gray METAR flag is displayed when the METAR text does not contain adequate information.

Figure 6-27 METAR Legend

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SURFACE ANALYSIS AND CITY FORECAST

> **NOTE:** *Surface Analysis and City Forecast data are displayed only within the installed Aviation Database service area.*

Surface Analysis and City Forecast information is available for current and forecast weather conditions. Forecasts are available for intervals of 12, 24, 36, and 48 hours.
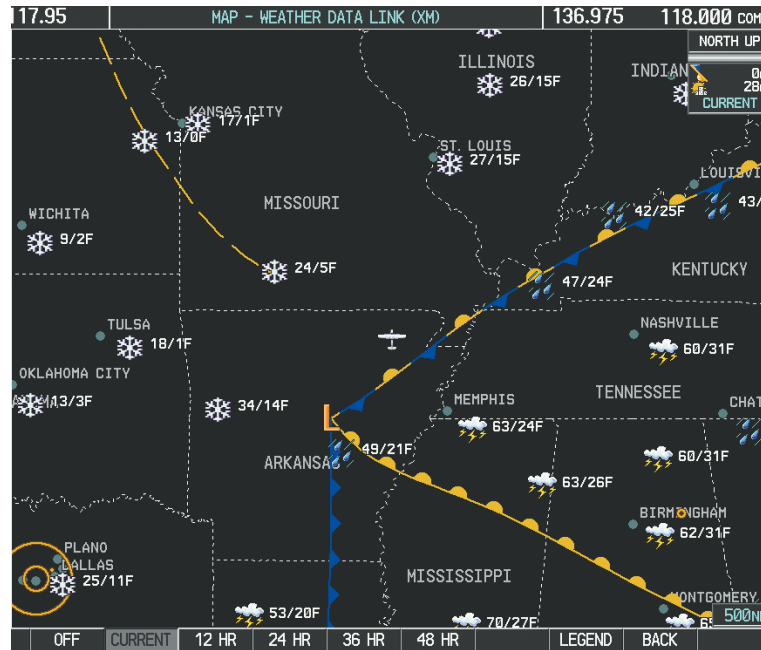

Figure 6-28 Current Surface Analysis Data

Displaying Surface Analysis and City Forecast information:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **SFC** Softkey.

4) Select the desired forecast time: **CURRENT**, **12 HR**, **24 HR**, **36 HR**, or **48 HR**. The **SFC** Softkey label changes to reflect the forecast time selected.

To display the Surface Analysis and City Forecast legend (Figure 6-29), press the **LEGEND** Softkey when Surface Analysis and City Forecast are selected to be displayed.
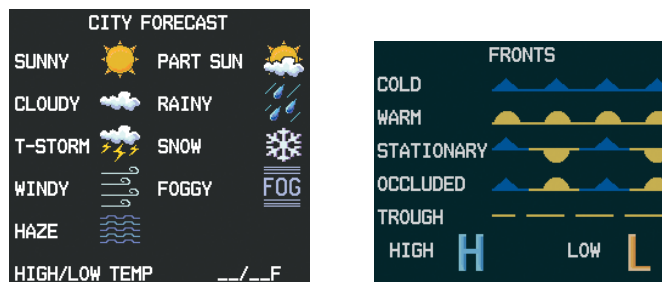

Figure 6-29 Surface Analysis Legend

FREEZING LEVELS

Freezing Level data shows the color-coded contour lines for the altitude and location at which the first isotherm is found (Figure 6-30). When no data is displayed for a given altitude, the data for that altitude has not been received, or is out of date and has been removed from the display. New data appears at the next update.
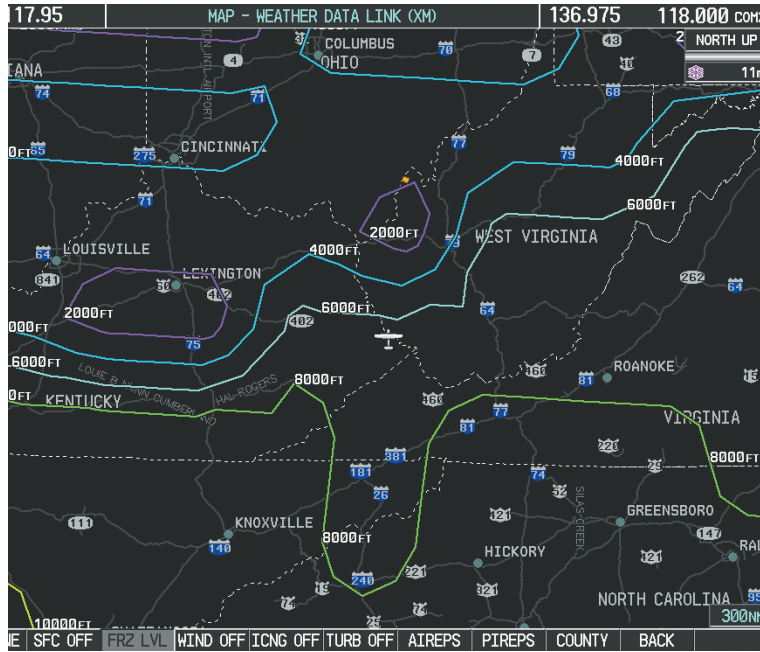

Figure 6-30 Freezing Level Data

Displaying Freezing Level information:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **FRZ LVL** Softkey.

To display the Freezing Level legend (Figure 6-31), press the **LEGEND** Softkey when Freezing Level data is selected to be displayed.
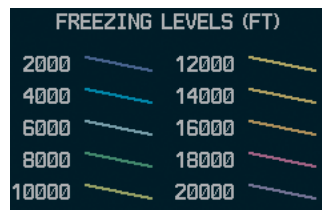

Figure 6-31 Freezing Level Legend

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WINDS ALOFT

Winds Aloft data (Figure 6-32) shows the forecasted wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3,000-foot increments from the surface up to 42,000 feet MSL.

Displaying Winds Aloft data:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **WIND** Softkey.

4) Select the desired altitude level: SFC (surface) up to 42,000 feet. Press the **NEXT** or **PREV** Softkey to cycle through the altitude softkeys. The **WIND** Softkey label changes to reflect the altitude selected.

Figure 6-32 Winds Aloft Data at 9,000 Feet

To display the Winds Aloft legend (Figure 6-33), press the **LEGEND** Softkey when Winds Aloft is selected for display.
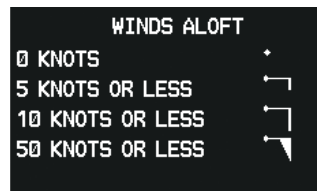

Figure 6-33 Winds Aloft Data with Legend

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Headwind and tailwind components aloft are available inside the Profile View on the Navigation Map Page (Figure 6-34). The displayed components are relative to current aircraft altitude and track, but not to aircraft speed.

Figure 6-34 Navigation Map Page with Winds Aloft Data on Profile View

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-4.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
←	→	5 knots
←	→	10 knots
←	→	50 knots

Table 6-4 Profile View Headwind/Tailwind Component Symbols

Showing/Hiding Profile View (containing winds aloft data)

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **PROFILE** Softkey.

Or:

1) Press the **MENU** Key.

2) Turn the large FMS Knob to highlight 'Show Profile View' or 'Hide Profile View' (choice dependent on current state) and press the **ENT** Key.

Winds Aloft data inside the Profile View is enabled by default when the Profile View is displayed on the Navigation Map Page. This behavior can be changed on the Navigation Map Page.

Enabling/disabling winds aloft data display in Profile View:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-35).

4) Turn the small **FMS** Knob to select the Profile Group and press the **ENT** Key (Figure 6-36).

5) Turn the large **FMS** Knob to select 'Profile Winds' (Figure 6-37).

6) Turn the small **FMS** Knob to select 'On' or 'Off'.

7) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
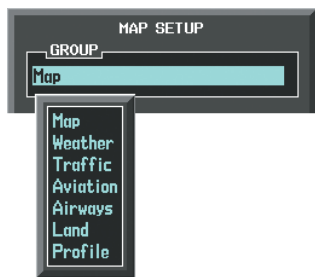
Figure 6-35 Navigation Map Page Menu

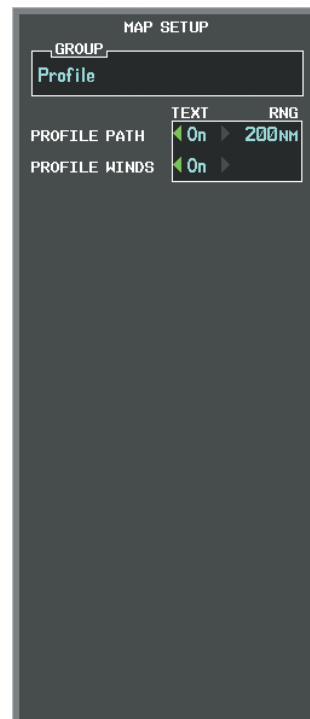**Figure 6-36 Navigation Map Page Setup Menu**

Figure 6-37 Navigation Map Page Setup Menu, Weather Group

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COUNTY WARNINGS

County data (Figure 6-38) provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on tornadoes, severe thunderstorms, and flood conditions.
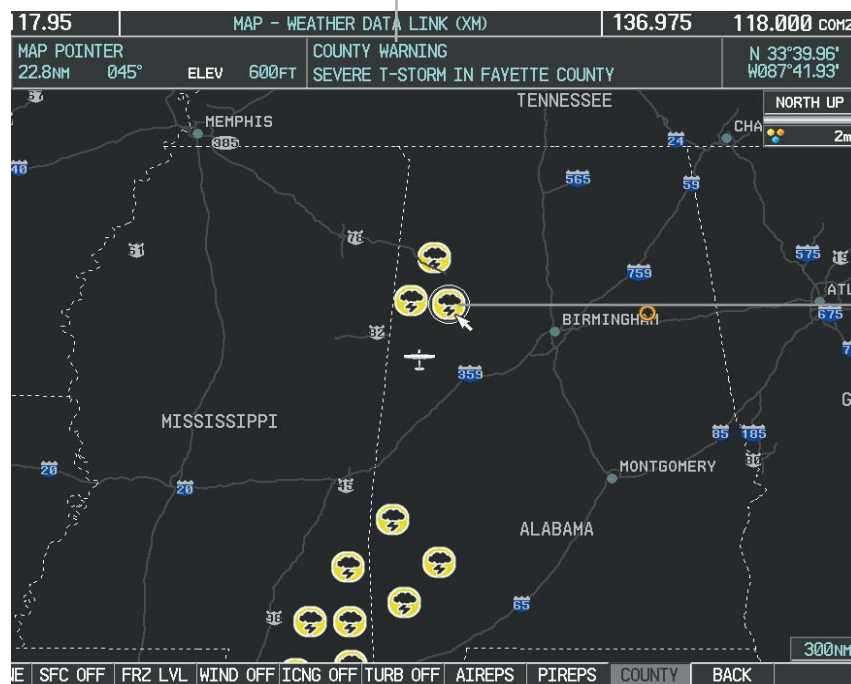
Additional Information on Thunderstorm Warning Selected with Map Pointer

Severe Thunderstorm Warning Selected

Figure 6-38 County Severe Thunderstorm Warning

Displaying County Warning information:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **COUNTY** Softkey.

To display the County Warnings legend (Figure 6-39), press the **LEGEND** Softkey when County Warnings are selected to be displayed.
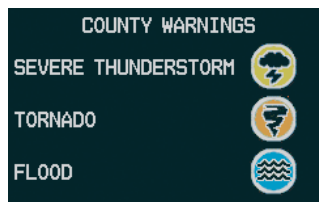

Figure 6-39 County Warnings Legend

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CYCLONE

The Cyclone weather product shows the current location of cyclones (hurricanes), tropical storms, and their projected tracks.
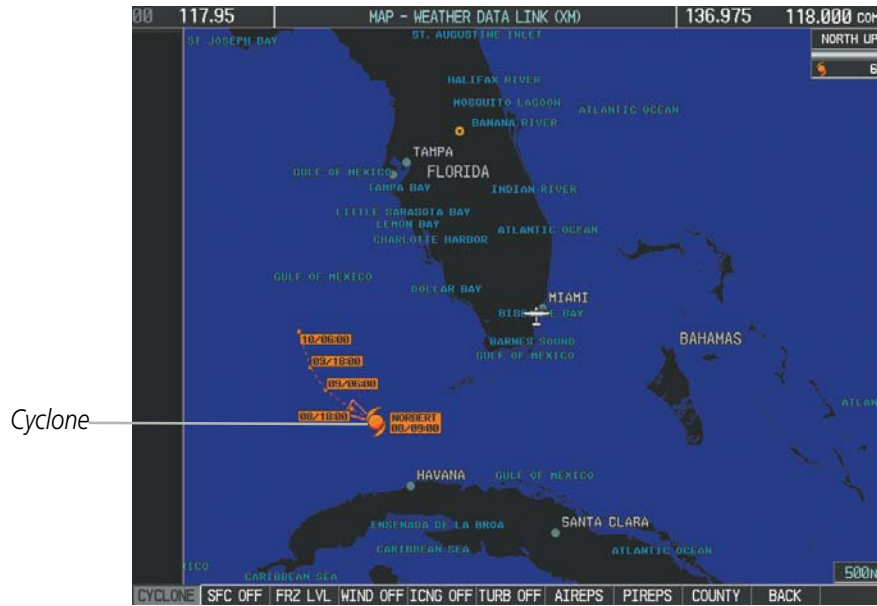

Figure 6-40 Cyclone Data Selected for Display

Displaying cyclone (hurricane) track information:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **CYCLONE** Softkey.

To display the Cyclone legend (Figure 6-41), press the **LEGEND** Softkey when Cyclones are selected to be displayed.
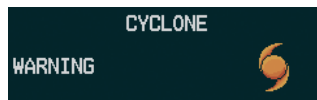

Figure 6-41 Cyclone Legend

ICING (CIP & SLD)

> **NOTE:** *Icing data cannot be displayed at the same time as NEXRAD*

Current Icing Product (CIP) data (Figure 6-42) shows a graphical view of the current icing environment. Icing severity is displayed in four categories: light, moderate, severe, and extreme (not specific to aircraft type). The CIP product is not a forecast, but a presentation of the current conditions at the time of the analysis.

Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

Displaying Icing data:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **ICNG** Softkey.

4) Select the desired altitude level: 1,000 feet up to 30,000 feet. Press the **NEXT** or **PREV** Softkey to cycle through the altitude softkeys. The **ICNG** Softkey label changes to reflect the altitude selected.
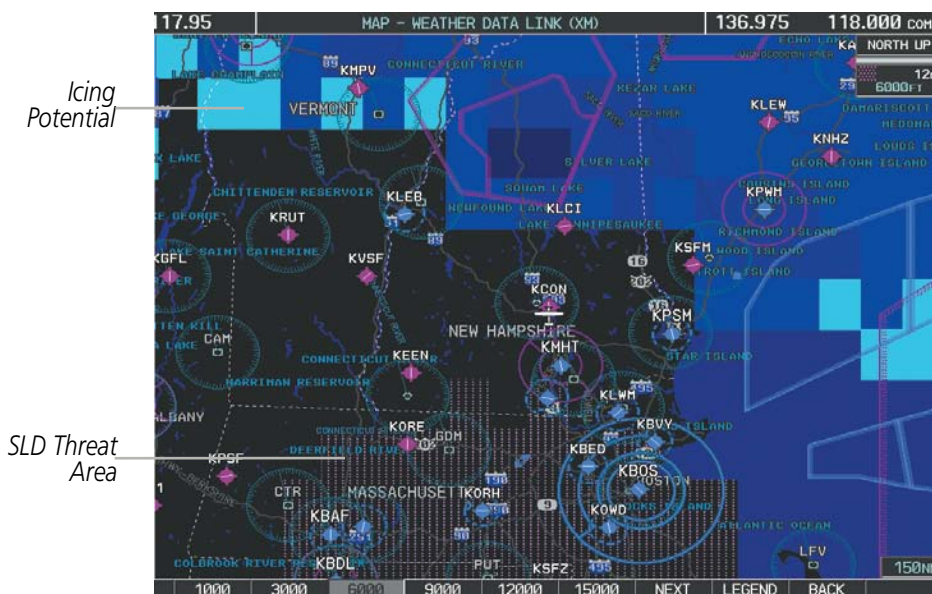

Figure 6-42 Icing Data at 6,000 Feet

To display the Icing Potential legend (Figure 6-43), press the **LEGEND** Softkey when Icing is selected for display.
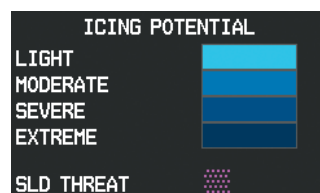

Figure 6-43 Icing Potential Legend

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TURBULENCE

> **NOTE:** *Turbulence data cannot be displayed with NEXRAD data.*

Turbulence data (Figure 6-44) identifies the potential for erratic movement of high-altitude air mass associated winds. Turbulence is classified as light, moderate, severe or extreme, at altitudes between 21,000 and 45,000 feet. Turbulence data is intended to supplement AIRMETs and SIGMETs.

Displaying Turbulence data:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **TURB** Softkey.

4) Select the desired altitude level: 21,000 feet up to 45,000 feet. Press the **NEXT** or **PREV** Softkey to cycle through the altitude softkeys. The **TURB** Softkey label changes to reflect the altitude selected.

Figure 6-44 Turbulence Data at 21,000 Feet

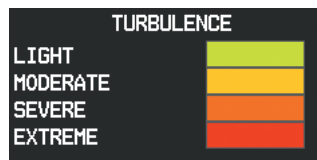To display the Turbulence legend (Figure 6-45), press the **LEGEND** Softkey when Turbulence is selected for display.

Figure 6-45 Turbulence Legend

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PIREPS AND AIREPS

Pilot Weather Reports (PIREPs) (Figure 6-46) provide timely weather information for a particular route of flight. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA).

Another type of PIREP is an Air Report (AIREP). AIREPs are used almost exclusively by commercial airlines.
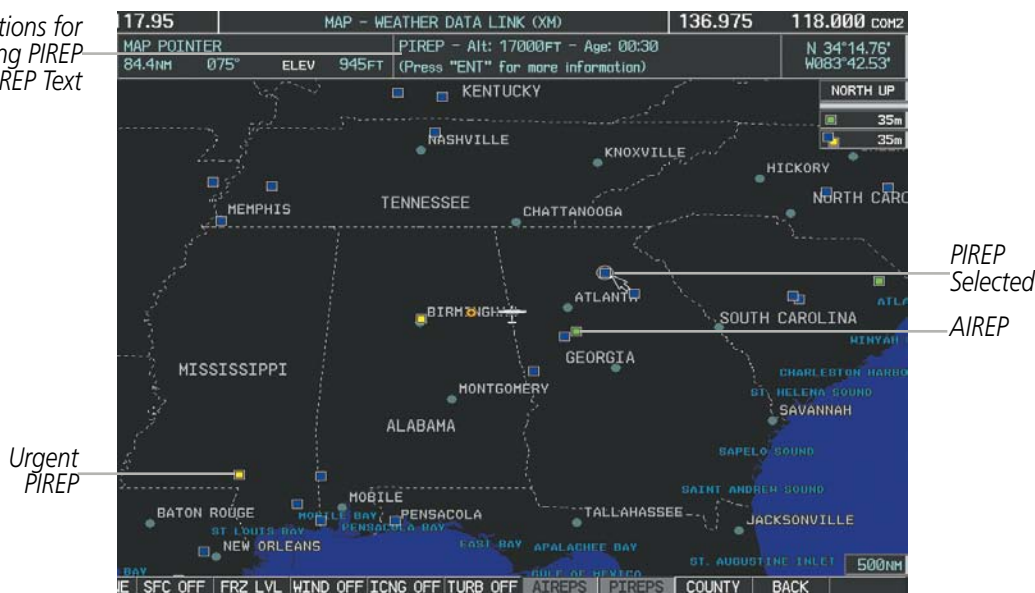

Figure 6-46 AIREPs and PIREPs on the Weather Data Link Page

Displaying PIREP and AIREP text:

1) Select the Weather Data Link (XM) Page.

2) Press the **MORE WX** Softkey.

3) Press the **AIREPS** or **PIREPS** Softkey.

4) Press the **RANGE** Knob and pan to the desired weather report. A gray circle will appear around the weather report when it is selected.

5) Press the **ENT** Key. The Weather Information Page is shown with PIREP or AIREP text. The data is first displayed in a decoded fashion, then as raw text.

6) Use the **FMS** Knob or the **ENT** Key to scroll through the PIREP or AIREP text.

7) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (XM) Page.

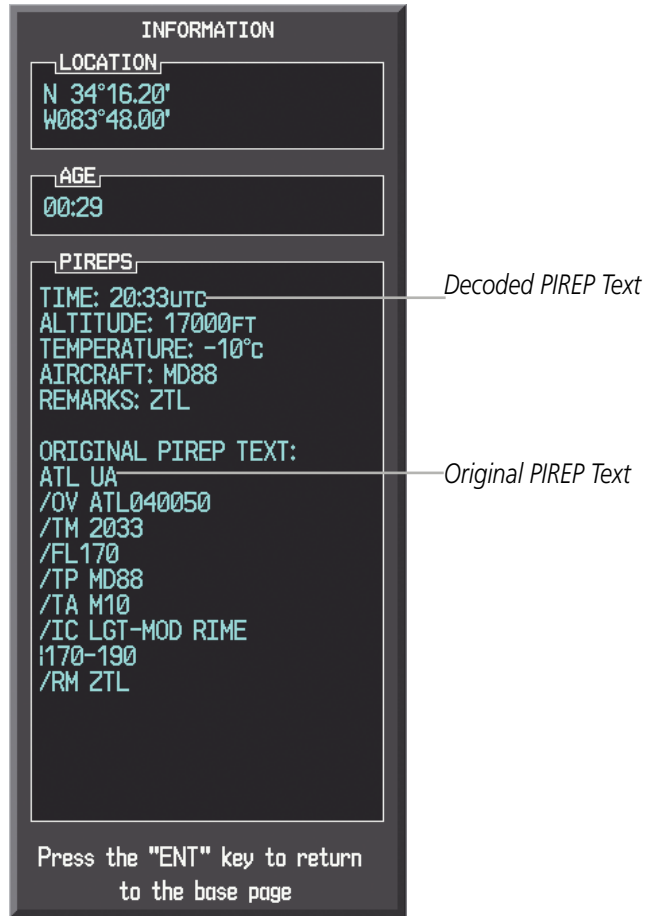*Decoded PIREP Text*

Original PIREP Text

Figure 6-47 PIREP Text on the Weather Data Link (XM) Page

To display the PIREP or AIREP legend (Figure 6-48), press the **LEGEND** Softkey when PIREPs or AIREPs are selected for display.

The PIREP color is determined by the type (routine or urgent).

Figure 6-48 AIREPs & PIREPs Legend

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TFRS

The Federal Aviation Administration (FAA) issues Temporary Flight Restrictions (TFRs) to designate areas where flight is restricted. TFRs are issued to restrict flight for a variety of reasons including national security, law enforcement, firefighting, natural disasters., airshows, and large sporting events. TFRs may be issued at any time, and TFR data displayed on the G1000 is only intended to supplement official TFR information obtained from official sources including Flight Service Stations (FSS), and air traffic control.

The age of TFR data is not shown; however, if TFR data is not available or has expired, the system displays 'TFR N/A' in the upper-left corner of maps on which TFRs can be displayed.
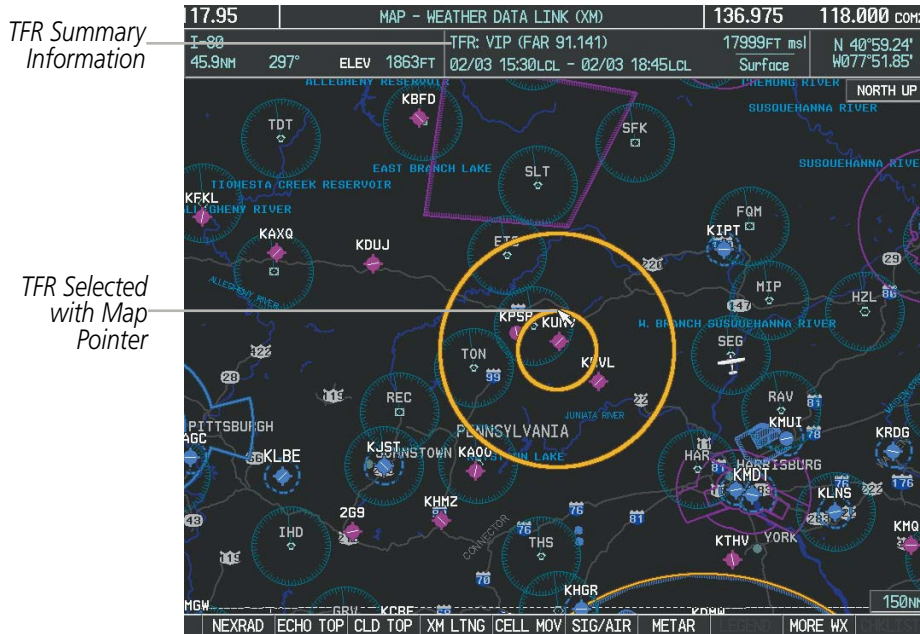
Figure 6-49 TFR Data on the Weather Data Link (XM) Page

Displaying TFR Data:

1) Select the Weather Data Link (XM) Page or Navigation Map Page.

2) Press the **RANGE** Knob and pan the map pointer over a TFR to highlight it. The system displays TFR summary information above the map.

3) Press the **ENT** Key. The system displays a pop-up menu.

4) If necessary, turn the **FMS** Knob to select 'Review Airspaces' and press the **ENT** Key. The system displays the TFR Information window.

5) Press the **FMS** Knob or the **CLR** Key to remove the TFR Information window.

Figure 6-50 Full Text for Selected TFR

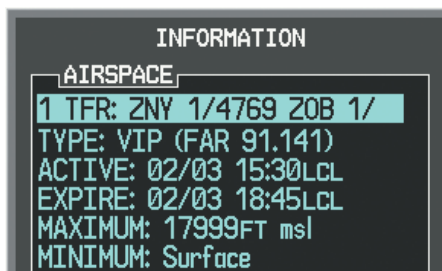The setup menus for the Navigation Map Page control the map range settings above which TFR data is decluttered from the display. If a map range larger than the TFR product map range setting is selected, the TFR product data is removed from the map.

Maps other than the Navigation Map Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing TFR data for maps on which TFR data can be displayed:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-51).

4) Turn the small **FMS** Knob to select the Aviation Group and press the **ENT** Key (Figure 6-52).

5) Turn the large **FMS** Knob to scroll to the TFR product range setting (Figure 6-53).

6) Turn the small **FMS** Knob to scroll through options (Off, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
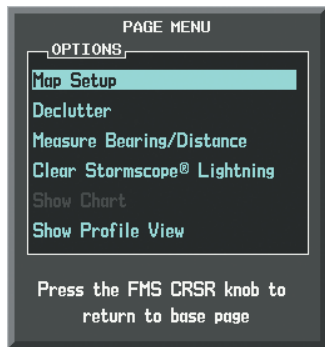
Figure 6-51 Navigation Map Page Menu

Figure 6-52 Navigation Map Page Setup Menu

Figure 6-53 Navigation Map Page Setup Menu, Aviation Group

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6.2 GFDS WORLDWIDE WEATHER

> **NOTE:** *Garmin Flight Data Services (GFDS) Worldwide Weather provides information for avoiding hazardous weather. Do not use Worldwide Weather information to penetrate hazardous weather.*

> **NOTE:** *The availability of specific GFDS weather products varies by region. For GFDS product coverage information, refer to fly.garmin.com/fly-garmin/gfds-weather.*

Garmin Flight Data Services (GFDS) provides Worldwide Weather reception capabilities to the G1000 through the optional GSR 56 Iridium satellite transceiver. Graphical weather information and associated text are displayed on the Multi Function Display (MFD) and the Primary Flight Display (PFD) Inset Map.

Weather data are provided after the pilot initiates either a manual or automatic GFDS data request on the Weather Data Link (GFDS) Page on the MFD.

Worldwide Weather requires an active Iridium satellite network account and a GFDS weather service subscription.

REGISTERING THE IRIDIUM SATELLITE SYSTEM

Before setting up an Iridium account, obtain the serial number of the Iridium Transceiver (GSR1) and the System ID by selecting the AUX- SYSTEM STATUS Page as shown in Figure 6-54. Contact Garmin Flight Data Services at 1-866-739-5687 in the United States or 913-397-8200, ext. 1135.
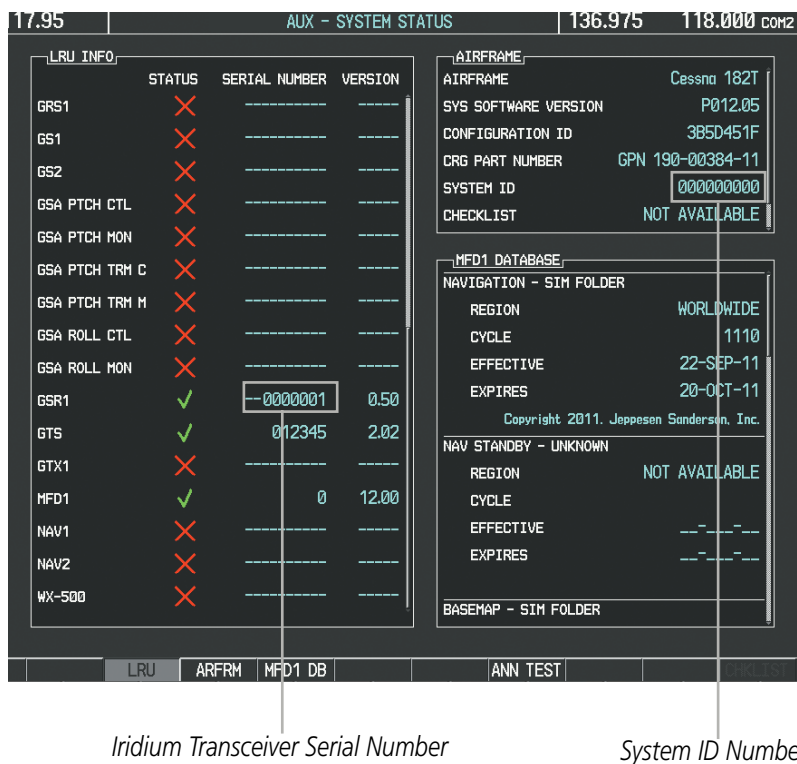

Iridium Transceiver Serial Number   *System ID Number*

Figure 6-54 Identification Needed for Iridium Registration

REGISTERING THE SYSTEM FOR GARMIN FLIGHT DATA SERVICES

When an account is established, Garmin Flight Data services provides an Access Code which must be entered on the G1000 in order to complete the registration process.

Registering the system to receive GFDS Weather:

1) With the aircraft outside and having a clear view of the sky, turn the large **FMS** Knob on the MFD to select the MAP page group.

2) Turn the small **FMS** Knob to select the MAP-WEATHER DATA LINK (GFDS or XM or FIS-B) Page. If 'XM' or 'FIS-B' is displayed in the page title, it will be necessary to change the datalink source to GFDS before continuing. Refer to 'Viewing the Weather Data Link Page' procedure to change the datalink source to GFDS prior to registration.

3) If the system displays the 'Garmin Flight Data Service Registration' window, proceed to step 7. Otherwise, press the **MENU** Key. The Page Menu window is now displayed as seen in Figure 6-55.

Figure 6-55 Select Register With GFDS

5) Turn the large **FMS** Knob to select 'Register With GFDS' in the menu list.

6) Press the **ENT** Key. The Garmin Flight Data Service Registration window is displayed as shown in Figure 6-56.

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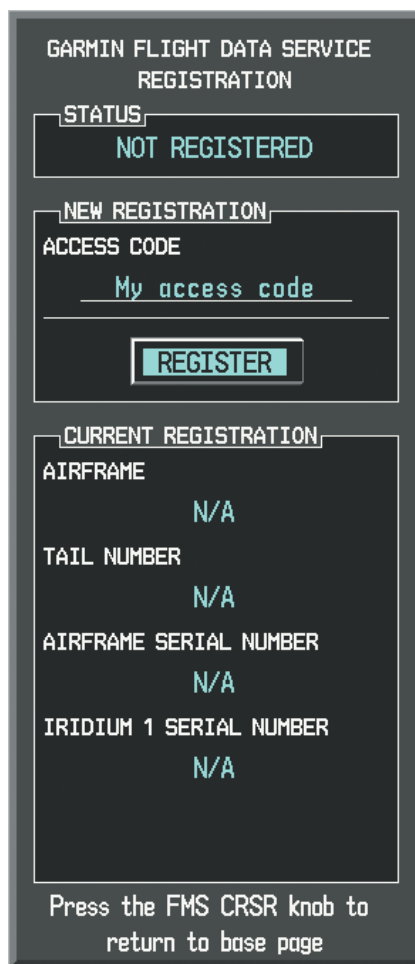
Figure 6-56 Enter Access Code

7) Enter the access code provided by Garmin Flight Data Services in the ACCESS CODE field.

8) Press the **ENT** Key. 'REGISTER' will now be highlighted as in Figure 6-56.

9) Press the **ENT** Key. The system will contact Garmin Flight Data Services. System registration is complete when 'REGISTERED' is displayed in the STATUS field.

ACCESSING GFDS WORLDWIDE WEATHER PRODUCTS

The principal map for viewing GFDS Weather data is the Weather Data Link (GFDS) Page in the Map Page Group (Figure 6-57). This is the only map display capable of showing information for all available GFDS Worldwide Weather products. No weather data is displayed until an initial GFDS Weather Data Request has been completed.

Viewing the Weather Data Link (GFDS) Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Weather Data Link (GFDS) Page.

Weather product age information

Precip Weather Product Display Enabled icon
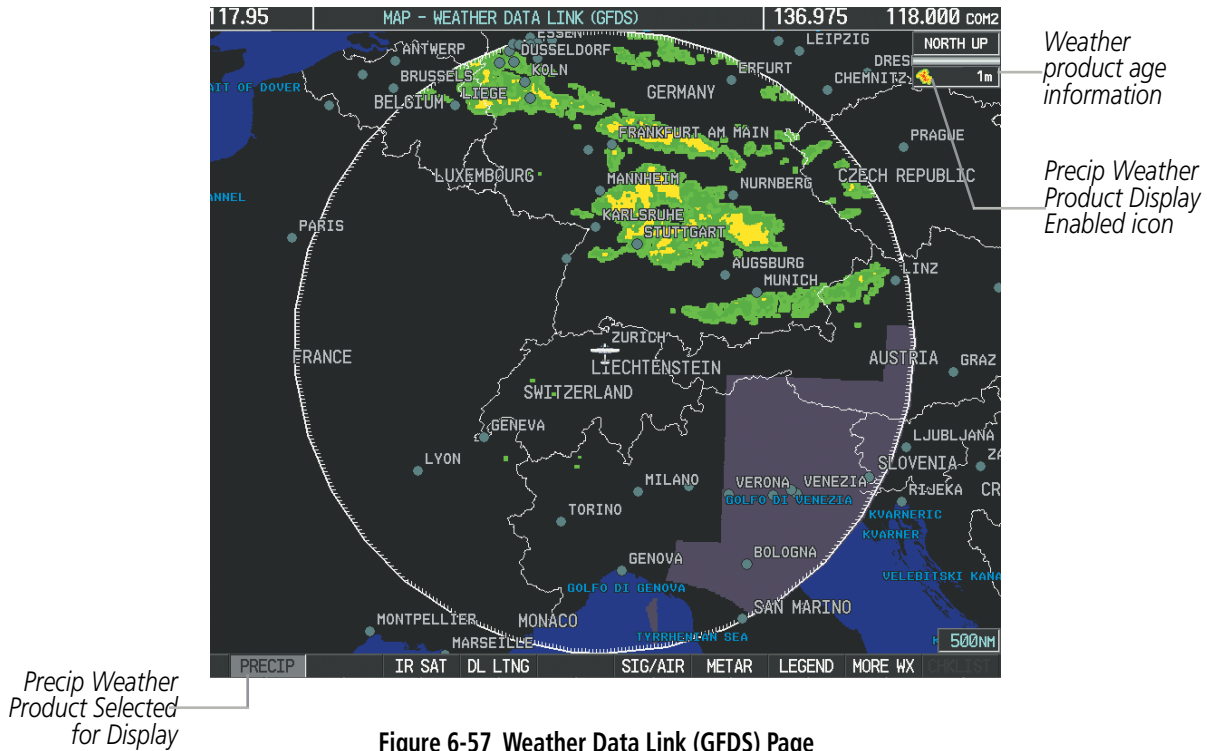
Precip Weather Product Selected for Display

Figure 6-57 Weather Data Link (GFDS) Page
(After GFDS Weather Request)

When a weather product is selected for display on the Weather Data Link (GFDS) Page, a box containing a symbol for the product and its age (in minutes) are shown in the upper right (Figure 6-57).   If weather data has not been requested yet or is not available, 'N/A' is shown next to the product symbol instead of age. The age of the weather product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are updated continuously or refreshed at specific intervals (defined in the **Refresh Rate** column in Table 6-5).

If for any reason, a weather product is not refreshed within the defined **Expiration Time** intervals (see Table 6-5), the data is considered expired and is removed from the display.   The age of the expired product is replaced by dashes. If more than half of the expiration time has elapsed, the color of the product age changes to yellow.

Table 6-5 shows the GFDS weather product symbols, the expiration time and the refresh rates. The refresh rate represents the interval at which the GFDS servers make available the most current known weather data. It does not necessarily represent the rate at which new content is received from weather sources.

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NOTE: *The availability of specific GFDS weather products varies by region. For GFDS product coverage information, refer to fly.garmin.com/fly-garmin/gfds-weather.*

Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
Radar Precipitation (PRECIP)		30	U.S.: 3* Canada: 3*† Europe: 15 Australia: 15ˆ
Infrared Satellite (IR SAT)		60	30
Datalink Lightning (DL LTNG)		30	Continuous
SIGMETs/AIRMETs (SIG/AIR)		60	Continuous
Meteorological Aerodrome Report (METARs)		90	Continuous
Winds Aloft (WIND)		60	Continuous
Pilot Weather Report (PIREPs)		90	Continuous
Temporary Flight Restrictions (TFRs)	no product image	60	Continuous
Terminal Aerodrome Reports (TAFs)	no product image	60	Continuous

* The composite precipitation image is updated every 3 minutes, but individual radar sites may take between 3 and 10 minutes to provide new data.
† Canadian radar precipitation data provided by Environment Canada.
ˆ Australian radar precipitation data provided by the Australia Bureau of Meteorology

Table 6-5 GFDS Weather Product Symbols and Data Timing

Table 6-6 shows which GFDS Weather products can be displayed (indicated with a '+' symbol) on specific G1000 maps.

GFDS Weather Product	PFD Inset Map	Navigation Map Page	Weather Data Link (GFDS) Page	Weather Information Page	AUX - Trip Planning Page	Nearest Page Group	Flight Plan Pages
Precipitation (PRECIP)	+	+	+		+	+	+
Infrared Satellite (IR SAT)			+				
Datalink Lightning (LTNG)	+	+	+		+	+	+
SIGMETs/AIRMETs (SIG/AIR)			+				
METARs	+	+	+	+	+	+	+
Winds Aloft (WIND)			+				
PIREPs			+	+			
Radar Coverage	+	+	+				
TFRs	+	+	+	+	+	+	+
TAFs			+	+			

Table 6-6 GFDS Weather Product Display Maps

Softkeys control the display of weather information on most MFD pages and the PFD Inset Map (Figure 6-58 shows the weather product softkeys for the Weather Data Link (GFDS) Page). When a weather product is selected for display, the corresponding softkey label changes to gray to indicate the product display is enabled.
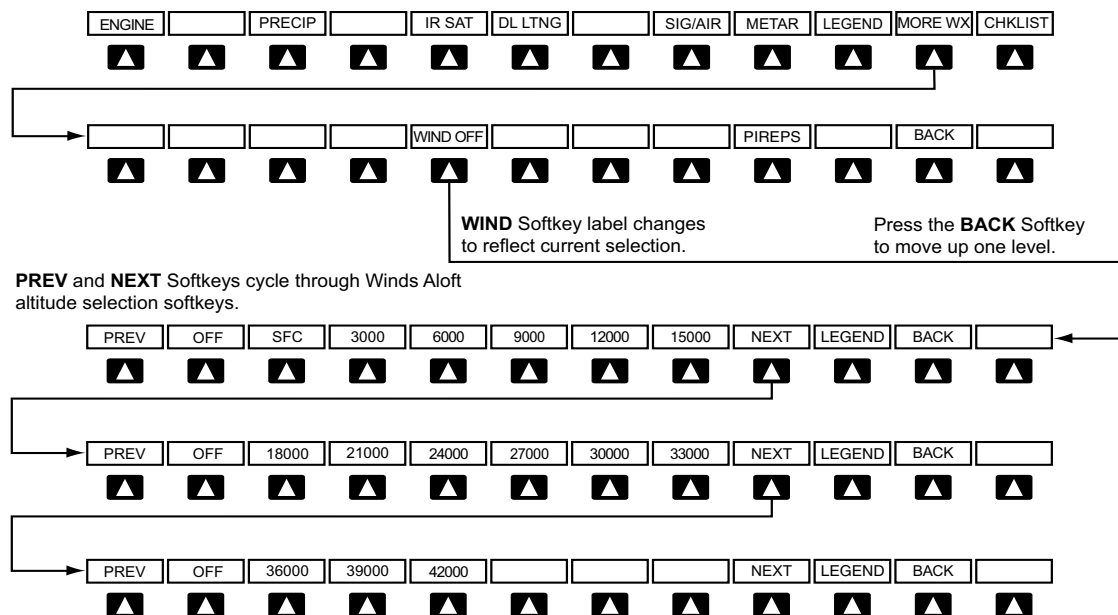
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| ENGINE | | PRECIP | | IR SAT | DL LTNG | | SIG/AIR | METAR | LEGEND | MORE WX | CHKLIST |
| ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |

| | | | | WIND OFF | | | PIREPS | | BACK | |
| ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |

WIND Softkey label changes to reflect current selection.

Press the **BACK** Softkey to move up one level.

PREV and **NEXT** Softkeys cycle through Winds Aloft altitude selection softkeys.

| PREV | OFF | SFC | 3000 | 6000 | 9000 | 12000 | 15000 | NEXT | LEGEND | BACK | |
| ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |

| PREV | OFF | 18000 | 21000 | 24000 | 27000 | 30000 | 33000 | NEXT | LEGEND | BACK | |
| ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |

| PREV | OFF | 36000 | 39000 | 42000 | | | NEXT | LEGEND | BACK | |
| ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |

Figure 6-58 GFDS Weather Product Softkeys (MFD)

The setup menus for the Navigation Map Page and the Weather Data Link (GFDS) Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The menus also provide a means in addition to the softkeys for enabling/disabling display of weather products.

Setting up and customizing the Weather Data Link (GFDS) Page:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key (Figure 6-59).

4) Turn the small **FMS** Knob to select 'Product Group 1' or 'Product Group 2', and press the **ENT** Key (Figure 6-60).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link (GFDS) Page with the changed settings.

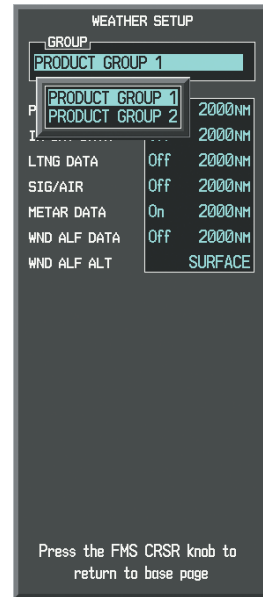**Figure 6-59 Weather Data Link (GFDS) Page Menu**

Figure 6-60 Weather Data Link (GFDS) Page Setup Menu

Restoring default Weather Data Link (GFDS) Page settings:

1)   Select the Weather Data Link (GFDS) Page.

2)   Press the **MENU** Key.

3)   With 'Weather Setup' highlighted, press the **ENT** Key.

4)   Press the **MENU** Key.

5)   Highlight the desired default(s) to restore (all or for selection) and press **ENT** Key.

The system supports three datalink weather installation options. Only one set of datalink weather products (GFDS, XM WX, or FIS-B) can be displayed at a time.

Selecting a datalink weather source (GFDS, XM WX, or FIS-B)

1)   Turn the large **FMS** Knob on the MFD to select the MAP page group.

2)   Turn the small **FMS** Knob to select the Weather Data Link Page. The currently selected weather datalink provider appears in the page title (GFDS, XM, or FIS-B). To select a difference weather source, proceed to the next step.

3)   Press the MENU Key.

4)   Turn the large **FMS** Knob to select 'Display GFDS Weather' or 'Display XM' Weather' or 'Display FIS-B Weather' (choice dependent on current weather source) and press the **ENT** Key.

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If multiple datalink weather services are installed, customizing the display settings for the corresponding weather products shown in Table 6-7 will result in identical settings for a comparable weather product from another service provider.

XM WX Product	GFDS Worldwide Weather Product	FIS-B Weather Product
Next-generation Radar (NEXRAD)	Precipitation (PRECIP)	Regional Radar Precipitation (PRECIP)
Cloud Top (CLD TOP)	Infrared Satellite (IR SAT)	Not applicable
XM Lightning (XM LTNG)	GFDS Lightning (DL LTNG)	Not applicable
SIGMETs/AIRMETs (SIG/AIR)	SIGMETs/AIRMETs (SIG/AIR)	Not applicable
Meteorological Aerodrome Report (METARs)	Meteorological Aerodrome Report (METARs)	Meteorological Aerodrome Report (METARs)
Winds Aloft (WIND)	Winds Aloft (WIND)	Not applicable
Pilot Weather Report (PIREPs)	Pilot Weather Report (PIREPs)	Not applicable

Table 6-7 Corresponding Weather Datalink Product Settings

Maps besides the Weather Data Link (GFDS) Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing weather data for the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-61).

4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key (Figure 6-62).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-63).

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

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Figure 6-61 Navigation Map Page Menu

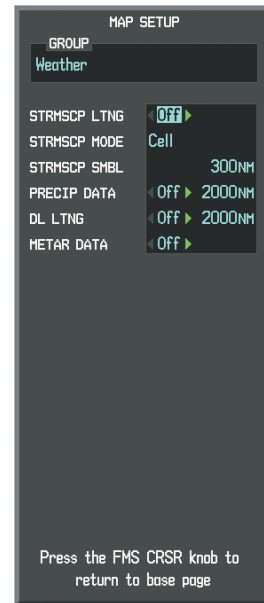**Figure 6-62 Navigation Map Page Setup Menu**

Figure 6-63 Navigation Map Page Setup Menu, Weather Group

Each active weather product has an associated legend which can be displayed on the Weather Data Link (GFDS) Page. If no weather product softkeys are selected, the **LEGEND** Softkey will be unavailable.

Viewing legends for displayed weather products

1) Select the Weather Data Link (GFDS) Page.

2) Press the **LEGEND** Softkey to display the legends for the displayed weather products.

   Or:

  a) Press the **MENU** Key.

  b) Select 'Weather Legend' and press the **ENT** Key.

3) Turn the **FMS** Knob to scroll through the legends if more are available than fit in the window.

4) To remove the Legend Window, select the **LEGEND** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about the following can be displayed by panning over the display on the map:

- Infrared Satellite (IR SAT)
- SIGMETs
- AIRMETs
- METARs
- TFRs
- PIREPs

The map panning feature is enabled by pressing the **RANGE** Knob. The map range is adjusted by turning the **RANGE** Knob. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.
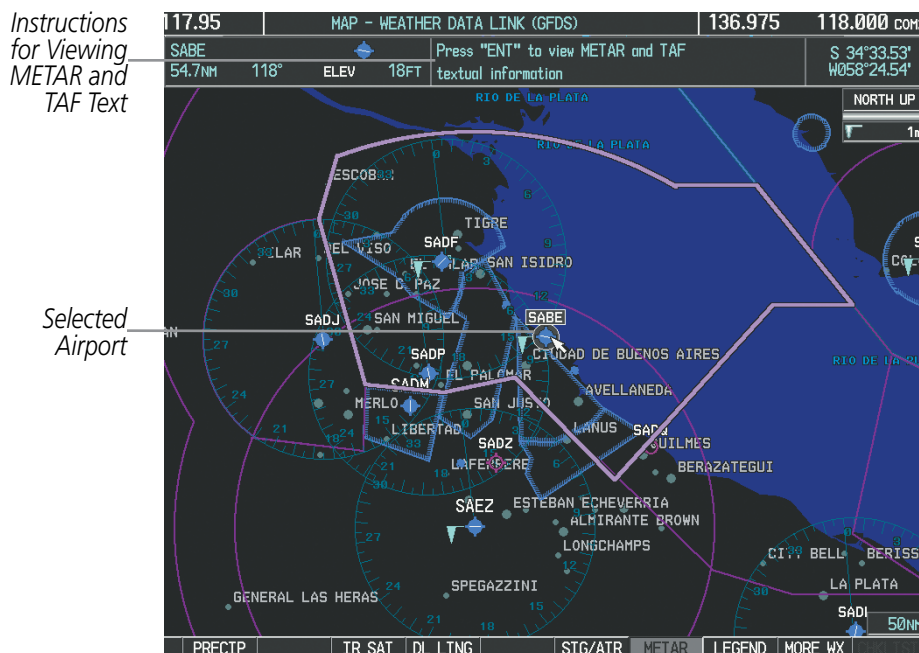
Figure 6-64 Panning on the Weather Data Link (GFDS) Page

GFDS WEATHER DATA REQUESTS

The GFDS Data Request window provides the flight crew with the options to enable or disable the requested weather coverage area(s), choose automatic weather update intervals (if desired), and the ability to send or cancel weather data requests. The status of the GFDS data request process is also displayed.

Before a GFDS data request can occur, a valid request coverage area must be defined from which all currently available GFDS weather products will be retrieved. At a minimum, either the aircraft's present position or a waypoint (as part of a flight plan or entered directly in the 'WAYPOINT' coverage field) must be part of the request coverage area, otherwise the request status window will indicate 'INVALID COVERAGE AREA' and the system will not allow a request to occur.

It is not necessary for a destination (based on an active flight plan), a flight plan, or waypoint to be specified prior to enabling these coverage areas; however no weather data will be retrieved for these option(s) until a flight plan or waypoint is provided, respectively.

Requesting GFDS weather data manually:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **MENU** Key.

3) With 'GFDS Data Request' highlighted, press the **ENT** Key (Figure 6-65).

4) Turn the large **FMS** Knob to highlight the desired coverage option(s) and press the **ENT** Key to check or uncheck one of more of the following coverage selections (Figures 6-66, 6-67):

   • PRESENT POSITION – Requests data based on current location.

   • DESTINATION – Requests data based on the active flight plan destination (Direct-To destinations excluded). See the Flight Management section for more information about entering and activating flight plans.

- FPL – Requests data along an active flight plan, if one exists. Turn the small **FMS** Knob to select the desired flight plan look-ahead distance option (or choose 'REMAINING FPL' to request the remainder of the flight plan), then press the **ENT** Key.

- WAYPOINT – Requests data based on a waypoint (which may be off-route). Turn the large and small **FMS** Knobs to enter a waypoint, then press the **ENT** Key.

5) Turn the large **FMS** Knob highlight to the 'DIAMETER / RTE WIDTH' (diameter/route width) distance field and turn the small **FMS** Knob to select the desired diameter and route width of the request, then press the **ENT** Key.

6) Turn the large **FMS** Knob until the 'SEND REQ' button is highlighted. Press the **ENT** Key to initiate the request immediately or press the **FMS** Knob to return to the Weather Data Link (GFDS) Page without requesting weather data.
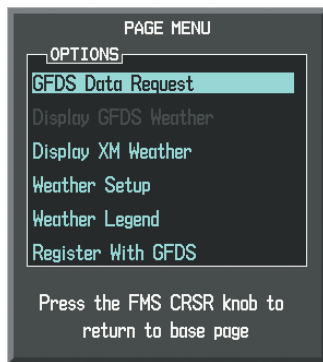

Figure 6-65 Weather Data Link (GFDS) Page Menu
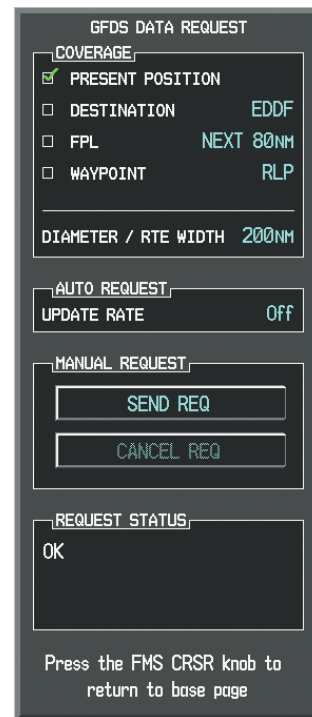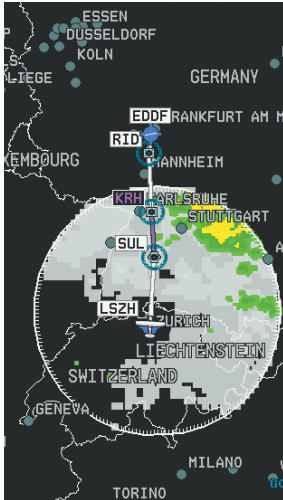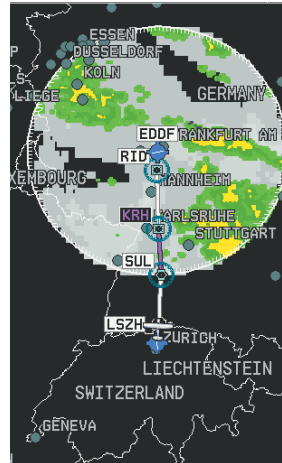

Figure 6-66 GFDS Data Request Window

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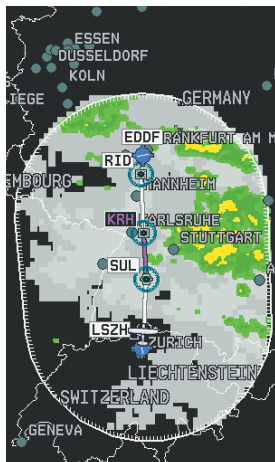HAZARD AVOIDANCE

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Present Position Selected, 200 nm Diameter Requested

Destination Selected, 200 nm Diameter Requested

Next 80 nm of Flight Plan Selected, 200 nm Route Width Requested

Off-Route Waypoint Selected, 200 nm Diameter Requested

Figure 6-67 GFDS Weather Data Request Results with Precipitation and Infrared Satellite Displayed

During a GFDS Data Request, the Request Status box initially displays "Contacting GFDS...". Once a connection is established, the Request Status Box displays "Receiving Wx Data... Time Remaining:" with an estimated data transfer time (either minutes or seconds). If desired, the GFDS Data Request window may be closed while the data request is processing by pressing the **FMS** Knob; the data request will continue to process in the background. GFDS Data Requests typically take between 1 to 4 minutes to complete depending on the size of the selected weather coverage area and Iridium signal strength.

The system retrieves all available Worldwide Weather products within the selected coverage area during an initial GFDS Data Request, regardless of which products (if any) are currently enabled for display. On subsequent requests, previously retrieved textual data (such as METARs and TAFS) is retained if it has not expired, while new textual weather data matching the current coverage area and all graphical weather data is downloaded during every data request.

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At the completion of a successful weather data request, the request status window (if still open) will indicate 'OK'.

Cancelling a GFDS Weather Data Request in Progress:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **MENU** Key.

3) With 'GFDS Data Request' highlighted, press the **ENT** Key.

4) Turn the large **FMS** Knob to select 'CANCEL REQ' and press the **ENT** Key. The request status box indicates 'Request Cancelled'.

5) Press the **FMS** Knob to return to the Weather Data Link (GFDS) Page.

The pilot can schedule GFDS data requests to recur automatically. Auto requests remain enabled until the pilot disables them, or the system power is cycled. The Request Status window will indicate a countdown timer until the next automatic data request occurs.

> **NOTE:** *If automatic GFDS data requests were enabled prior to the system entering Reversionary Mode, the automatic weather data requests will continue in Reversionary Mode, however the GFDS Data Request window and its associated options will not be available.*

Enabling/disabling automatic GFDS Data Requests:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **MENU** Key.

3) With 'GFDS Weather Request' highlighted, press the **ENT** Key.

4) Choose the desired weather coverage options.

5) Turn the large **FMS** Knob to select the 'UPDATE RATE' setting. Then turn the small **FMS** Knob to highlight the desired automatic update frequency (OFF, 5 Min, 10 Min, 15 Min, 20 Min, 25 Min, 30 Min, 45 Min, or 60 Min), then press the **ENT** Key.

6) The 'SEND REQ" button is highlighted and a countdown timer is displayed in the 'REQUEST STATUS' based on the currently selected update rate. Press the **ENT** Key to immediately send an immediate GFDS Data Request.

   Or:

   Press the **FMS** Knob to return to the Weather Data Link (GFDS) Page.

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WORLDWIDE WEATHER PRODUCTS

PRECIPITATION

Precipitation (PRECIP) data is not real-time. The lapsed time between collection, processing, and dissemination of radar images can be significant and may not reflect the current radar synopsis. Due to the inherent delays and the relative age of the data, it should be used for long-range planning purposes only.
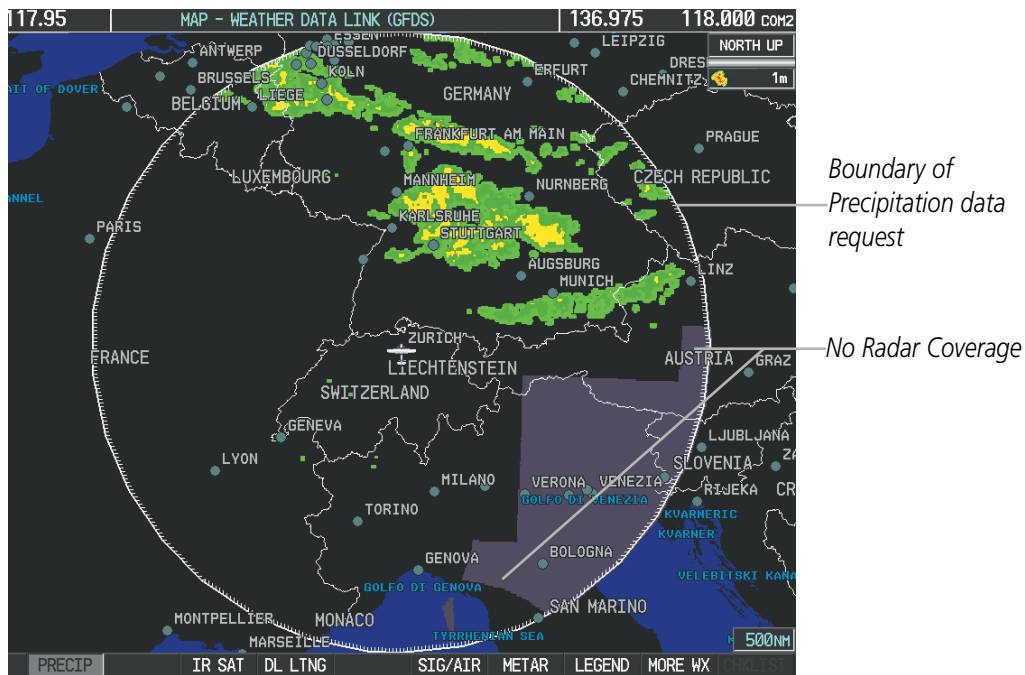

Boundary of Precipitation data request

No Radar Coverage

Figure 6-68 Precipitation Data on the Weather Data Link (GFDS) Page

Precipitation data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link (GFDS) Page
- Airport Information Page

- Trip Planning Page
- Nearest Pages
- Flight Plan Pages
- AUX - Video Page

Displaying Precipitation weather information:

1) Select the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey). This step is not necessary on the Weather Data Link (GFDS) Page.

2) Press the **PRECIP** Softkey.

Radar data shown represents lowest level, base reflectivity, of radar returns. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the Weather Data Link (GFDS) Page. For the Precipitation legend (Figure 6-69), press the **LEGEND** Softkey when Precipitation is selected for display.
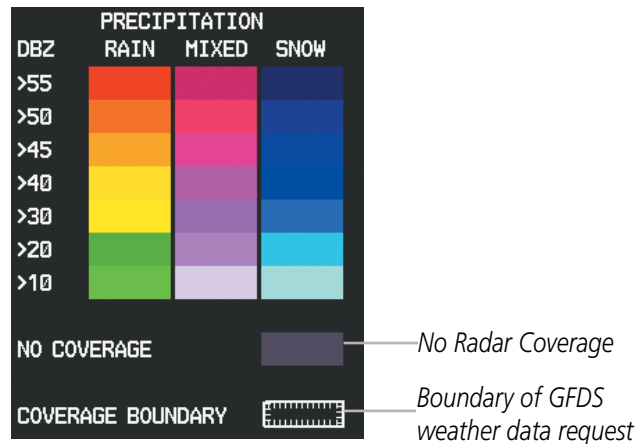
Figure 6-69 Precipitation Data Legend

The display of radar coverage is enabled when Precipitation is selected for display. Areas where precipitation radar coverage is not currently available or is not being collected are indicated in gray shade of purple. A white boundary line with white tick marks depicts the selected coverage area of the GFDS weather data request. This boundary encloses the precipitation data when this weather product is displayed.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the Precipitation display directly correlate to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different radar echo intensities are measured in decibels (dB) relative to reflectivity (Z). Weather radars measure the reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

PRECIPITATION LIMITATIONS

Radar images may have certain limitations:

• Radar base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.

• Radar base reflectivity is sampled at the minimum antenna elevation angle. An individual radar site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.

• When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers.

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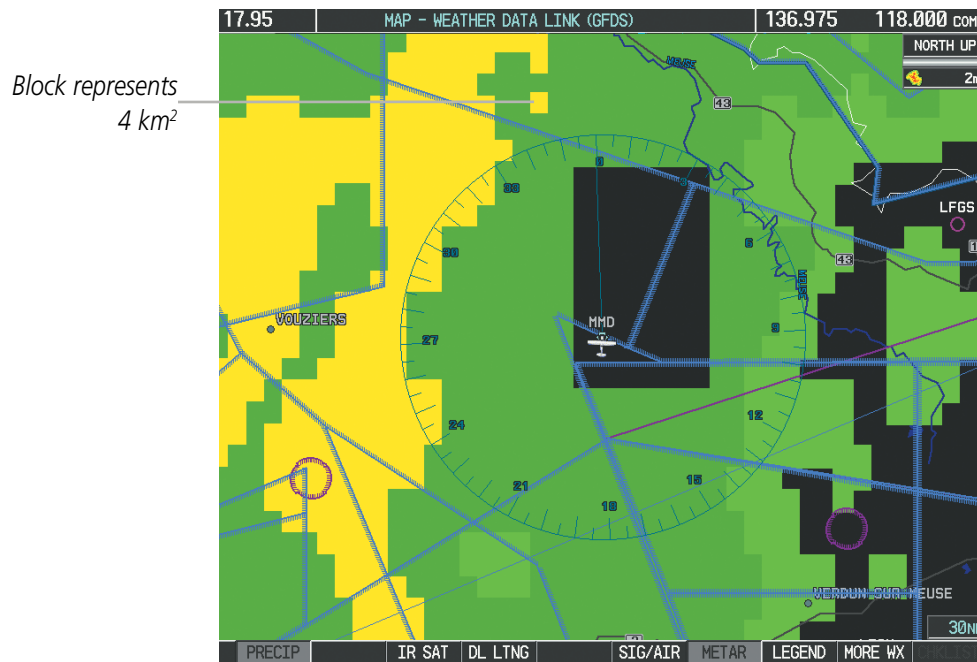*Block represents 4 km²*

Figure 6-70 Precipitation Data - Zoomed

The following may cause abnormalities in displayed radar images:

- Ground clutter

- Strobes and spurious radar data

- Sun strobes (when the radar antenna points directly at the sun)

- Interference from buildings or mountains, which may cause shadows

- Metallic dust from military aircraft, which can cause alterations in radar scans

INFRARED SATELLITE

Infrared Satellite (IR SAT) data (Figure 6-71) depicts cloud top temperatures from satellite imagery. Brighter cloud top colors indicate cooler temperatures occurring at higher altitudes.

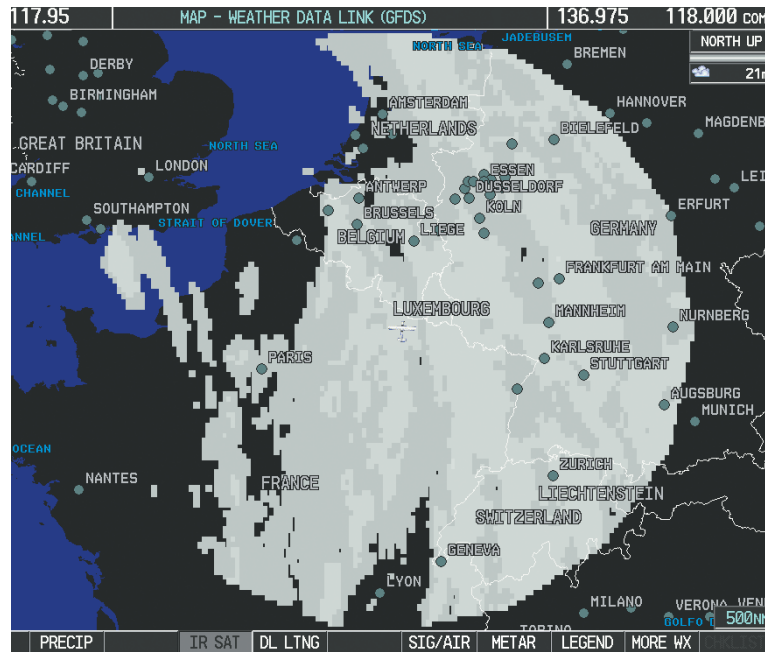**Figure 6-71 Infrared Satellite Data on the Weather Data Link (GFDS) Page**

Displaying Cloud Tops information:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **IR SAT** Softkey.

To display the Infrared Satellite legend (Figure 6-72), select the **LEGEND** Softkey when Infrared Satellite data is selected for display.

Figure 6-72 Infrared Satellite Legend

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DATALINK LIGHTNING

Datalink Lightning (DL LTNG) data (Figure 6-73) shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike that has occurred within a two-kilometer region. Neither cloud-to-cloud nor the exact location of the lightning strike is displayed.
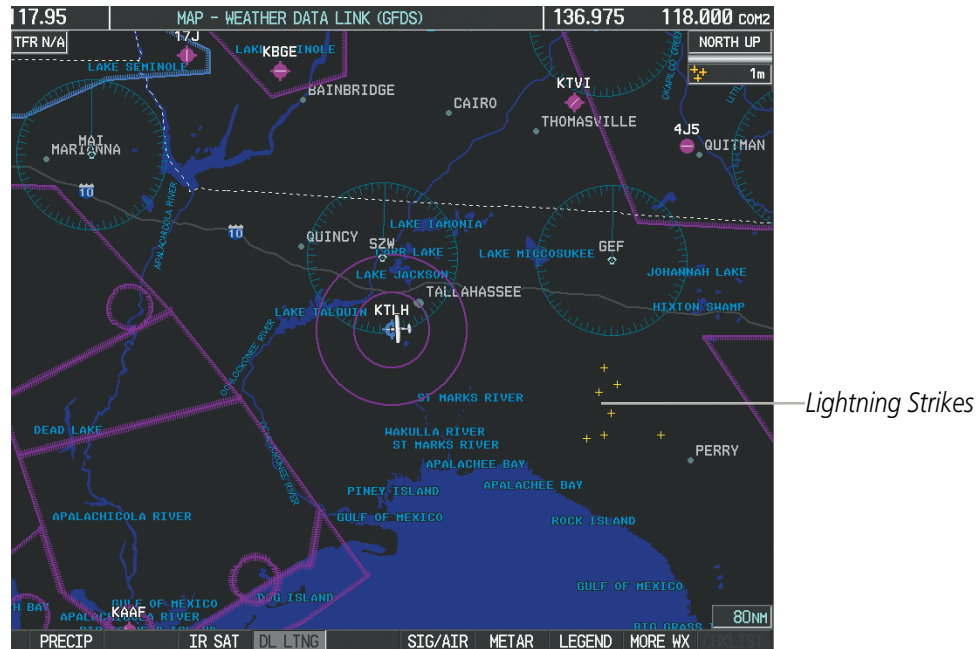
Figure 6-73 Datalink Lightning

Datalink Lightning data displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link Page
- AUX - Video Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying Datalink Lightning information:

1) Press the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey). This step is not necessary on the Weather Data Link (GFDS) Page.

2) Press the **DL LTNG** Softkey.

To display the Datalink Lightning legend on the Weather Data Link (GFDS) Page (Figure 6-74), select the **LEGEND** Softkey when Datalink Lightning is selected for display.

Figure 6-74 Datalink Lightning Legend

SIGMETS AND AIRMETS

SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) are issued for potentially hazardous weather. A Convective SIGMET is issued for hazardous convective weather s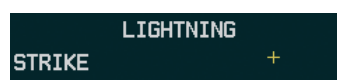uch as severe or widespread thunderstorms. A localized SIGMET can be displayed when significant weather conditions are not widespread.

The entire SIGMET or AIRMET is displayed as long as any portion of it is issued within the coverage area of the GFDS data request.

Instructions for Viewing SIGMET/AIRMET Text

SIGMET

Figure 6-75 SIGMET/AIRMET Data

Displaying SIGMETs and AIRMETs:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **SIG/AIR** Softkey.

3) To view the text of the SIGMET or AIRMET, press the **RANGE** Knob and move the Map Pointer over the icon.

4) Press the **ENT** key. Figure 6-76 shows sample SIGMET text.

To display the SIGMET and AIRMET legend (Figure 6-77), select the **LEGEND** Softkey when SIGMETs and AIRMETs are selected for display.

Figure 6-76 Sample SIGMET Text

Figure 6-77 SIGMET/AIRMET Legend

METARS AND TAFS

> **NOTE:** Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.

> **NOTE:** METAR information is only displayed within the installed navigation database service area.

METARs (METeorological Aerodrome Reports) typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect hourly observations; non-routine updates include the code "SPECI" in the report. METARs are shown as colored flags at airports that provide them.

Figure 6-78 METAR Flags on the Weather Data Link Page

TAFs (Terminal Aerodrome Forecasts) are weather predictions for specific airports within a 24-hour period, and may span up to 36 hours. TAFs typically include forecast wind, visibility, weather phenomena, and sky conditions using METAR codes.

METAR and TAF text are displayed on the Weather Information Page. METAR data is displayed first in a decoded fashion, then as raw text. TAF information is displayed only in its raw form when it is available

Displaying METAR and TAF text:

1) On the Weather Data Link (XM) Page, press the **METAR** Softkey.

2) Press the **RANGE** Knob and pan to the desired airport.

3) Press the **ENT** Key. The Weather Information Page is shown with METAR and TAF text.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. METAR text must be completely scrolled through before scrolling through the TAF text.

5) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (XM) Page.

Or:

1) Select the Weather Information Page.

    a) Turn the large **FMS** Knob to select the Waypoint Page Group.

    b) Press the **WX** Softkey to select the Weather Information Page.

2) Press the **FMS** Knob to display the cursor.

3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.

Figure 6-79 METAR and TAF Text on the Weather Information Page

Raw METAR text is also accessible while panning the map cursor over a METAR flag on any map page on which a METAR is displayed. The METAR text is shown in a box near the METAR flag.

In addition, METAR flags and their associated text are displayed on the Active Flight Plan Page on the MFD. METAR flags appears next to waypoints in the flight plan with an associated METAR. A solid light blue METAR flag indicates the METAR observations are available for a specific waypoint; a hollow light blue METAR flag indicates an off-route METAR near the waypoint is available. When off-route METAR text is displayed, the system provides additional information as to the origin, distance, and direction of the report in relation to the selected flight plan waypoint.

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Displaying raw METAR text on the Active Flight Plan Page:

1) Select the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob to activate the cursor.

3) Turn the large **FMS** Knob to highlight the desired waypoint. The METAR text will appear in the 'SELECTED WAYPOINT WEATHER' window below.

4) When finished, press the **FMS** Knob to remove the cursor or press the **FPL** Key to exit the Active Flight Plan Page.

To display the METAR legend on the Weather Data Link (XM) Page (Figure 6-80), press the **LEGEND** Softkey when METARs are selected for display.

The METAR flag color is determined by the information in the METAR text. A gray METAR flag is displayed when the METAR text does not contain adequate information.

Figure 6-80 METAR Legend

WINDS ALOFT

Winds Aloft data (Figure 6-81) shows the forecasted wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3,000-foot increments up to 42,000 feet MSL.

Displaying Winds Aloft data:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **MORE WX** Softkey.

3) Press the **WIND** Softkey.

4) Select the desired altitude level: SFC (surface) up to 42,000 feet. Select the **NEXT** or **PREV** Softkey to cycle through the altitude softkeys. The **WIND** Softkey label changes to reflect the altitude selected.

Figure 6-81 Winds Aloft at 3,000 Feet

To display the Winds Aloft legend (Figure 6-82), press the **LEGEND** Softkey when Winds Aloft is selected for display.
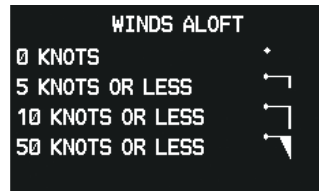

Figure 6-82 Winds Aloft Data with Legend

Headwind and tailwind components aloft are available inside the Profile View on the Navigation Map Page (Figure 6-83). The displayed components are relative to current aircraft altitude and track, but not to aircraft speed.

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Figure 6-83 Navigation Map Page with Winds Aloft Data on Profile View

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-8.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-8 Profile View Headwind/Tailwind Component Symbols

Showing/Hiding Profile View (containing winds aloft data)

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

2) Press the **PROFILE** Softkey.

Or:

1) Press the **MENU** Key.

2) Turn the large FMS Knob to highlight 'Show Profile View' or 'Hide Profile View' (choice dependent on current state) and press the **ENT** Key.

Winds Aloft data inside the Profile View is enabled by default when the Profile View is displayed on the Navigation Map Page. This behavior can be changed on the Navigation Map Page.

Enabling/disabling winds aloft data display in Profile View:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-84).

4) Turn the small **FMS** Knob to select the Profile Group and press the **ENT** Key (Figure 6-85).

5) Turn the large **FMS** Knob to select 'Profile Winds' (Figure 6-86).

6) Turn the small **FMS** Knob to select 'On' or 'Off'.

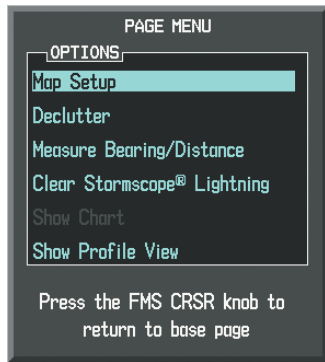**7)** Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

Figure 6-84 Navigation Map Page Menu

Figure 6-85 Navigation Map Page Setup Menu

Figure 6-86 Navigation Map Page Setup Menu, Weather Group

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PIREPS

Pilot Weather Reports (PIREPs) describe in-flight weather encountered by pilots. A PIREP may contain unforecast adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, turbulence, and type of aircraft flown. PIREPs are issued as either Routine (UA) or Urgent (UUA).

Instructions for Viewing PIREP Text

Urgent PIREP
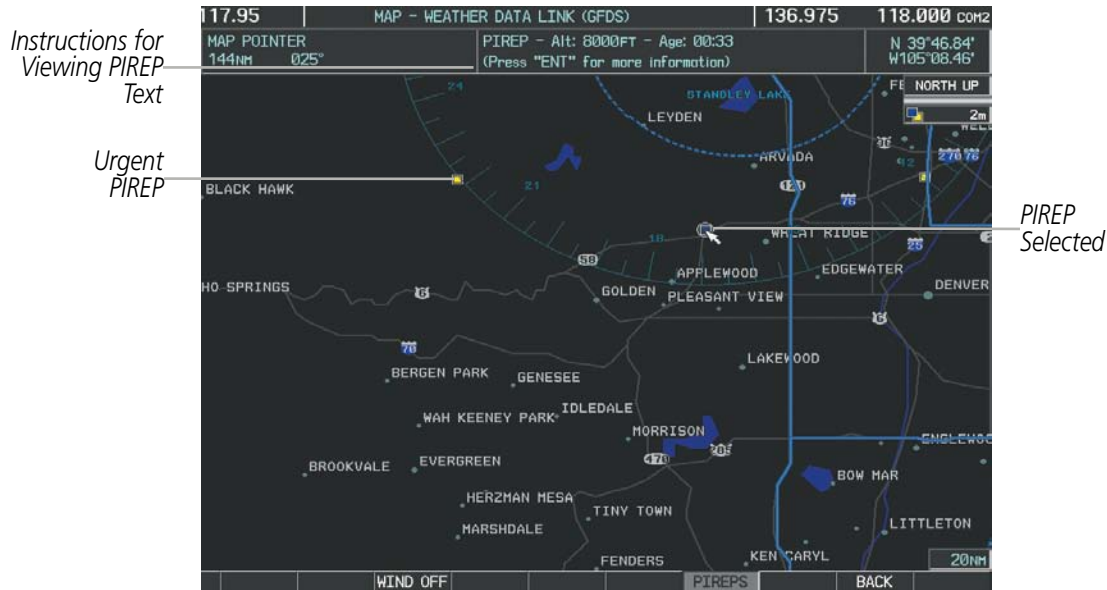
PIREP Selected

Figure 6-87 PIREPs on the Weather Data Link (GFDS) Page

Displaying PIREP text:

1) Select the Weather Data Link (GFDS) Page.

2) Press the **MORE WX** Softkey.

3) Press the **PIREPS** Softkey.

4) Press the **RANGE** Knob and pan to the desired weather report. A gray circle will appear around the weather report when it is selected.

5) Press the **ENT** Key. The PIREP tex is first displayed in a decoded fashion, then as raw text.

6) Use the **FMS** Knob or the **ENT** Key to scroll through the PIREP text.

7) Press the **FMS** Knob or the **CLR** Key to close the PIREP text window and return to the Weather Data Link (GFDS) Page.

Decoded PIREP Text
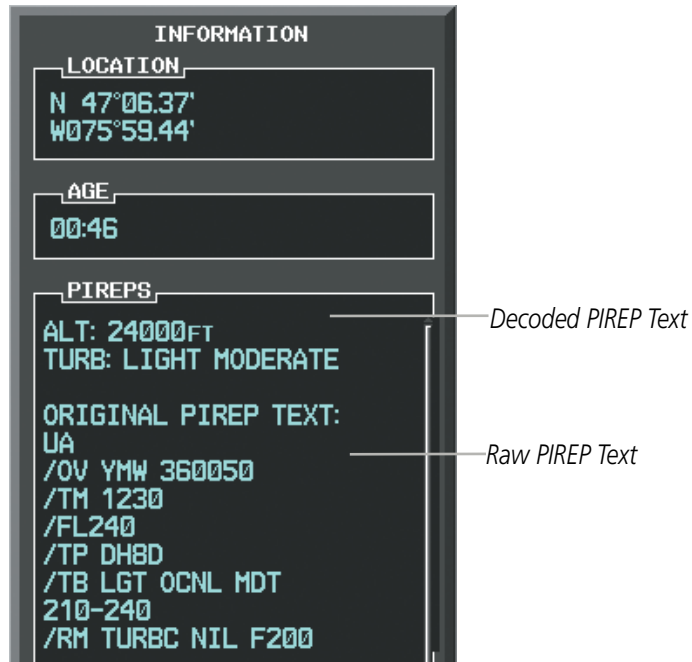
Raw PIREP Text

Figure 6-88 PIREP Text on the Weather Data Link (GFDS) Page

To display the PIREP legend (Figure 6-89), press the **LEGEND** Softkey when PIREPs are selected for display. The PIREP color is determined by the type (routine or urgent).

Figure 6-89 AIREPs & PIREPs Legend

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TFRS

✓ **NOTE:** *Temporary Flight Restriction (TFR) data from GFDS is only available in the United States (not including any U.S. territories.) Refer to fly.garmin.com/fly-garmin/gfds-weather for GFDS product coverage information.*

In the United States, the Federal Aviation Administration (FAA) issues Temporary Flight Restrictions (TFRs) to designate areas where flight is restricted. TFRs are issued to restrict flight for a variety of reasons including national security, law enforcement, firefighting, natural disasters., airshows, and large sporting events. TFRs may be issued at any time, and TFR data displayed on the G1000 is only intended to supplement official TFR information obtained from Flight Service Stations (FSS), and air traffic control.

The age of TFR data is not shown; however, if TFR data is not available or has expired, the system displays 'TFR N/A' in the upper-left corner of maps on which TFRs can be displayed.
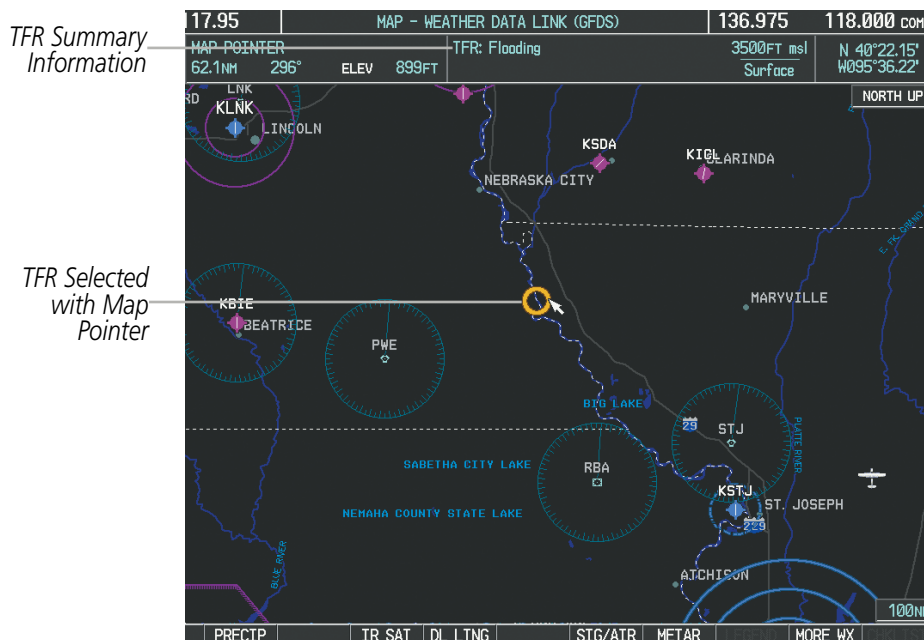
Figure 6-90 TFR Data on the Weather Data Link (XM) Page

Displaying TFR Data:

1) Select the Weather Data Link (GFDS) Page or Navigation Map Page.

2) Press the **RANGE** Knob and pan the map pointer over a TFR to highlight it. The system displays TFR summary information above the map.

3) Press the **ENT** Key. The system displays a pop-up menu.

4) If necessary, turn the **FMS** Knob to select 'Review Airspaces' and press the **ENT** Key. The system displays the TFR Information window (Figure 6-91).

5) Press the **FMS** Knob or the **CLR** Key to remove the TFR Information window.

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Figure 6-91 Full Text for Selected TFR

The setup menus for the Navigation Map Page control the map range settings above which TFR data is decluttered from the display. If a map range larger than the TFR product map range setting is selected, the TFR product data is removed from the map.

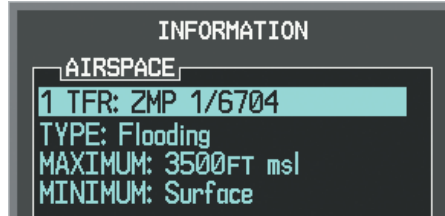Maps other than the Navigation Map Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing TFR data for maps on which TFR data can be displayed:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-92).

4) Turn the small **FMS** Knob to select the Aviation Group and press the **ENT** Key (Figure 6-93).

5) Turn the large **FMS** Knob to scroll to the TFR product range setting (Figure 6-94).

6) Turn the small **FMS** Knob to scroll through options (Off, range settings).

7) Press the **ENT** Key to select an option.

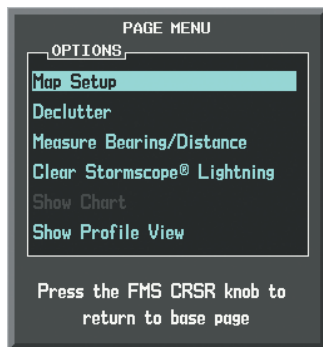8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

Figure 6-92 Navigation Map Page Menu

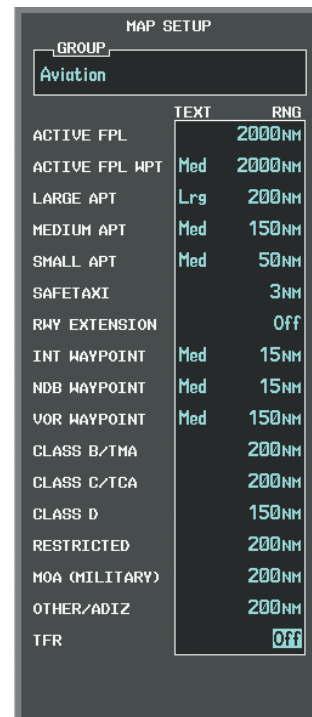**Figure 6-93 Navigation Map Page Setup Menu**

Figure 6-94 Navigation Map Page Setup Menu, Weather Group

ABNORMAL OPERATIONS

If the system cannot complete a GFDS weather data request, one or more messages will appear in the request status window.

Weather Request Status Message	Desciption
Auto requests inhibited Send manual request to reset.	The system has disabled automatic weather data requests due to excessive errors. Automatic weather data requests have stopped. Send a manual weather data request to resume automatic updates.
Auto update retry: ## Seconds	The system will attempt another automatic weather data request after an error occurred during the previous request. Timer counts down until the next automatic request occurs.
GFDS Comm Error [2]	A communications error has occurred with the GIA. The G1000 should be serviced.
GFDS Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or a GIA is off-line.
GFDS Comm Error [5]	The Iridium or GFDS networks are not accessible. Check Iridium signal strength. If this error persists, the G1000 should be serviced.
GFDS Comm Error [6]	A communications error has occurred. It this error persists, the G1000 should be serviced.
GFDS Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the data request.
GFDS Comm Error [8]	A server error has occurred or invalid data received.
GFDS Login Invalid	There is a problem with the GFDS registration. Contact Garmin Flight Data Services at 1-866-739-5687 in the United States or 913-397-8200, ext. 1135 for assistance.
GFDS Server Temporarily Inop	The GFDS weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
GFDS Server Inop	The GFDS weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The weather data request coverage area does not contain at least one of the following: a waypoint, a flight plan, or a flight plan destination. Verify at least one of the coverage options is enabled (checked) and contains required criteria, then re-send the data request.
NO GFDS Subscription	The system is not be currently subscribed to GFDS, or the access code is incorrect. Verify the access code. Contact Garmin Flight Data Services at 1-866-739-5687 in the United States or 913-397-8200, ext. 1135 for assistance.
Reduce Request Area	The GFDS weather data request area exceeds size limits. Reduce weather coverage area and re-send data request.
Request Cancelled	The user has cancelled a GFDS weather data request.
Requested area too large. Reduce coverage area.	The size of the GFDS weather data request has exceeded limits. Reduce the size of the coverage area and try the weather data request again.
Request Failed - Try Again	The weather data request timed-out. Re-send data request.

Table 6-9 Abnormal GFDS Request Status Messages

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WORLDWIDE WEATHER IN REVERSIONARY MODE

When the system is operating in Reversionary Mode, only those weather products which can be displayed on the PFD Inset map will be available for display (see Table 6-6 for a list of weather products and their associated map availability).

If manual weather data requests were enabled prior to entering Reversionary Mode, no new GFDS weather data can be retrieved while operating in Reversionary Mode. If automatic weather data requests were enabled prior to Reversionary Mode operation, the system will continue the automatic data requests in Reversionary Mode (provided automatic requests have not been inhibited due to a system error).

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6.3 FIS-B WEATHER

> **NOTE:** *The Flight Information Service - Broadcast (FIS-B) weather data provides information for avoiding hazardous weather. Do not use FIS-B information to penetrate hazardous weather.*

The optional GDL 90 receives Flight Information Services - Broadcast (FIS-B) weather data from a network of UAT (Universal Access Transceiver) ground-based transmitters.   The system displays FIS-B graphical weather information and associated text on the Multi Function Display (MFD) and the Primary Flight Display (PFD) Inset Map.

FIS-B weather data reception requires the aircraft being within range and line-of-sight of an operating ground-based transceivers (GBT) broadcasting FIS-B weather data. Reception may be affected by factors including altitude or terrain.

Reception of FIS-B weather data occurs automatically without any pilot action. FIS-B broadcasts provide weather data in a repeating cycle which may take approximately ten minutes to transmit all available weather data. Therefore, not all available weather data may be available immediately upon initial FIS-B signal acquisition.

USING FIS-B WEATHER PRODUCTS

The primary map for viewing FIS-B Weather data is the Weather Data Link (FIS-B) Page in the Map Page Group.

Viewing the Weather Data Link (FIS-B) Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Weather Data Link (FIS-B, XM, or GFDS) Page.

3) If the page title displays a weather datalink source other than 'FIS-B', such as 'XM' or 'GFDS', proceed to the following steps to change the weather datalink source.

4) Press the **MENU** Key.

5) Turn the small **FMS** Knob to select 'Display FIS-B Weather' and press the **ENT** Key. The page title will display 'MAP - WEATHER DATA LINK (FIS-B)' to indicate FIS-B is now the selected weather datalink source.
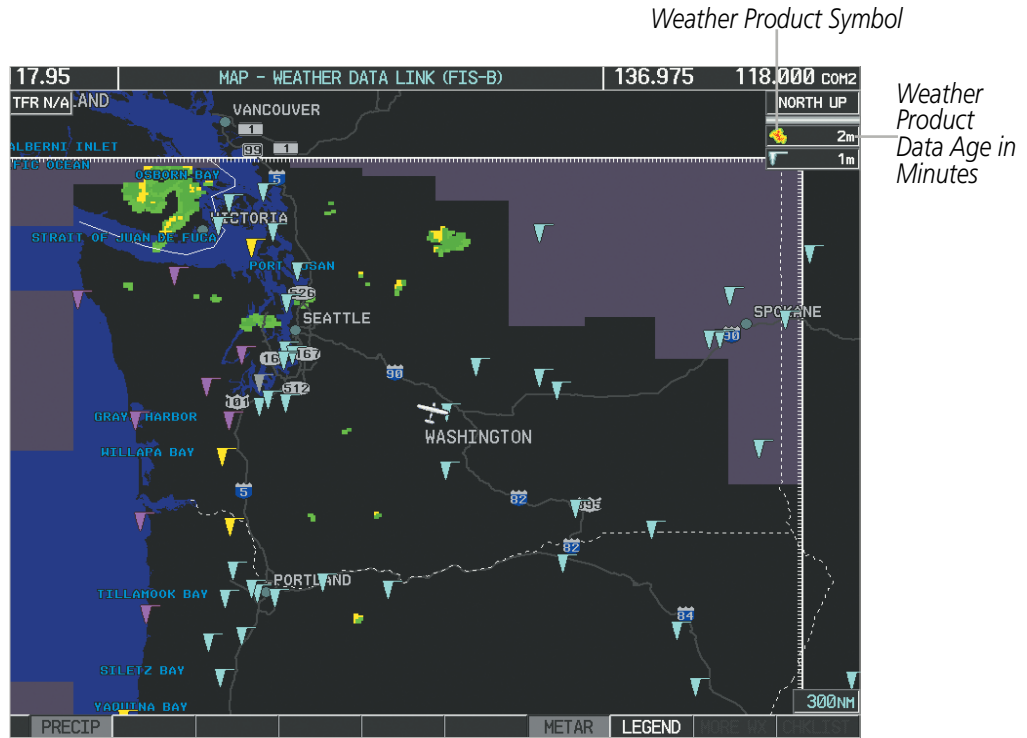
Figure 6-95 Weather Data Link (FIS-B) Page

When a FIS-B weather product is active on a map, the age of the data is displayed on the screen to the right of the product symbol (Figure 6-95). The age of the product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are refreshed at specific intervals (defined in the **Refresh Rate** column in Table 6-10).

If for any reason, a weather product is not refreshed within the **Expiration Time** intervals (see Table 6-10), the data is considered expired and is removed from the display. This ensures that the displayed data is consistent with FIS-B broadcast data. If more than half of the expiration time has elapsed, the color of the product age displayed changes to yellow. The system displays dashes instead of a product age when a product has expired. If a weather product is not available or has not been received, the system displays 'N/A' instead of a product age.

Table 6-10 shows the FIS-B weather product symbols, the expiration time and the refresh rate. The refresh rate represents the interval at which FIS-B GBTs broadcast new signals that may or may not contain new weather data. It does not represent the rate at which weather data is updated or new content is received by the GDL 90.

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FIS-B Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
Regional Radar Precipitation (PRECIP)		30	2.5
Meteorological Aerodrome Report (METARs)		90	5
Radar Coverage (RADAR CVRG)	no product image	30	2.5
Terminal Aerodrome Reports (TAFs)	no product image	60	10

Table 6-10 Weather Product Symbols and Data Timing

Table 6-11 shows which FIS-B weather products can be displayed (indicated with a '+' symbol) on specific maps.

FIS-B Weather Product	PFD Inset Map	Navigation Map Page	Weather Data Link (XM) Page	Weather Information Page	AUX - Trip Planning Page	AUX - Video Page	Nearest Page Group	Flight Plan Pages
PRECIP	+	+	+		+	+	+	+
METARs	+	+	+	+	+	+	+	+
TAFs			+	+				

Table 6-11 FIS-B Weather Product Display Maps

Softkeys control the display of weather information on most MFD pages and the PFD Inset Map (Figure 6-96) shows the weather product softkeys for the Weather Data Link (FIS-B) Page). When a weather product is selected for display, the corresponding softkey label changes to gray.

| ENGINE | | PRECIP | | | | | METAR | LEGEND | MORE WX | CHKLIST |

Figure 6-96 Weather Data Link Weather Product Softkeys (FIS-B)

The system can display weather data from multiple providers, however data for only one provider may be enabled for display at a time.

Selecting a weather datalink source for display:

1) Turn the large **FMS** Knob on the MFD to select the MAP page group.

2) Turn the small **FMS** Knob to select the Weather Data Link Page. The system displays the name of the currently selected weather source after the page title (FIS-B, GFDS, or XM). To change the weather data source, proceed to the next step.

3) Press the MENU Key.

4) Turn the large **FMS** Knob to highlight the selected weather service (FIS-B, GFDS, or XM) and press the **ENT** Key.

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Maps besides the Weather Data Link (FIS-B) Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing FIS-B weather data for the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-97).

4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key (Figure 6-98).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-99).

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
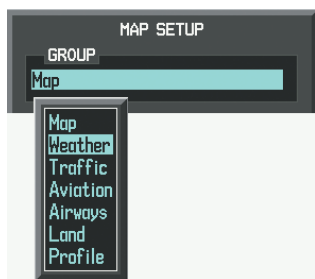
Figure 6-97 Navigation Map Page Menu

Figure 6-98 Navigation Map Page Setup Menu

Figure 6-99 Navigation Map Page Setup Menu, Weather Group

The setup menus for the Navigation Map Page and the Weather Data Link (FIS-B) Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The menus also provide a means in addition to the softkeys for enabling/disabling display of weather products.

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Setting up and customizing the Weather Data Link (FIS-B) Page:

1) Select the Weather Data Link (FIS-B) Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key (Figure 6-100).

4) Turn the small **FMS** Knob to select 'Product Group 1', and press the **ENT** Key (Figure 6-101).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link (FIS-B) Page with the changed settings.

Figure 6-100 Weather Data Link Page (FIS-B) Menu

Figure 6-101 Weather Data Link Page Setup Menu

Restoring default Weather Data Link (FIS-B) Page settings:

1) Select the Weather Data Link (FIS-B) Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key.

4) Press the **MENU** Key.

5) Highlight the desired default(s) to restore (all or for selection) and press **ENT** Key.

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When a FIS-B weather product is enabled for display on the PFD Inset Map, the weather product information box (with the product icon and age) can be displayed inside the PFD Inset Map.

Displaying/removing the weather product information box on the PFD Inset Map:

1) On the PFD, press the **INSET** Softkey.

2) Press the **WX LGND** Softkey.

3) To remove the weather product information box, press the **WX LGND** Softkey again.

Each active weather product has an associated legend which can be displayed on the Weather Data Link (FIS-B) Page. A weather product legend can also be displayed on the Navigation Map Page for active FIS-B weather products displayed on that page.

Viewing legends for displayed weather products on the Weather Data Link (FIS-B) Page:

1) Select the Weather Data Link (FIS-B) Page.

2) Press the **LEGEND** Softkey to display the legends for the displayed weather products.

   Or:

   a) Press the **MENU** Key.

   b) Select 'Weather Legend' and press the **ENT** Key.

3) To remove the Legend Window, press the **LEGEND** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Viewing legends for displayed weather products (on the Navigation Map Page):

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **LEGEND** Softkey (available if one or more FIS-B weather products are enabled for display).

4) To remove the Legend Window, press the **LEGEND** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about METARs can be displayed by panning over a METAR flag on the map:

The map panning feature is enabled by pressing the **RANGE** Knob. The map range is adjusted by turning the **RANGE** Knob. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.
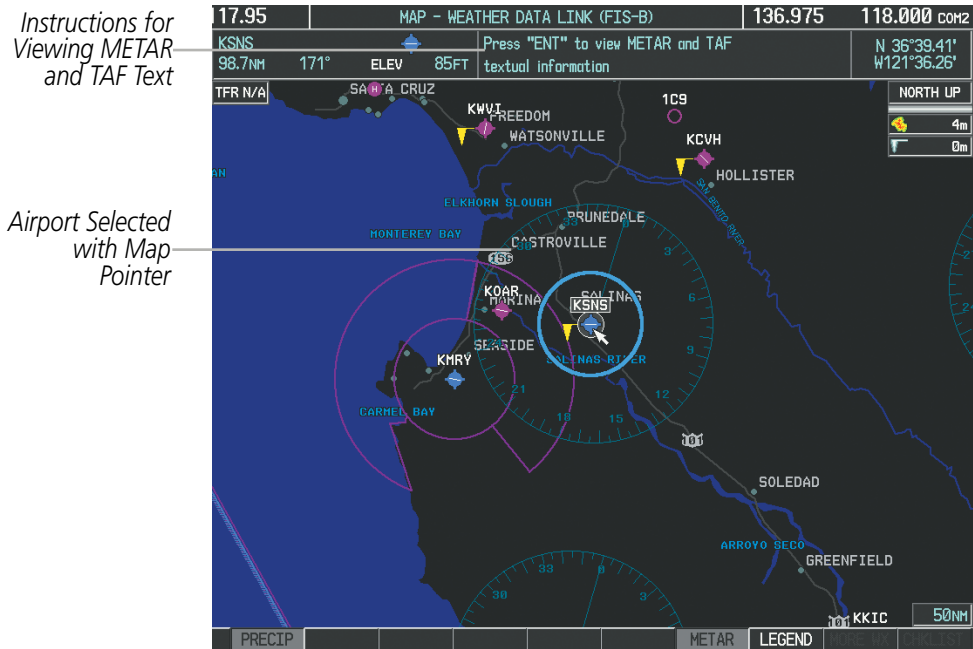
Instructions for Viewing METAR and TAF Text

Airport Selected with Map Pointer

Figure 6-102 Panning on the Weather Data Link (FIS-B) Page)

REGIONAL RADAR PRECIPITATION

✓ **NOTE:** *Regional Radar Precipitation data cannot be displayed at the same time as terrain.*

FIS-B regional radar precipitation is based on WSR-88D, or NEXRAD (NEXt-generation RADar), a network of high-resolution Doppler radar systems that are operated by the National Weather Service (NWS). The maximum range of a single NEXRAD radar site is 250 nm. In addition to a wide array of services, the NEXRAD network provides important information about severe weather and air traffic safety.

Radar precipitation data is not real-time. The lapsed time between collection, processing, and dissemination of composite radar images can be significant and may not reflect the current radar synopsis. Due to the inherent delays and the relative age of the data, it should be used for long-range planning purposes only. Never use NEXRAD data or any radar data to penetrate hazardous weather. Rather, use it in an early-warning capacity of pre-departure and enroute evaluation.
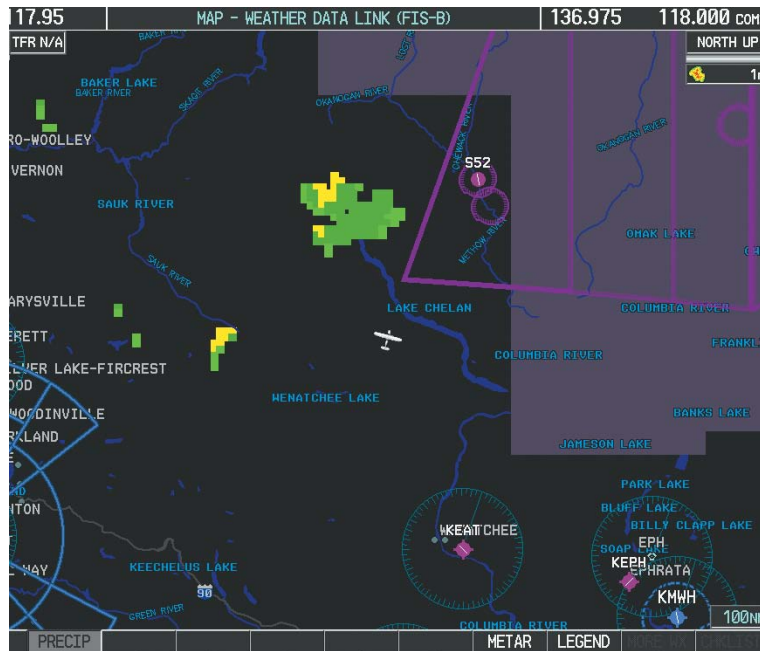
Figure 6-103 Regional Radar Precipitation Data on the Weather Data Link (FIS-B) Page)

Regional Radar Precipitation data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link (FIS-B) Page
- Airport Information Page

- Trip Planning Page
- Nearest Pages
- Flight Plan Pages
- AUX - Video Page

Displaying Regional Radar Precipitation information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the Weather Data Link (FIS-B) Page.

2) Press the **PRECIP** Softkey.

The Regional Radar Precipitation product coverage area varies, as it is determined by the data received from ground-based sources. When the Regional Radar Precipitation product is enabled, a white hashed boundary rectangle encloses this area to indicate the geographic limits of the regional radar coverage being displayed. The system shows composite radar data from all available NEXRAD sites inside of this boundary area.
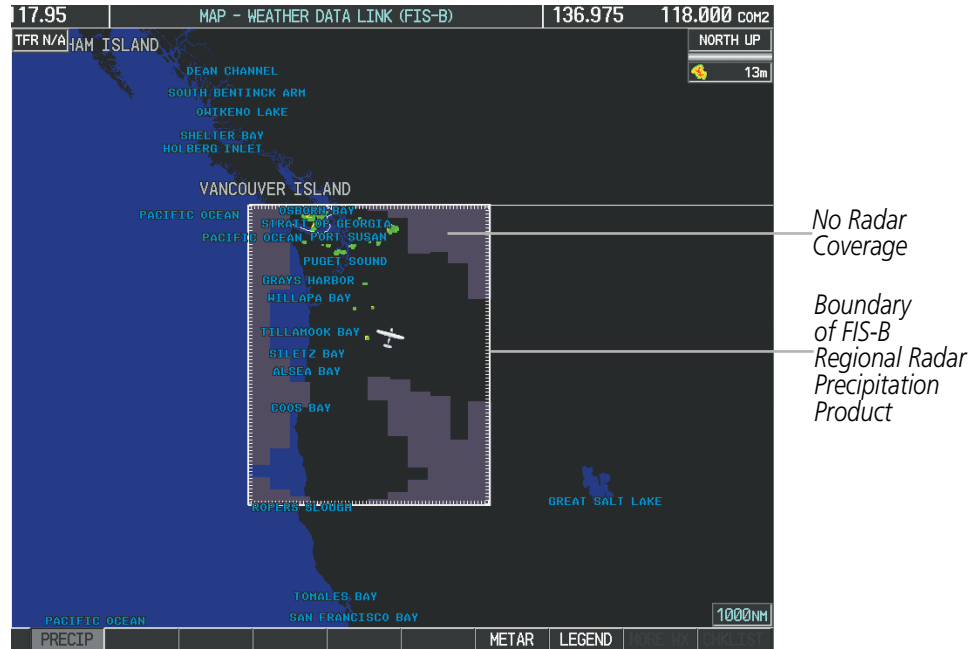
Figure 6-104 Regional Radar Precipitation Data on the Weather Data Link (FIS-B) Page)

This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the Weather Data Link (FIS-B) Page. For the Precipitation legend (Figure 6-105), press the **LEGEND** Softkey when Regional Radar Precipitation data is selected for display.
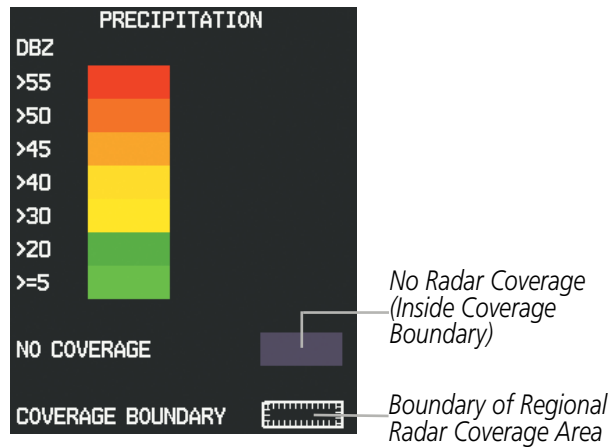

Figure 6-105 Regional Radar Precipitation Data Legend

The display of radar coverage is enabled when PRECIP is selected for display. Areas within the coverage boundary where radar precipitation data is not currently available, has not yet been received, or is not being collected are indicated in gray shade of purple.

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> **NOTE:** If the system has not received all available Regional Radar Precipitation data (such as during initial FIS-B signal aquisitiation), the sytem may temporarily display areas of no radar coverage which are subsquently removed as radar data is received. It may take up approximately ten minutes to receive all FIS-B data.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD LIMITATIONS

NEXRAD radar images may have certain limitations:

- NEXRAD base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.

- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD site cannot depict high altitude storms at close ranges. It has no information about storms directly over the radar site.

- When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers. The intensity level reflected by each square represents the *highest* level of NEXRAD data sampled within the area (Figure 6-106).
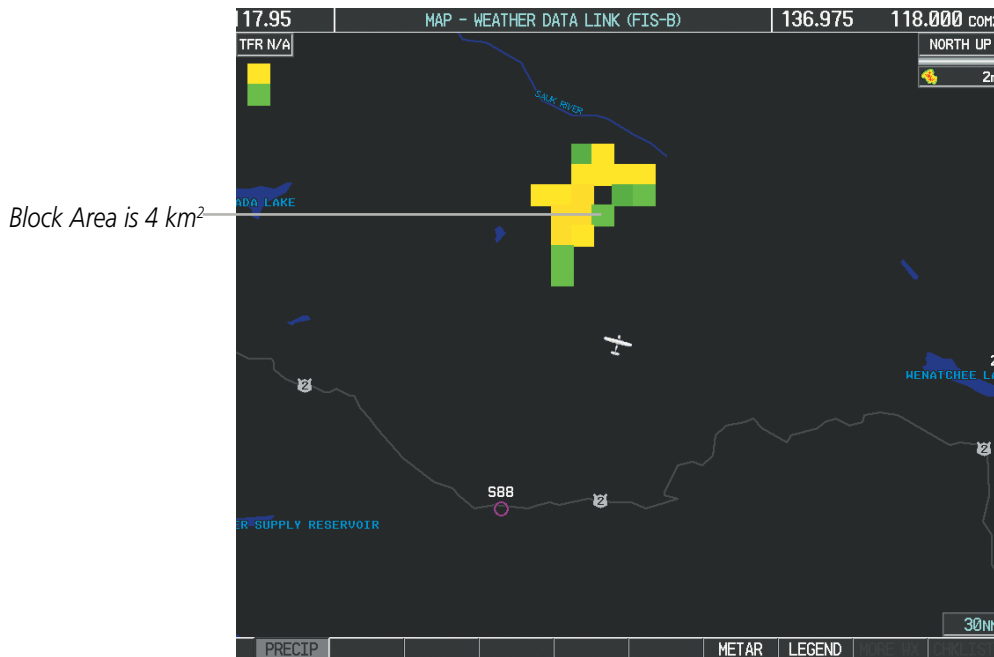
Block Area is 4 km²

Figure 6-106 Regional Radar Data - Zoomed

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter

- Strobes and spurious radar data

- Sun strobes (when the radar antenna points directly at the sun)

- Interference from buildings or mountains, which may cause shadows

- Metallic dust from military aircraft, which can cause alterations in radar scans

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METARS AND TAFS

> **NOTE:** *Atmospheric pressure is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.*

> **NOTE:** *The system will begin to display METAR flags as it receives reports; however it may take approximately ten minutes for all available METAR and TAF data to be received over a FIS-B broadcast.*

Aviation Routine Weather Reports or METARs typically contain current information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect routine hourly observations. An Aviation Selected Special Report or SPECI includes the code "SPECI" in the report, and may be issued if critical information has changed after the issuance of a METAR. The system displays colored flags at airports with report(s) available.
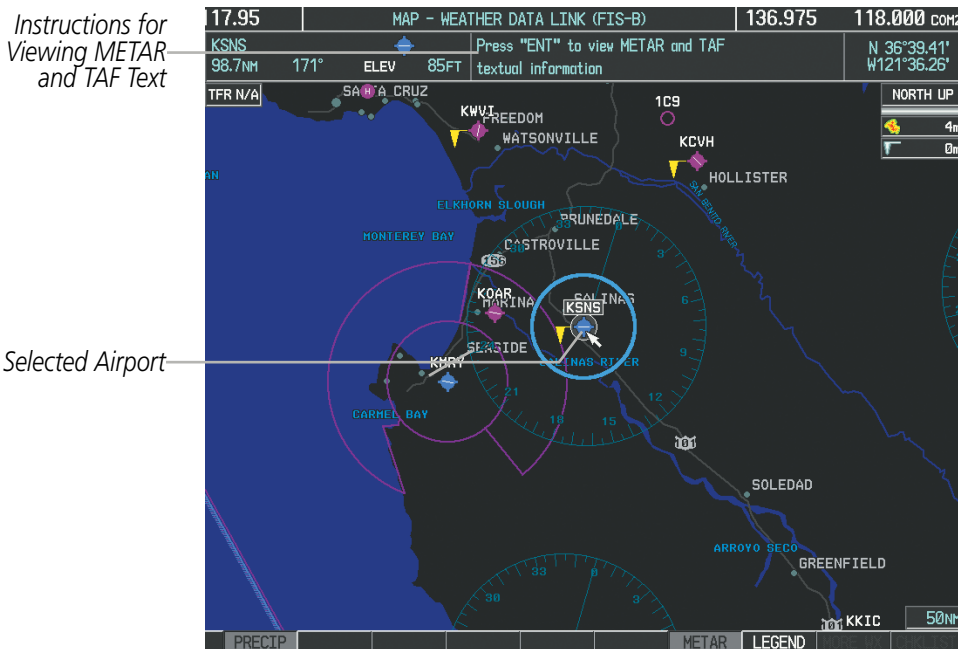

Figure 6-107 METAR Flags on the Weather Data Link Page

TAFs (Terminal Aerodrome Forecasts) are predications of expected weather conditions for an area within five statute miles of the center of an airport's runway complex. The National Weather Service issues scheduled TAFs four times each day, and additional amended TAFs if conditions warrant. TAFs typically span a forecast period of 24 hours, but may be scheduled for a longer period. TAFs may include forecast wind, visibility, significant weather phenomena, and sky conditions using METAR codes.

METAR and TAF text are available on the Weather Information Page. METAR data is displayed first in a decoded fashion, then as raw text. TAF information, when available, appears only as raw text.

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Displaying METAR and TAF text:

1) On the Weather Data Link (FIS-B) Page, press the **METAR** Softkey.

2) Press the **RANGE** Knob and pan to the desired airport.

3) Press the **ENT** Key. The Weather Information Page is shown with METAR and TAF text.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. METAR text must be completely scrolled through before scrolling through the TAF text.

5) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (FIS-B) Page.

Or:

1) Select the Weather Information Page.

   a) Turn the large **FMS** Knob to select the Waypoint Page Group.

   b) Press the **WX** Softkey to select the Weather Information Page.

2) Press the **FMS** Knob to display the cursor.

3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.
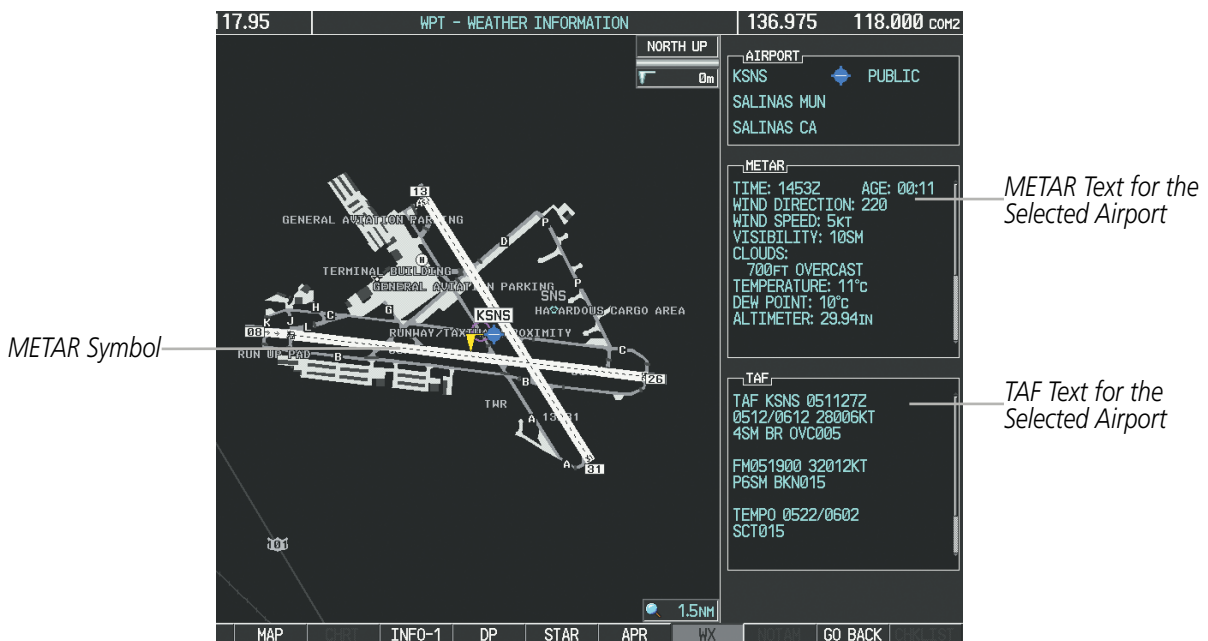
Figure 6-108 METAR and TAF Text on the Weather Information Page

Raw METAR text is also accessible while panning the map cursor over a METAR flag on any map page on which a METAR is displayed. The METAR text is shown in a box near the METAR flag.

In addition, METAR flags and their associated text are displayed on the Active Flight Plan Page on the MFD. METAR flags appears next to waypoints in the flight plan with an associated METAR. A solid light blue

METAR flag indicates the METAR observations are avable for specific waypoint; a hollow light blue METAR flag indicates an off-route METAR is available near the waypoint.

Displaying raw METAR text on the Active Flight Plan Page:

1) Select the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob to activate the cursor.

3) Turn the large **FMS** Knob to highlight the desired waypoint. The METAR text will appear in the 'SELECTED WAYPOINT WEATHER' window below.

4) When finished, press the **FMS** Knob to remove the cursor or press the **FPL** Key to exit the Active Flight Plan Page.

To display the METAR legend on the Weather Data Link (FIS-B) Page (Figure 6-109), press the **LEGEND** Softkey when METARs are selected for display.

The METAR flag color is determined by the information in the METAR text. The system displays a gray METAR flag when the METAR text does not contain adequate classification information.

Figure 6-109 METAR Legend

6.4 WX-500 STORMSCOPE

> **NOTE:** The L-3 WX-500 Stormscope® system is not intended for hazardous thunderstorm penetration. Weather information on the G1000 MFD is approved for weather avoidance only. Refer to the WX-500 Pilot's Guide for a detailed description of Stormscope operation.

> **NOTE:** Stormscope lightning data cannot be displayed at the same time as lightning data from XM WX or GFDS datalink weather sources.

The following pages can display Stormscope data:

- Stormscope Page
- Navigation Map
- AUX - Trip Planning Page
- Nearest Pages

To display Stormscope data on the Navigation Map, AUX - Trip Planning Page, or any of the Nearest Pages, press the **MAP** Softkey, then press the **STRMSCP** Softkey. These pages can also display cell or strike data using the yellow lightning strike symbology shown in Table 6-12.

Lightning Age	Symbol
Strike is less than 6 seconds old	⚡
Strike is between 6 and 60 seconds old	⚡
Strike is between 1 and 2 minutes old	✛
Strike is between 2 and 3 minutes old	✛

Table 6-12 Lightning Age and Symbols

SETTING UP STORMSCOPE ON THE NAVIGATION MAP

Setting up Stormscope options on the Navigation Map:

1) On the Navigation Map Page, press the **MENU** Key.

2) With 'Map Setup' selected (Figure 6-110), press the **ENT** Key.

3) Turn the small **FMS** Knob to display the group selection window. Turn the small **FMS** Knob to select 'Weather', and press the **ENT** Key.

4) Turn the large **FMS** Knob to highlight and move between the product selections (Figure 6-111).

5) When an item is highlighted, turn the small **FMS** Knob to select the option.

6) Press the **ENT** Key.

7) Press the **FMS** Knob to return to the Navigation Map Page (Figure 6-112).

The following options are available (Figure 6-111):

- **STRMSCP LTNG –** Turns the display of Stormscope data on or off.
- **STRMSCP MODE –** Selects the CELL or STRIKE mode of lightning activity. Cell mode identifies clusters or cells of electrical activity. Strike mode indicates the approximate location of lightning strikes.
- **STRMSCP SMBL –** Selects the range at which Stormscope data displays. Stormscope data is removed when a map range greater than the STRMSCP SMBL value is selected.
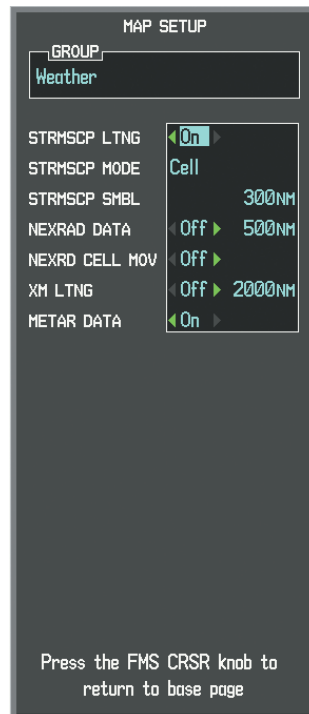
Figure 6-110 Page Menu

Figure 6-111 Map Setup Menu

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CELL AND STRIKE MODE ON THE NAVIGATION MAP

On the Navigation Map, cell mode identifies cells of lightning activity (Figure 6-112). Stormscope identifies clusters of electrical activity that indicate cells. Strike mode indicates the approximate location of lightning strikes.

Selecting the 'cell' or 'strike' mode on the Navigation Map:

1) Press the **MENU** Key.

2) With 'Map Setup' selected, press the **ENT** Key.

3) Select the 'Weather' group.

4) Press the **ENT** Key. The cursor flashes on 'STRMSCP LTNG'.

5) Turn the **large FMS** Knob to select 'STRMSCP MODE'.

6) Turn the **small FMS** Knob to change between 'CELL' and 'STRIKE' options. When an item is selected, press the **ENT** Key.

7) Press the **FMS** knob to return to the Navigation Map Page.
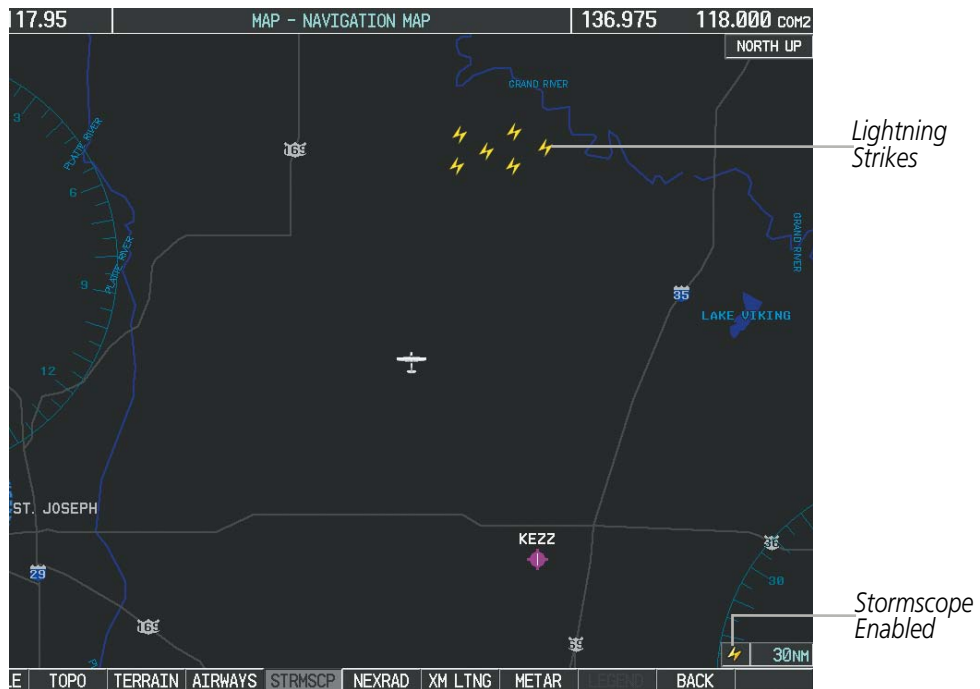
**Figure 6-112 Navigation Map Page with
Stormscope Lightning Data**

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn (Figure 6-113). This is to ensure that the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft.

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Manually clearing Stormscope data on the Navigation Map:

1) Press the **MENU** Key.

2) Select 'Clear Stormscope® Lightning'.

3) Press the **ENT** Key.

Figure 6-113 Navigation Map Page Options Menu

ZOOM RANGE ON THE NAVIGATION MAP

Stormscope lightning data can be displayed up to 800 nm zoom range (in North up mode) on the Navigation Map Page. **However, in the track up mode at the 500 nm range, a portion of Stormscope lightning data can be behind the aircraft and therefore not visible on the Navigation Map**. Since the range for Stormscope data is 400 nm diameter total (200 nm in front and 200 nm behind), the 500 nm range in North up mode shows all the data.

At a map range of less than 25 nm, Stormscope lightning data is not displayed, but can still be present.

The maximum zoom range can also be set on the Navigation Map. Note that Stormscope data above the selected maximum zoom range is decluttered.

Selecting a Stormscope range on the Navigation Map:

1) Press the **MENU** Key.

2) Select 'MAP SETUP'.

3) Select the 'Weather' group.

4) Press the **ENT** Key.

5) Turn the **large FMS** Knob to select 'STRMSCP SMBL'.

6) Turn the **small FMS** Knob to select the maximum display range.

7) Press the **ENT** Key.

8) Press the **FMS** Knob to return to the Navigation Map Page.

To change the display range on the Navigation Map Page, turn the **RANGE** Knob clockwise to zoom out or counter-clockwise to zoom in.

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SELECTING THE STORMSCOPE PAGE

Stormscope lightning data can be displayed at the ranges of 25 nm, 50 nm, 100 nm, and 200 nm.

Adjusting the Stormscope Map Range:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Stormscope Page.

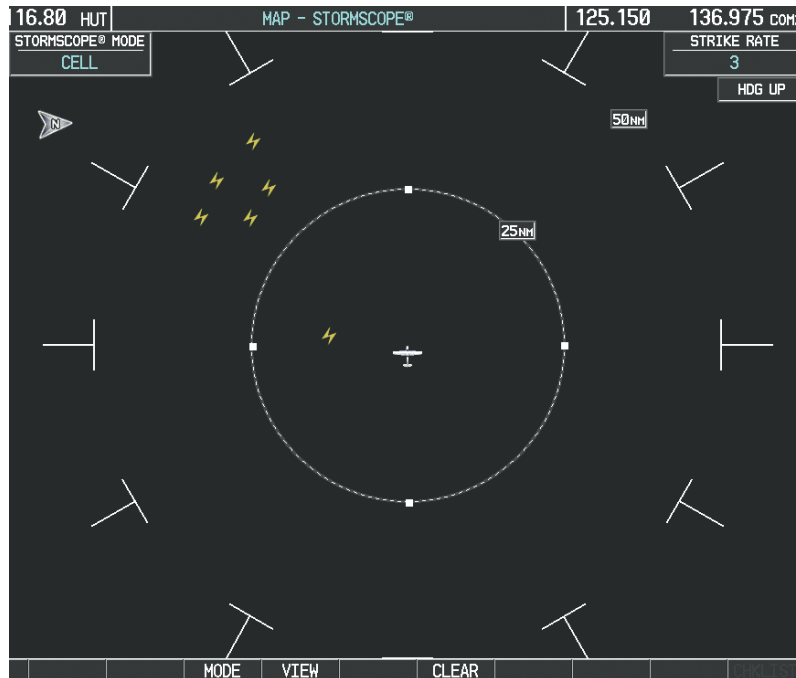3) To change the map range, turn the **RANGE** Knob clockwise to zoom out or counter-clockwise to zoom in.

Figure 6-114 Stormscope Page

Changing between 'cell' and 'strike' mode on the Stormscope Page:

1) Select the Stormscope Page.

2) Press the **MODE** Softkey. The **CELL** and **STRIKE** softkeys are displayed.

3) Press the **CELL** Softkey to display 'CELL' data or press the **STRIKE** Softkey to display 'STRIKE' data. 'CELL' or 'STRIKE' is displayed in the mode box in the upper left corner of the Stormscope Page.

4) Press the **BACK** Softkey to return to the main Stormscope page.

Changing the viewing mode between 360˚ and 120˚ on the Stormscope Page:

1) Select the Stormscope Page.

2) Press the **VIEW** Softkey. The **360** and **ARC** softkeys are displayed. Press the **360** Softkey to display a 360˚ viewing area or press the **ARC** Softkey to display a 120˚ viewing area.

3) Press the **BACK** Softkey to return to the main Stormscope page.

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6.5 TERRAIN PROXIMITY

⚠️ **WARNING:** *Do not use Terrain Proximity information for primary terrain avoidance. Terrain Proximity is intended only to enhance situational awareness.*

✓ **NOTE:** *Terrain data is not displayed if the aircraft is outside of the installed terrain database coverage area.*

G1000 Terrain Proximity is a terrain awareness system that does not comply with TSO-C151b certification standards. It increases situational awareness and aids in reducing controlled flight into terrain (CFIT). Do not confuse Terrain Proximity with the optional Terrain Awareness and Warning System - Class B (TAWS-B). TAWS-B is more sophisticated and robust, and it is TSO-C151b certified. Terrain Proximity does not provide warning annunciations or voice alerts. It only provides color indications on map displays when terrain and obstacles are within a certain altitude threshold from the aircraft. Although the terrain and obstacle color map displays are the same, TAWS-B uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles.

Terrain Proximity requires the following components to operate properly:

• Valid 3-D GPS position

• Valid terrain/obstacle database

Terrain Proximity displays altitudes of terrain and obstructions relative to the aircraft position and altitude with reference to a database that may contain inaccuracies. Terrain and obstructions are shown only if they are in the database. Terrain and obstacle information should be used as an aid to situational awareness. They should never be used to navigate or maneuver around terrain.

Note that all obstructions may not be available in the terrain and obstacle database. No terrain and obstacle information is shown without a valid 3-D GPS position.

The G1000 GPS receiver provides the horizontal position and altitude. GPS altitude is derived from satellite position. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level calculated geometrically. GSL altitude is used to determine terrain and obstacle proximity. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source.

Terrain and obstacle databases are referenced to MSL. Using the GPS position and altitude, the Terrain Proximity feature portrays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. GPS position and GSL altitude are used to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles. In this way, the pilot can view predicted dangerous terrain and obstacle conditions.

DISPLAYING TERRAIN PROXIMITY DATA

The symbols and colors in Figure 6-115 and Table 6-13 are used to represent obstacles and aircraft altitude when the Terrain Proximity Page is selected for display. Terrain Proximity uses black, yellow, and red to represent terrain information relative to aircraft altitude. The color of each obstacle is associated with the altitude of the aircraft.
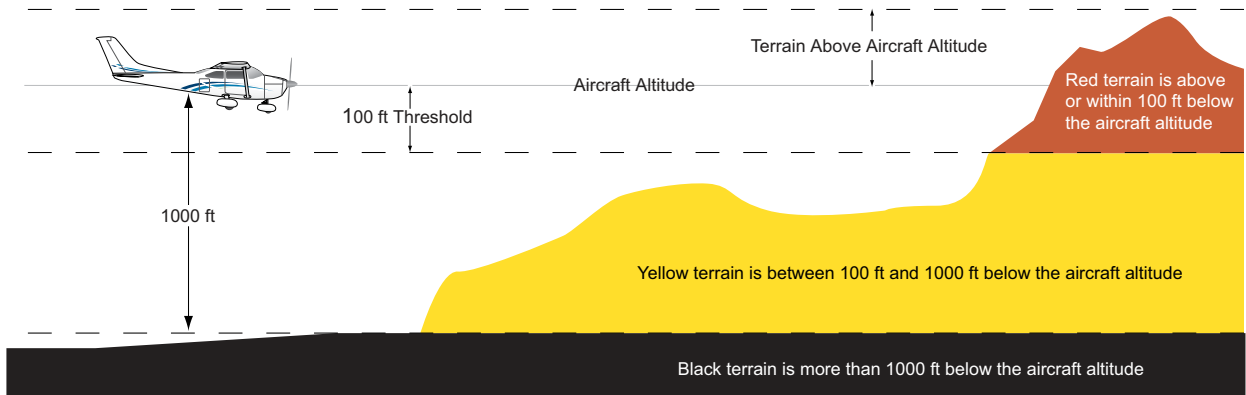
Figure 6-115 Terrain Altitude/Color Correlation for Terrain Proximity

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude

Table 6-13 Terrain Proximity Terrain/Obstacle Colors and Symbology

Terrain and obstacle information can be displayed on the following pages:

- PFD Inset Map
- Navigation Map Page
- Terrain Proximity Page
- Trip Planning Page
- Active Flight Plan Page
- Video Page

Displaying terrain and obstacle information (maps other than the Terrain Proximity Page):

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey).

2) Press the **TERRAIN** Softkey to display terrain and obstacle data.

When Terrain Proximity is selected on maps other than the Terrain Proximity Page, an icon to indicate the feature is enabled for display and a legend for Terrain Proximity colors are shown (Figure 6-119).

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map.

Terrain data can be selected for display independently of obstacle data; however, obstacles recognized by Terrain Proximity as yellow or red are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the Terrain Proximity Page use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the

Navigation Map. If the maximum range for obstacle display on the Navigation Map is adjusted to below 20 nm, the highest obstacle display range settings on the other applicable maps are also adjusted proportionally.

⚠ **CAUTION:** *Terrain and obstacle data will not be displayed when the Navigation Map range is larger than the MAP SETUP range setting for TERRAIN DATA and OBSTACLE DATA.*

Customizing terrain and obstacle display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-116).

4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key (Figure 6-117).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-118).

   • TERRAIN DATA – Turns the display of terrain data on or off and sets maximum range at which terrain is shown

   • OBSTACLE DATA – Turns the display of obstacle data on or off and sets maximum range at which obstacles are shown

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
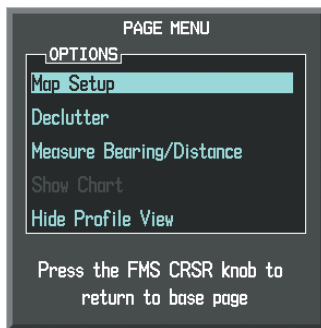
Figure 6-116 Navigation Map Page Menu

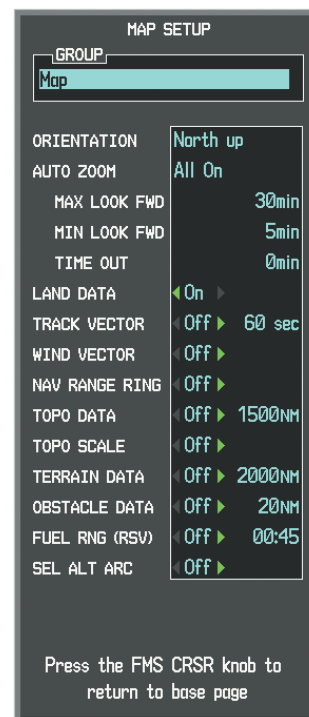Figure 6-117 Navigation Map Page Setup Menu

Figure 6-118 Navigation Map Page Setup Menu, Map Group

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Additional information about obstacles can be displayed by panning over the display on the map. The map panning feature is enabled by pressing the **RANGE** Knob. The map range is adjusted by turning the **RANGE** Knob. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.
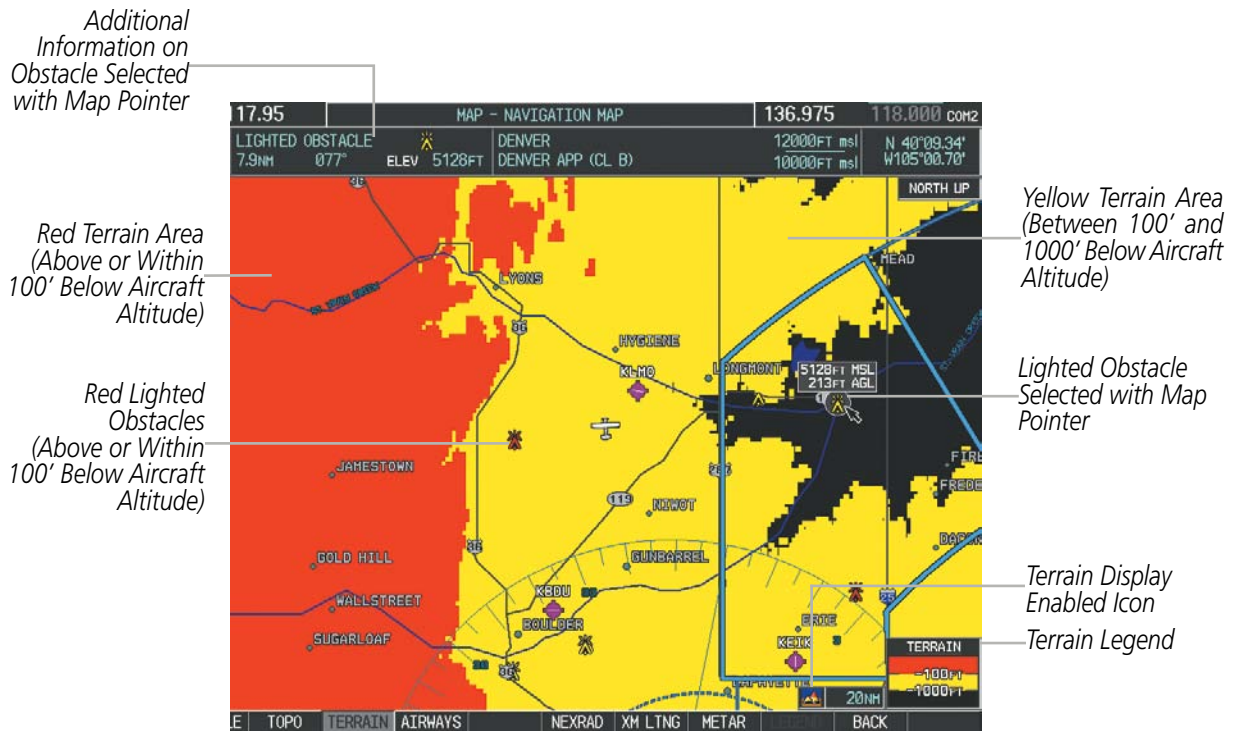

Additional Information on Obstacle Selected with Map Pointer

Red Terrain Area (Above or Within 100' Below Aircraft Altitude)

Red Lighted Obstacles (Above or Within 100' Below Aircraft Altitude)

Yellow Terrain Area (Between 100' and 1000' Below Aircraft Altitude)

Lighted Obstacle Selected with Map Pointer

Terrain Display Enabled Icon

Terrain Legend

Figure 6-119 Terrain Information on the Navigation Map Page

TERRAIN PROXIMITY PAGE

The Terrain Proximity Page is specialized to show terrain and obstacle data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the **RANGE** Knob from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the Terrain Proximity Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Terrain Proximity Page.

3) To change the view,

   a) Press the **VIEW** Softkey.

   b) Press the **360** or **ARC** Softkey to select the desired view.

   Or:

   a) Press the **MENU** Key.

   b) Select 'View Arc' or 'View 360°' (choice dependent on current state) and press the **ENT** Key to change the view.

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Showing/hiding aviation information on the Terrain Proximity Page:

1) Press the **MENU** Key.

2) Select 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the **ENT** Key.
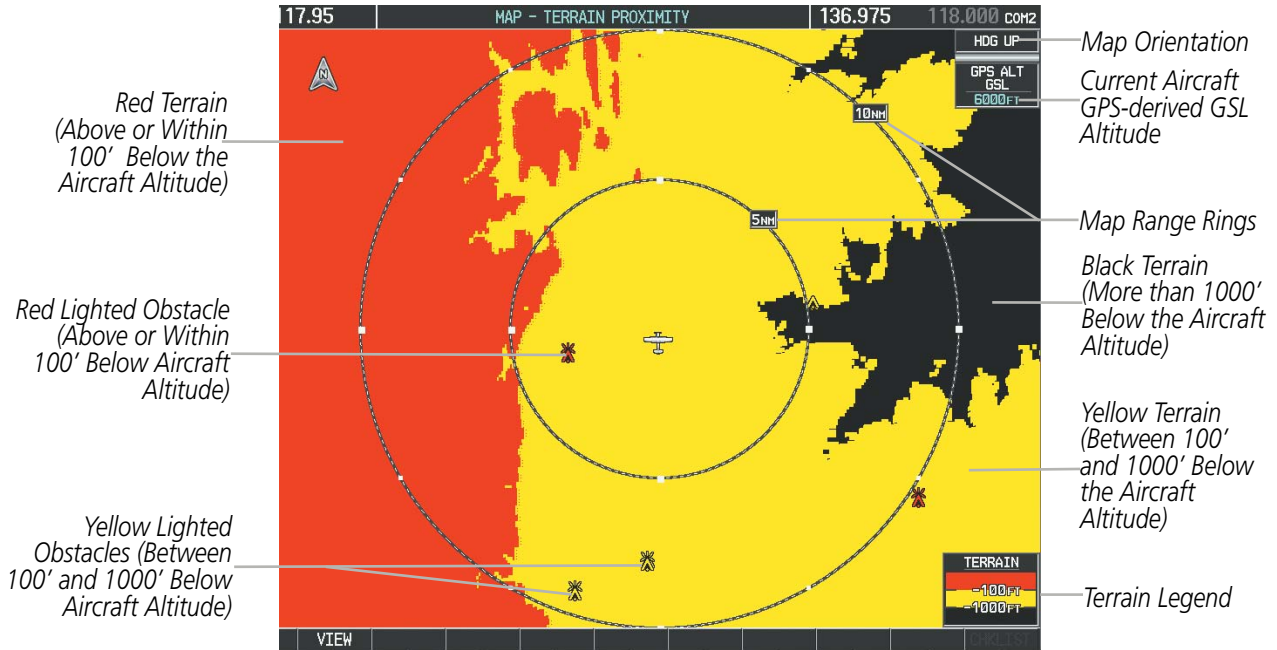
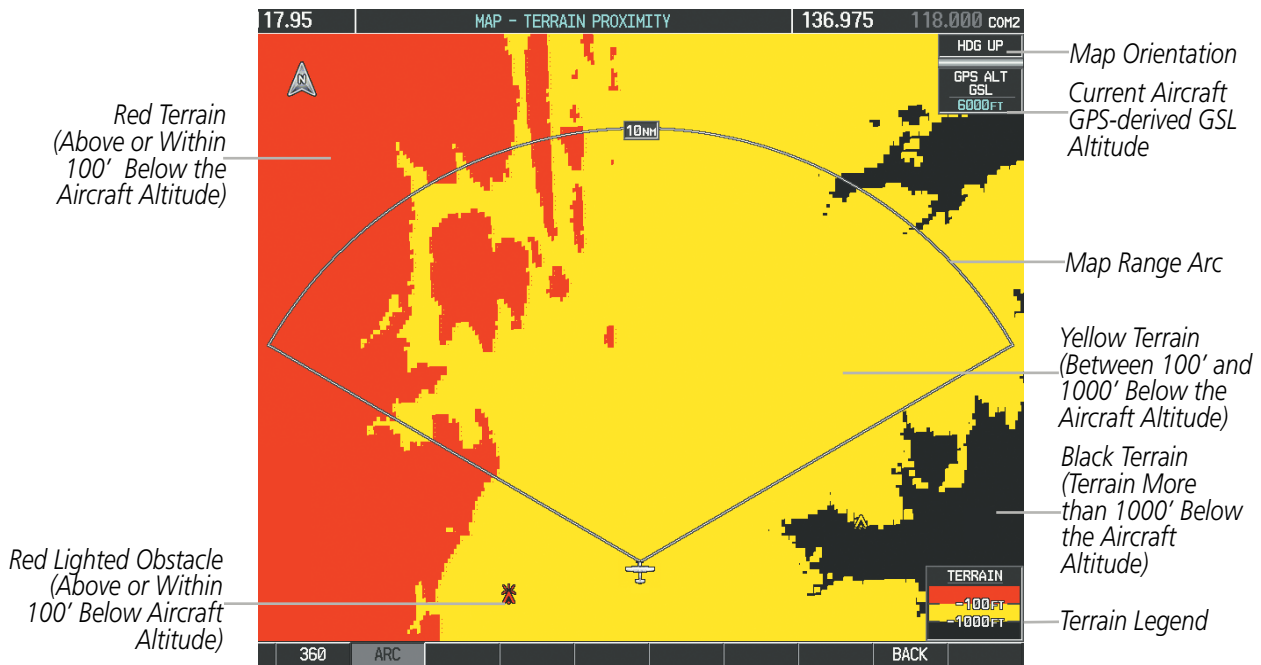

Figure 6-120 Terrain Proximity Page

Figure 6-121 Terrain Proximity Page (ARC View)

6.6 PROFILE VIEW TERRAIN

⚠️ **WARNING:** *Do not use Profile View Terrain data for primary terrain avoidance. Profile View Terrain is intended only to enhance situational awareness.*

✓ **NOTE:** *Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.*

The G1000 offers a Profile View of terrain and obstacles relative to the aircraft's current flight path and altitude on the Navigation Map Page of the MFD. Profile View does not provide terrain or obstacle caution or warning annunciations or voice alerts, nor does it display potential impact points inside the Profile View. The colors and symbols used to represent terrain and obstacles are the same as those used in Terrain Proximity discussed previously.

Accessing Profile View:

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **PROFILE** Softkey to enable or disable Profile View.

Or:

1) Press the **MENU** Key.

2) Select 'Show Profile View' or 'Hide Profile View' (choice dependent on current state) and press the **ENT** Key.

Enabling/Disabling Profile View Terrain on the Navigation Map (when Profile View is enabled):

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **TERRAIN** Softkey.

PROFILE VIEW DISPLAY

When the Profile View is enabled, it is displayed in a window below the Navigation Map. Altitude is shown along a vertical scale, with an aircraft icon positioned at the current altitude. Distance is represented horizontally along the bottom of the Profile View, and increases from left (present position) to right.

When the Navigation Map range is adjusted with the **RANGE** Knob, the horizontal distance of the Profile View is adjusted proportionately to be 1/2 of the Navigation Map range distance down to 1 nm, at which point Profile View is no longer available ('PROFILE NOT AVAILABLE' is displayed). When Navigation Map range is adjusted to remove altitude-correlated colored terrain data (as shown in the Terrain Legend) or obstacles from the Navigation Map, these items are also removed from the Profile View; only an outline of the terrain will be displayed in black in the Profile View window. Refer to the Terrain Proximity, Terrain-SVS, or TAWS-B discussions for more information about displaying terrain or obstacles on the Navigation Map Page.

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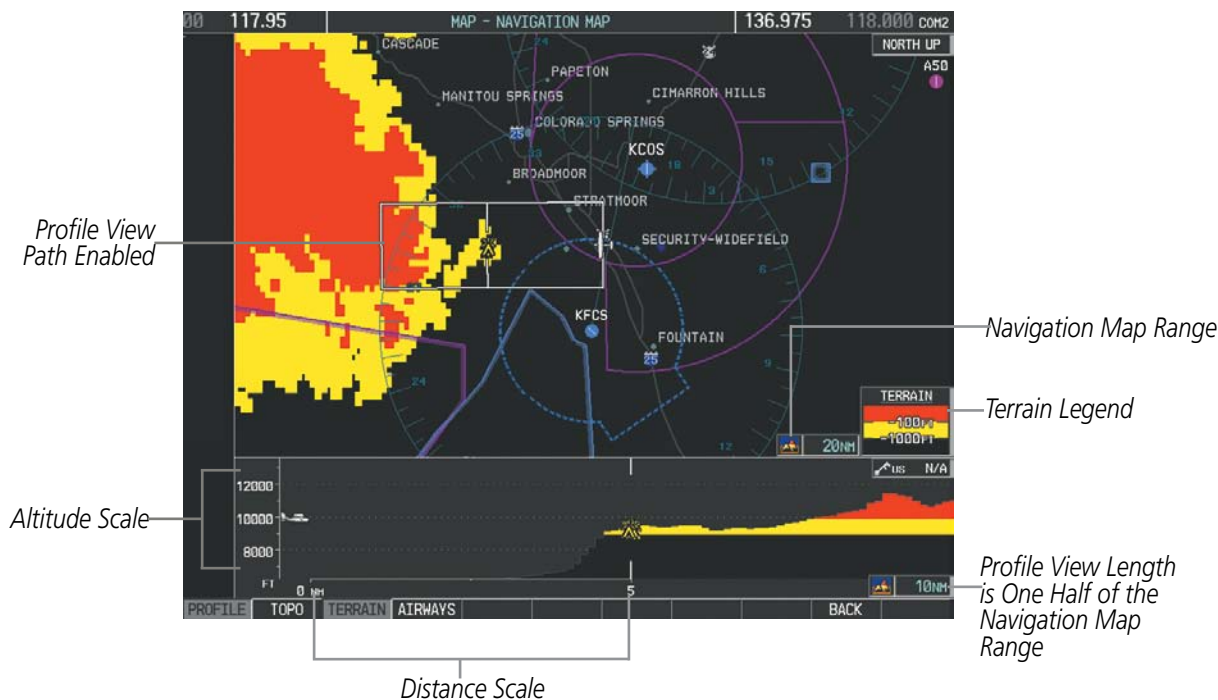
Figure 6-122 Profile View on Navigation Map with Terrain Display Enabled

The Profile View is based on the current aircraft track (or heading if track is unavailable) and shows the *highest* known terrain or obstacles within a predetermined width from the present aircraft position to the end of the profile range. The width of the Profile View (Table 6-14) is determined by the phase of flight, as annunciated on the HSI. Refer to the Flight Instruments section for more information about flight phases.

Flight Phase	Total Profile View Width
Approach	0.6 nm
Departure	0.6 nm
Terminal	2.0 nm
Enroute	4.0 nm
Oceanic	4.0 nm

Table 6-14 Profile View Width Scale

PROFILE PATH

The Profile Path displays the horizontal and lateral boundaries of the Profile View. The path is shown as a white rectangle on the Navigation Map Page (Figure 6-122) and is only available when Profile View is enabled. White range markers both edges of the Profile Path rectangle match the range markers along the distance scale inside the Profile View display window whenever the profile range is at least 4 nm (or 7.5 km if configured for metric units).

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The Profile Path rectangle may be configured on or off, and the Navigation Map range at which the Profile Path is removed from map display can be changed.

⚠️ **CAUTION:** *Terrain and obstacle data will not be displayed when the Navigation Map range is larger than the MAP SETUP range setting for TERRAIN DATA and OBSTACLE DATA.*

Customizing the Profile Path display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-123).

4) Turn the small **FMS** Knob to select the 'Profile' Group and press the **ENT** Key (Figure 6-124).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-125).

   • PROFILE PATH – Turns the display of the Profile Path on or off and sets maximum map range at which the Profile Path is shown

6) Turn the small **FMS** Knob to scroll through options (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

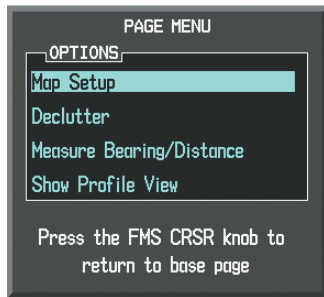8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

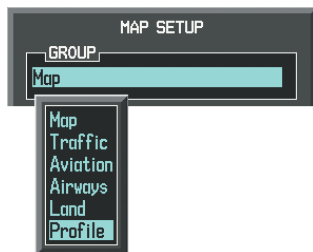**Figure 6-123 Navigation Map Page Menu**
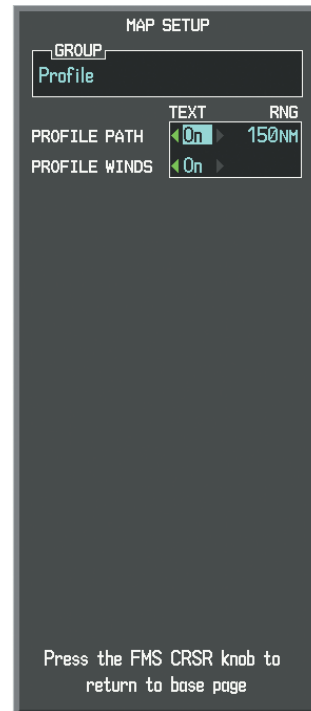
Figure 6-124 Navigation Map Page Setup Menu

Figure 6-125 Navigation Map Page Setup Menu, Profile Group

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6.7 TERRAIN-SVS

⚠️ **WARNING:** *Do not use TERRAIN-SVS information for primary terrain avoidance. TERRAIN-SVS is intended only to enhance situational awareness.*

✓ **NOTE:** *Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.*

✓ **NOTE:** *Terrain-SVS is standard when the Synthetic Vision System (SVS) option is installed. The TAWS-B option will take precedence over Terrain-SVS when TAWS-B is installed.*

Terrain-SVS is a terrain awareness system available with the Synthetic Vision System (SVS). SVS functionality is offered as an optional enhancement. The optional Terrain Awareness and Warning System - Class B (TAWS-B) or standard Terrain-SVS is integrated within SVS to provide visual and auditory alerts to indicate the presence of threatening terrain relevant to the projected flight path. For detailed information regarding SVS, refer to the Additional Features section of this Pilot's Guide.

Terrain-SVS does not comply with TSO-C151b certification standards. It increases situational awareness and aids in reducing controlled flight into terrain (CFIT). Do not confuse Terrain-SVS with TAWS-B. TAWS-B is more sophisticated and robust, and it is TSO-C151b certified. Although the terrain and obstacle color map displays are the same, TAWS-B uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles.

Terrain-SVS does not provide the following:

• Premature Descent Alerting (PDA)

• Excessive Descent Rate (EDR)

• Negative Climb Rate (NCR)

• Descent to 500 Feet Callout (DFC)

Terrain-SVS requires the following components to operate properly:

• Valid 3-D GPS position

• Valid terrain/airport terrain/obstacle database

Terrain-SVS displays altitudes of terrain and obstructions relative to the aircraft position and altitude with reference to a database that may contain inaccuracies. Terrain and obstructions are shown only if they are in the database. Terrain and obstacle information should be used as an aid to situational awareness. They should never be used to navigate or maneuver around terrain.

Note that all obstructions may not be available in the terrain and obstacle database. No terrain and obstacle information is shown without a valid 3-D GPS position.

The G1000 GPS receiver provides the horizontal position and altitude. GPS altitude is derived from satellite position. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level calculated geometrically. GSL altitude is used to determine terrain and obstacle proximity. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that

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normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source.

Terrain and obstacle databases are referenced to GSL. Using the GPS position and altitude, the Terrain-SVS feature portrays a 3-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. GPS position and GSL altitude are used to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles. In this way, the pilot can view predicted dangerous terrain and obstacle conditions.

DISPLAYING TERRAIN-SVS DATA

Terrain-SVS uses yellow (caution) and red (warning) to depict terrain and obstacles (with heights greater than 200 feet above ground level, AGL) alerts relative to aircraft altitude. Colors are adjusted automatically as the aircraft altitude changes. The colors and symbols in Figure 6-126 and Tables 6-15 and 6-16 are used to represent terrain, obstacles, and potential impact points.
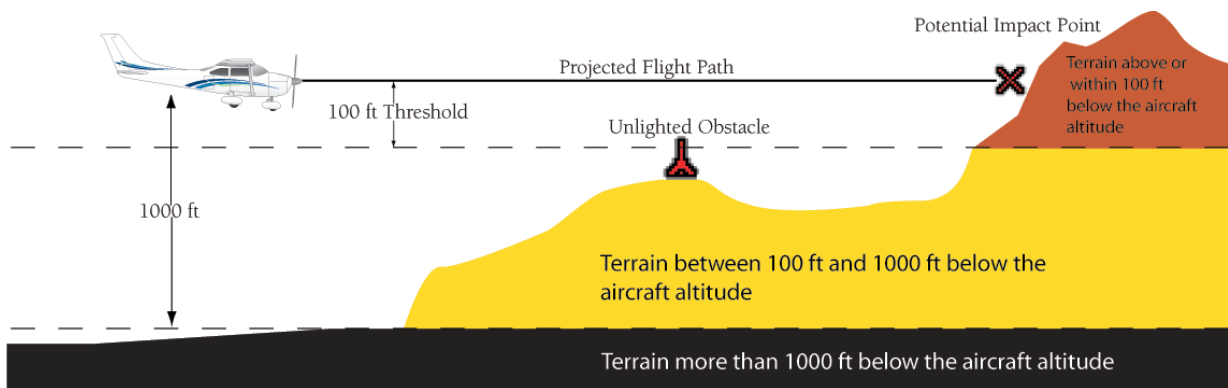

Figure 6-126 Terrain Altitude/Color Correlation for Terrain-SVS

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude

Table 6-15 Terrain-SVS Obstacle Colors and Symbology

Potential Impact Point Symbol	Alert Type	Example Annunciation
	Warning	TERRAIN
	Caution	TERRAIN

Table 6-16 Terrain-SVS Potential Impact Point Symbols with Alert Types

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Terrain-SVS information can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- Terrain-SVS Page
- Trip Planning Page
- Flight Plan Pages
- Video Page

Displaying terrain and obstacle information (maps other than the TERRAIN-SVS Page):

1) Press the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey).

2) Press the **TERRAIN** Softkey to display terrain and obstacle data.

When Terrain-SVS is selected on maps other than the Terrain-SVS Page, a terrain icon is shown to indicate the feature is enabled for display.

The Navigation Map Page Setup Menu provides a means in addition to the softkeys for enabling/disabling the display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. For terrain data, the enable/disable function applies only to the MFD, while the range setting also affects the PFD Inset Map.

Terrain data can be selected for display independently of obstacle data; however, obstacles for which warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the Terrain-SVS Page use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the Navigation Map. If the maximum range for obstacle display on the Navigation Map is adjusted to below 20 nm, the highest obstacle display range settings on the other applicable maps are also adjusted proportionally.

⚠ **CAUTION:** *Terrain and obstacle data will not be displayed when the Navigation Map range is larger than the MAP SETUP range setting for TERRAIN DATA and OBSTACLE DATA.*

Customizing terrain and obstacle display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-127).

4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key (Figure 6-128).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-129).

- TERRAIN DATA – Turns the display of terrain data on or off and sets maximum range at which terrain is shown

- OBSTACLE DATA – Turns the display of obstacle data on or off and sets maximum range at which obstacles are shown

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

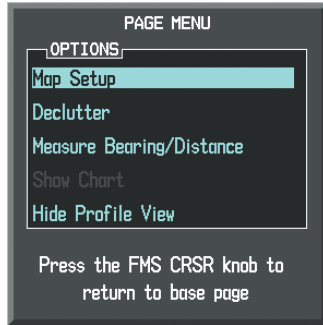8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

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Figure 6-127 Navigation Map Page Menu

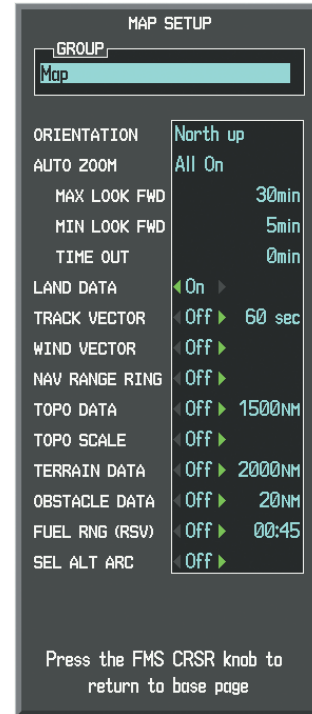**Figure 6-128 Navigation Map Page Setup Menu**

Figure 6-129 Navigation Map Page Setup Menu, Map Group

TERRAIN-SVS PAGE

The Terrain-SVS Page is specialized to show terrain, obstacle, and potential impact point data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference. If an obstacle and the projected flight path of the aircraft intersect, the display automatically zooms in to the closest potential point of impact on the Terrain-SVS Page.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the **RANGE** Knob from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the Terrain-SVS Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the TERRAIN-SVS Page.

Changing the Terrain-SVS Page view:

1) Press the **VIEW** Softkey.

2) Press the **360** or **ARC** Softkey to select the desired view.

   Or:

1) Press the **MENU** Key.

2) Select 'View Arc' or 'View 360º' (choice dependent on current state) and press the **ENT** Key to change the view

Showing/hiding aviation information on the Terrain-SVS Page:

1) Press the **MENU** Key.

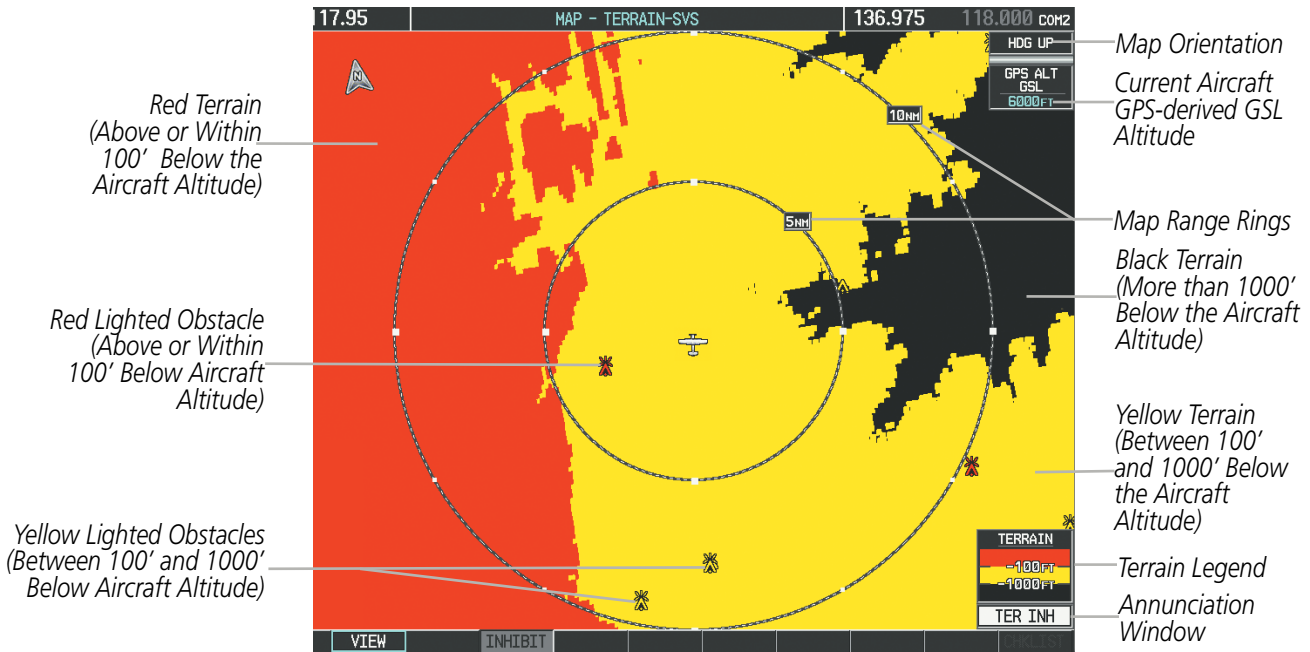2) Select 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the **ENT** Key.

Red Terrain (Above or Within 100' Below the Aircraft Altitude)

Red Lighted Obstacle (Above or Within 100' Below Aircraft Altitude)

Yellow Lighted Obstacles (Between 100' and 1000' Below Aircraft Altitude)

Map Orientation

Current Aircraft GPS-derived GSL Altitude

Map Range Rings

Black Terrain (More than 1000' Below the Aircraft Altitude)

Yellow Terrain (Between 100' and 1000' Below the Aircraft Altitude)

Terrain Legend

Annunciation Window

Figure 6-130 Terrain-SVS Page

Red Terrain (Above or Within 100' Below the Aircraft Altitude)

Red Lighted Obstacle (Above or Within 100' Below Aircraft Altitude)

Map Orientation

Current Aircraft GPS-derived GSL Altitude

Map Range Arc

Yellow Terrain (Between 100' and 1000' Below the Aircraft Altitude)

Black Terrain (Terrain More than 1000' Below the Aircraft Altitude)
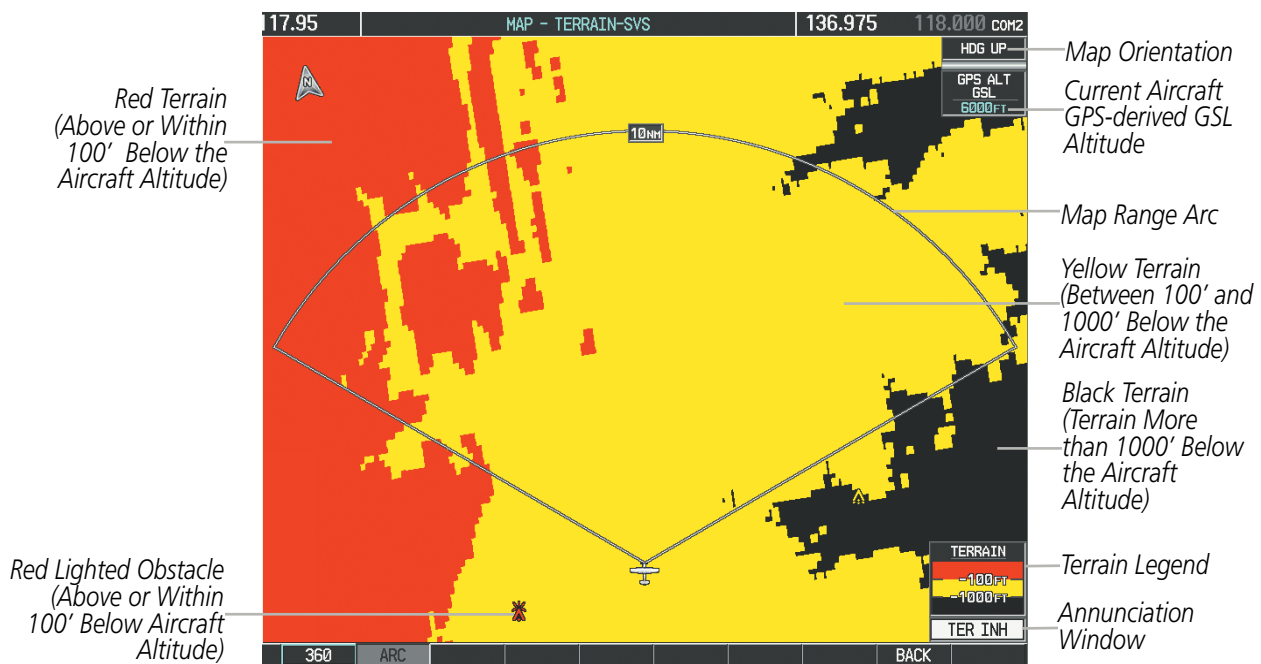
Terrain Legend

Annunciation Window

Figure 6-131 Terrain-SVS Page (ARC View)

TERRAIN-SVS ALERTS

Alerts are issued when flight conditions meet parameters that are set within Terrain-SVS software algorithms. Terrain-SVS alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed and aural alerts are simultaneously issued. Table 6-17 shows Terrain-SVS alert types with corresponding annunciations and aural messages.

When an alert is issued, annunciations appear on the PFD and MFD. The Terrain-SVS Alert Annunciation is shown to the upper left of the Altimeter on the PFD and below the Terrain Legend on the MFD. If the Terrain-SVS Page is not displayed at the time, a pop-up alert appears on the MFD. To acknowledge the pop-up alert:

- Press the **CLR** Key (returns to the currently viewed page), or
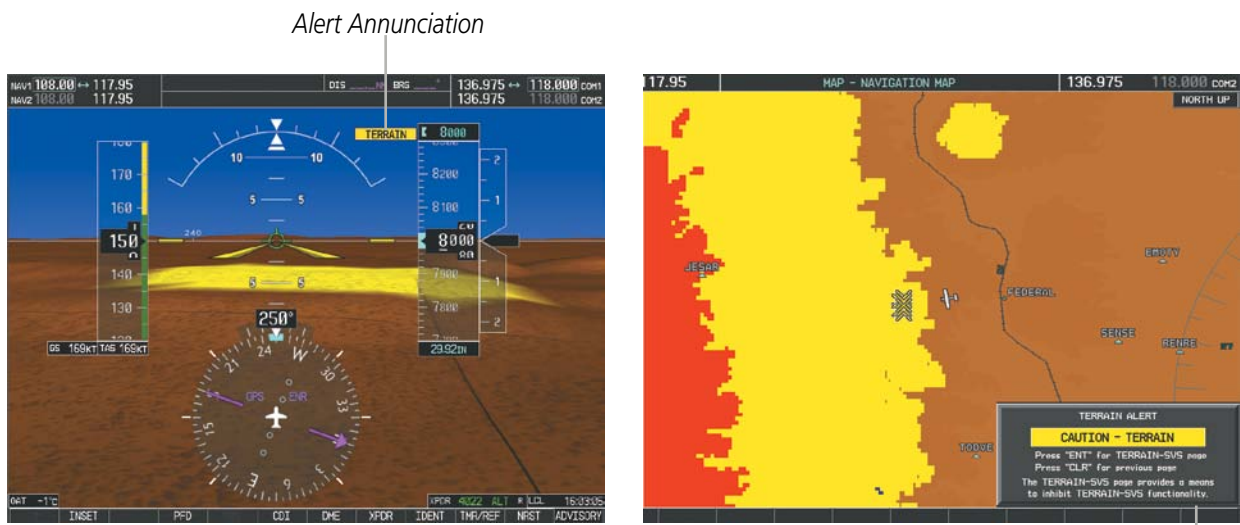- Press the **ENT** Key (accesses the Terrain-SVS Page)

Alert Annunciation

Figure 6-132 Terrain-SVS Alert Annunciations

Pop-up Alert

Terrain Display Enabled
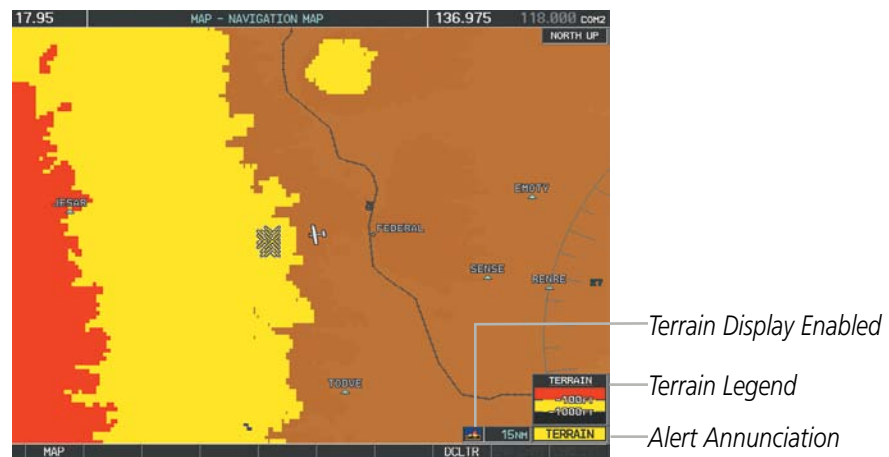
Terrain Legend

Alert Annunciation

Figure 6-133 Navigation Map Page
(After Terrain-SVS Pop-up Alert Acknowledgment)

Alert Type	PFD/MFD* Alert Annunciation	MFD Pop-Up Alert (except Terrain-SVS Page)	Aural Message
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING – TERRAIN	"Warning; Terrain, Terrain"
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING – TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING – OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING – OBSTACLE	"Warning; Obstacle, Obstacle"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN	"Caution; Terrain, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN	"Caution; Terrain, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE	"Caution; Obstacle, Obstacle"

Annunciation is displayed on the MFD when terrain display is enabled.

Table 6-17 Terrain-SVS Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVS compares the aircraft's projected flight path with known terrain and obstacles in their respective databases and issues four types of alerts as either a caution or a warning:

Reduced Required Terrain Clearance (RTC) and **Reduced Required Obstacle Clearance (ROC)** alerts are issued when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values in Figure 6-134. When an RTC alert is issued, a potential impact point is displayed on the Terrain-SVS Page.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts are issued when the aircraft is below the elevation of a terrain or obstacle cell in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact point displayed on the Terrain-SVS Page. The alert is annunciated when the projected vertical flight path is calculated to come within minimum clearance altitudes in Figure 6-134.
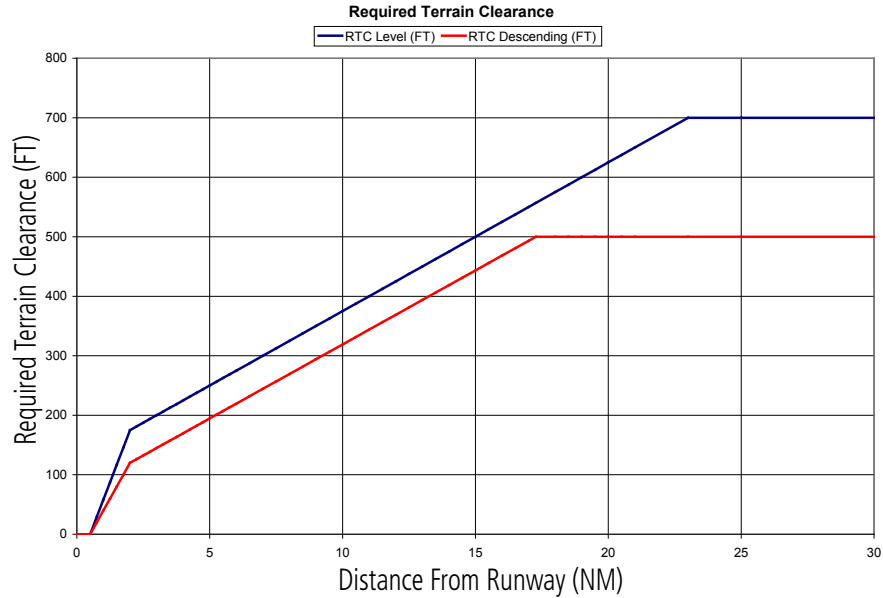
Required Terrain Clearance

Figure 6-134 FLTA Alert Minimum Terrain and Obstacle Clearance Values

FLTA alerts are automatically inhibited when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends. When Terrain-SVS alerts are inhibited, the annunciation 'TER INH' is shown on the PFD and in the MFD terrain annunciation window.

FLTA alerts may also be manually inhibited. Use discretion when inhibiting FLTA alerts, as they should be enabled where appropriate.

TER INH

**Figure 6-135 Terrain-SVS Alerting Disabled
(Terrain-SVS Inhibited) Annunciation**

Inhibiting/enabling Terrain-SVS alerting:

1) Select the Terrain-SVS Page.

2) Press the **INHIBIT** Softkey to inhibit or enable Terrain-SVS (choice dependent on current state).

  Or:

1) Select the Terrain-SVS Page.

2) Press the **MENU** Key.

3) Select 'Inhibit Terrain-SVS' or 'Enable Terrain-SVS' (choice dependent on current state) and press the **ENT** Key.

If Terrain-SVS alerts are inhibited when the Final Approach Fix is the active waypoint in a GPS SBAS approach, a 'LOW ALT' annunciation may appear on the PFD next to the Altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix. See the Flight Instruments Section for details.

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SYSTEM STATUS

During power-up, Terrain-SVS conducts a self-test of its aural and visual annunciations. An aural alert is issued at test completion.

Terrain-SVS continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the aural message **"Terrain System Failure"** is generated along with the 'TER FAIL' alert annunciation.

Terrain-SVS requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation 'TER N/A' is generated in the annunciation window and on the Terrain-SVS Page. The aural message **"Terrain System Not Available"** is generated. When sufficient GPS signal is returns and the aircraft is within the database coverage area, the aural message "**Terrain System Available**" is generated.

Alert Type	PFD/MFD† Alert Annunciation	Terrain-SVS Page Center Banner Annunciation	Aural Message
System Test in Progress	TER TEST	**TERRAIN TEST**	None
System Test Pass	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited	TER INH	None	None
No GPS position	TER N/A	**NO GPS POSITION**	"Terrain System Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available"*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	**TERRAIN FAIL**	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain-SVS operating with PFD Terrain or Obstacle databases	None	**TERRAIN DATABASE FAILURE**	None

† *Annunciation is shown on Terrain-SVS Page and the Navigation Map Page when Terrain is enabled.*
* *"Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.*

Table 6-18 Terrain-SVS System Status Annunciations

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6.8 TAWS-B

⚠️ **WARNING:** *Do not use TAWS information for primary terrain avoidance. TAWS is intended only to enhance situational awareness.*

✓ **NOTE:** *Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.*

✓ **NOTE:** *The data contained in the TAWS databases comes from government agencies. Garmin accurately processes and cross-validates the data but cannot guarantee the accuracy and completeness of the data.*

TAWS-B (Terrain Awareness and Warning System - Class B) is used to increase situational awareness and aid in reducing controlled flight into terrain (CFIT). TAWS provides visual and aural annunciations when terrain and obstacles are within the given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only.

TAWS-B satisfies TSO-C151b Class B requirements for certification.

TAWS-B requires the following to operate properly:

• A valid terrain/obstacle/airport terrain database

• A valid 3-D GPS position solution

TAWS-B uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. The data undergoes verification by Garmin to confirm accuracy of the content, per TSO-C151b. However, the displayed information should never be understood as being all-inclusive and data may be inaccurate.

TAWS-B uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level (MSL) calculated geometrically. GSL altitude is used to determine TAWS-B alerts. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by TAWS-B are referenced to MSL. Using the GPS position and GSL altitude, TAWS-B displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the GPS position and GSL altitude are used to calculate and "predict" the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, TAWS-B can provide advanced alerts of predicted dangerous terrain conditions.

Baro-corrected altitude (or indicated altitude) is derived by adjusting the altimeter setting for local atmospheric conditions. The most accurate baro-corrected altitude can be achieved by frequently updating the altimeter setting to the nearest reporting station along the flight path. However, because actual atmospheric conditions seldom match the standard conditions defined by the International Standard Atmosphere (ISA) model (where

pressure, temperature, and lapse rates have fixed values), it is common for the baro-corrected altitude (as read from the altimeter) to differ from the GSL altitude. This variation results in the aircraft's GSL altitude differing from the baro-corrected altitude.

DISPLAYING TAWS-B DATA

TAWS-B uses yellow (caution) and red (warning) to depict terrain and obstacles (with heights greater than 200 feet above ground level, AGL) alerts relative to aircraft altitude. Colors are adjusted automatically as the aircraft altitude changes. The colors and symbols in the figure and tables below are used to represent terrain, obstacles, and potential impact points.
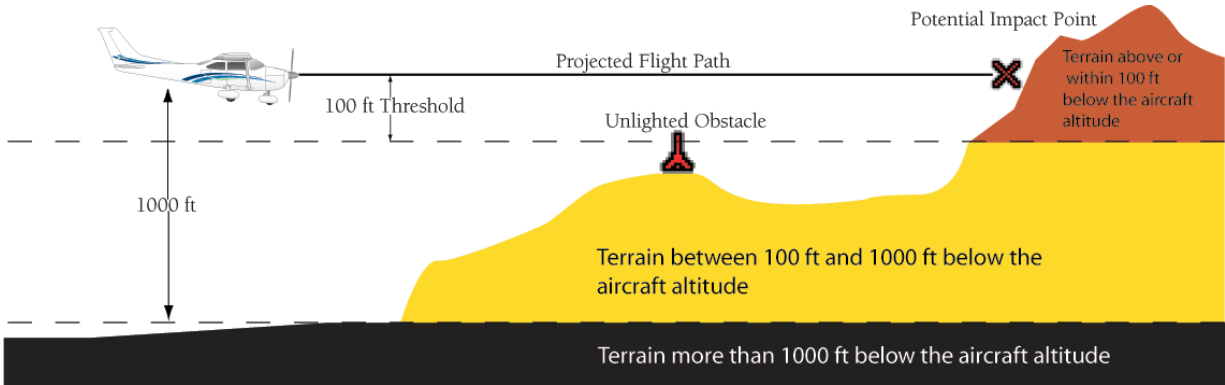
Figure 6-136 Terrain Altitude/Color Correlation for TAWS

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude

Table 6-19 TAWS-B Obstacle Colors and Symbology

Potential Impact Point Symbol	Alert Type	Example Annunciation
	Warning	PULL UP
	Caution	TERRAIN

Table 6-20 TAWS-B Potential Impact Point Symbols with Alert Types

TAWS-B information can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- TAWS-B Page

- Trip Planning Page
- Flight Plan Pages
- Video Pages

Displaying terrain and obstacle information (maps other than the TAWS-B Page):

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey).

2) Press the **TERRAIN** Softkey to display terrain and obstacle data.

When TAWS-B is selected on maps other than the TAWS-B Page, an icon is shown to indicate that the feature is enabled for display. A legend for TAWS-B terrain colors will accompany the icon on the Navigation Map Page (Figure 6-137) and the Flight Plan Pages. The icon is always shown on the TAWS-B Page.
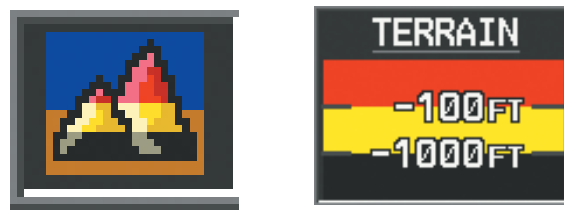
Figure 6-137 TAWS-B Icon and Legend

The Navigation Map Page Setup Menu provides a means in addition to the softkeys for enabling/disabling the display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. For terrain data, the enable/disable function applies only to the MFD, while the range setting also affects the PFD Inset Map.

Terrain data can be selected for display independently of obstacle data; however, obstacles for which warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the TAWS-B Page use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the Navigation Map. If the maximum range for obstacle display on the Navigation Map is adjusted to below 20 nm, the highest obstacle display range settings on the other applicable maps are also adjusted proportionally.

CAUTION: *Terrain and obstacle data will not be displayed when the Navigation Map range is larger than the MAP SETUP range setting for TERRAIN DATA and OBSTACLE DATA.*

Customizing terrain and obstacle display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-138).

4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key (Figure 6-139).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-140).

- TERRAIN DATA – Turns the display of terrain data on or off and sets maximum range at which terrain is shown

- OBSTACLE DATA – Turns the display of obstacle data on or off and sets maximum range at which obstacles are shown

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

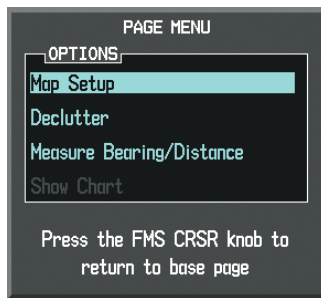8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

Figure 6-138 Navigation Map Page Menu

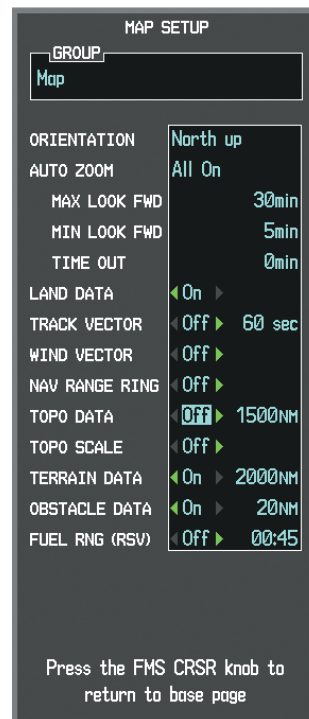**Figure 6-139 Navigation Map Page Setup Menu**

Figure 6-140 Navigation Map Page Setup Menu, Map Group

TAWS-B PAGE

The TAWS-B Page is specialized to show terrain, obstacle, and potential impact point data in relation to the aircraft's current altitude, without clutter from the basemap. It is the principal map page for viewing TAWS-B information. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference. If an obstacle and the projected flight path of the aircraft intersect, the display automatically zooms in to the closest potential point of impact on the TAWS-B Page.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the **RANGE** Knob from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the TAWS-B Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select TAWS-B Page.

Changing the TAWS-B Page view:

1) Press the **VIEW** Softkey.

2) Press the **360** or **ARC** Softkey to select the desired view.

   Or:

1) Press the **MENU** Key.

2) Select 'View Arc' or 'View 360°' (choice dependent on current state) and press the **ENT** Key to change the view

Showing/hiding aviation information on the TAWS-B Page:

1) Press the **MENU** Key.

2) Select 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the **ENT** Key.

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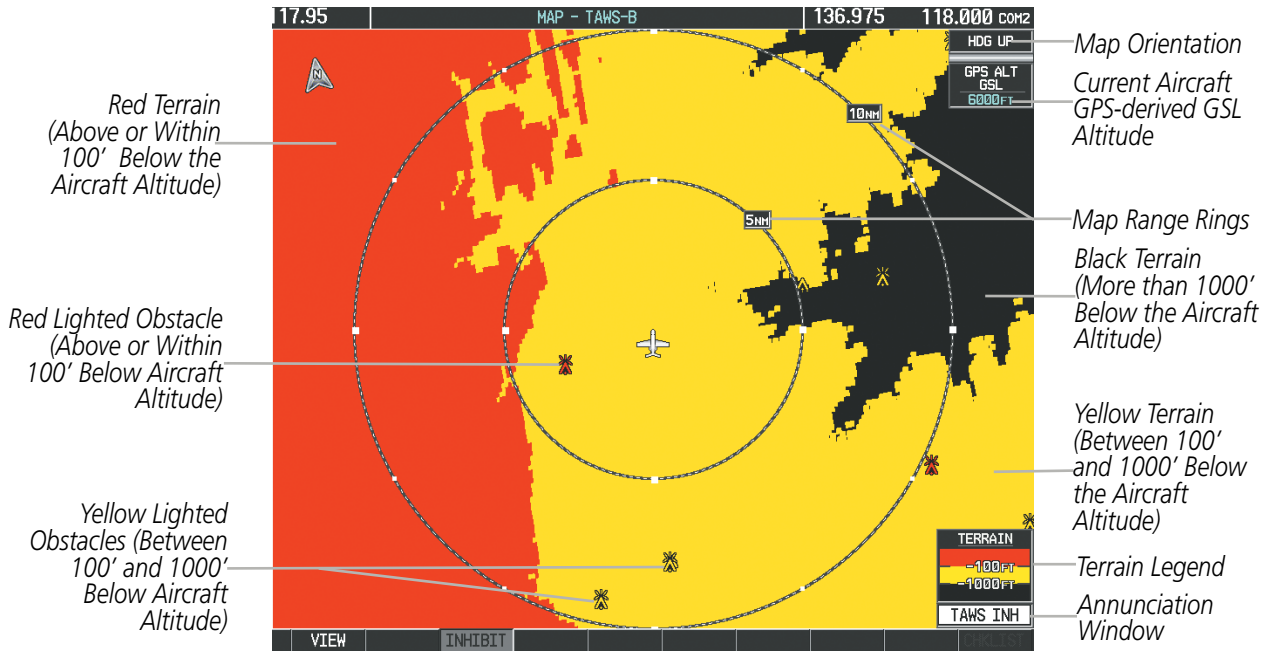
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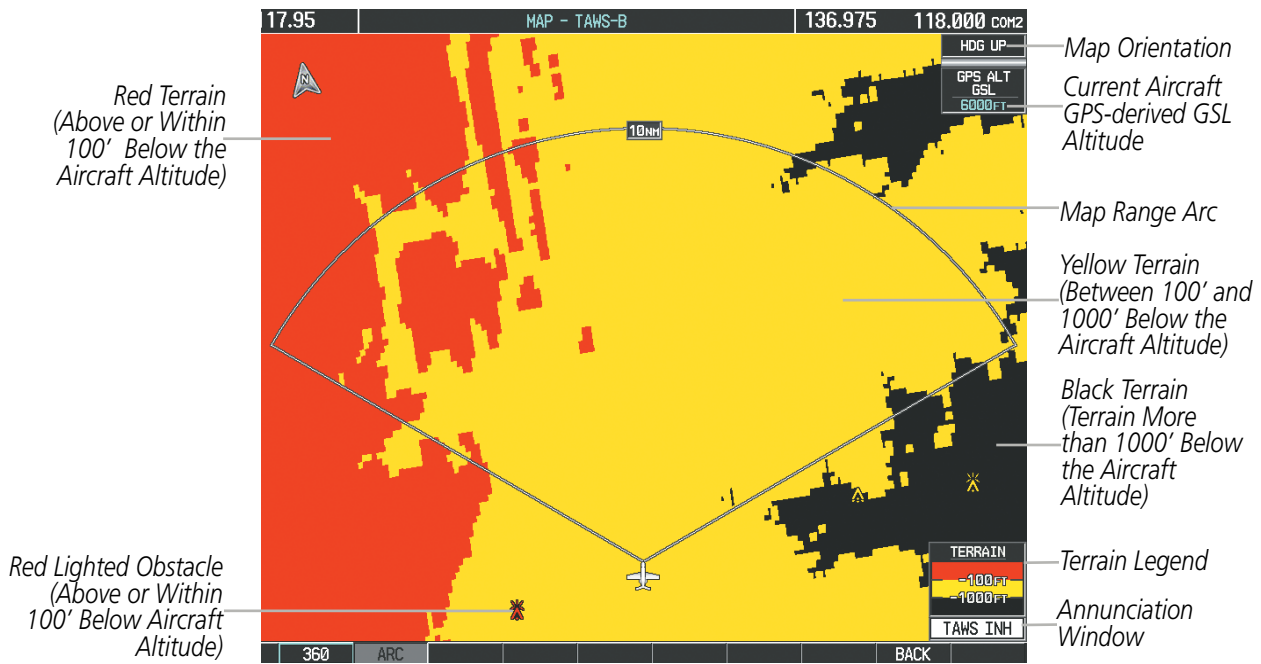
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Red Terrain (Above or Within 100' Below the Aircraft Altitude)

Red Lighted Obstacle (Above or Within 100' Below Aircraft Altitude)

Yellow Lighted Obstacles (Between 100' and 1000' Below Aircraft Altitude)

Map Orientation

Current Aircraft GPS-derived GSL Altitude

Map Range Rings

Black Terrain (More than 1000' Below the Aircraft Altitude)

Yellow Terrain (Between 100' and 1000' Below the Aircraft Altitude)

Terrain Legend

Annunciation Window

Figure 6-141 TAWS-B Page

Red Terrain (Above or Within 100' Below the Aircraft Altitude)

Red Lighted Obstacle (Above or Within 100' Below Aircraft Altitude)

Map Orientation

Current Aircraft GPS-derived GSL Altitude

Map Range Arc

Yellow Terrain (Between 100' and 1000' Below the Aircraft Altitude)

Black Terrain (Terrain More than 1000' Below the Aircraft Altitude)

Terrain Legend

Annunciation Window

Figure 6-142 TAWS-B Page (ARC View)

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TAWS-B ALERTS

Alerts are issued when flight conditions meet parameters that are set within TAWS-B software algorithms. TAWS-B alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed and aural alerts are simultaneously issued. Table 6-21 shows TAWS-B alert types with corresponding annunciations and aural messages.

When an alert is issued, annunciations appear on the PFD and MFD. The TAWS-B Alert Annunciation is shown to the upper left of the Altimeter on the PFD and below the Terrain Legend on the MFD. If the TAWS-B Page is not displayed at the time, a pop-up alert appears on the MFD. To acknowledge the pop-up alert:

- Press the **CLR** Key (returns to the currently viewed page), or

- Press the **ENT** Key (accesses the TAWS-B Page)

Alert Annunciation

Figure 6-143 TAWS-B PFD Alert Annunciation
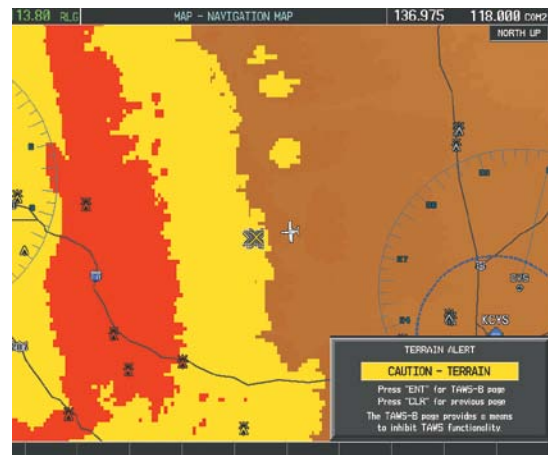
Figure 6-144 Navigation Map Page TAWS-B Pop-up Alert
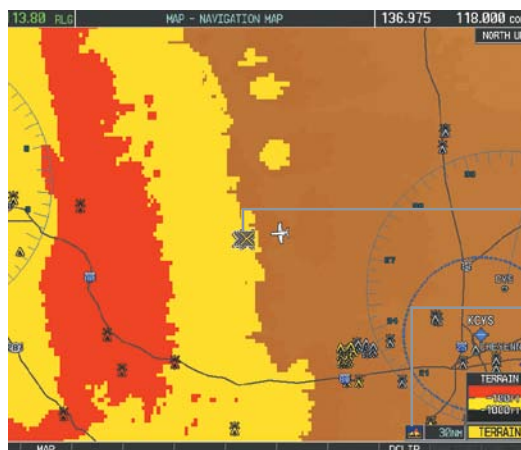
Potential Impact Points

Terrain Display Enabled Icon

Terrain Legend

Alert Annunciation

Figure 6-145 Navigation Map Page (After TAWS-B Pop-up Alert Acknowledgment)

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Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Aural Message
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN – PULL-UP * or TERRAIN AHEAD – PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"* or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN – PULL-UP or TERRAIN AHEAD – PULL-UP *	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"*
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE – PULL-UP * or OBSTACLE AHEAD – PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"* or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL-UP or OBSTACLE AHEAD – PULL-UP *	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"*
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN * or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain"* or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN or TERRAIN AHEAD *	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead"*
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE or OBSTACLE AHEAD *	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead"*
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"* or "Obstacle Ahead; Obstacle Ahead"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW – TERRAIN	"Too Low, Terrain"
Altitude Callout "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DON'T SINK * or TOO LOW – TERRAIN	"Don't Sink"* or "Too Low, Terrain"

Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.
*** Annunciation is displayed on the MFD when terrain display is enabled.*

Table 6-21 TAWS-B Alerts Summary

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide suitable notification when the aircraft is determined to be closing (descending) upon terrain at an excessive speed. Figure 6-146 shows the parameters for the alert as defined by TSO-C151b.
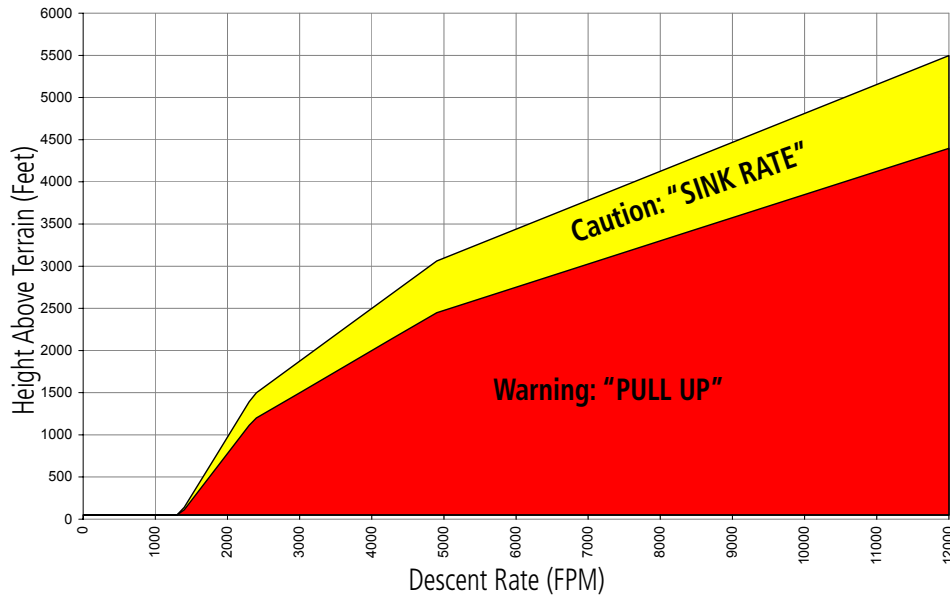

Figure 6-146 Excessive Descent Rate Alert Criteria

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of TAWS-B compares the aircraft's projected flight path with known terrain and obstacles in their respective databases and issues four types of alerts as either a caution or a warning:

Reduced Required Terrain Clearance (RTC) and **Reduced Required Obstacle Clearance (ROC)** alerts are issued when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values in Figure 6-147. When an RTC alert is issued, a potential impact point is displayed on the TAWS-B Page.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts are issued when the aircraft is below the elevation of a terrain or obstacle cell in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact point displayed on the TAWS-B Page. The alert is annunciated when the projected vertical flight path is calculated to come within minimum clearance altitudes in Figure 6-147.
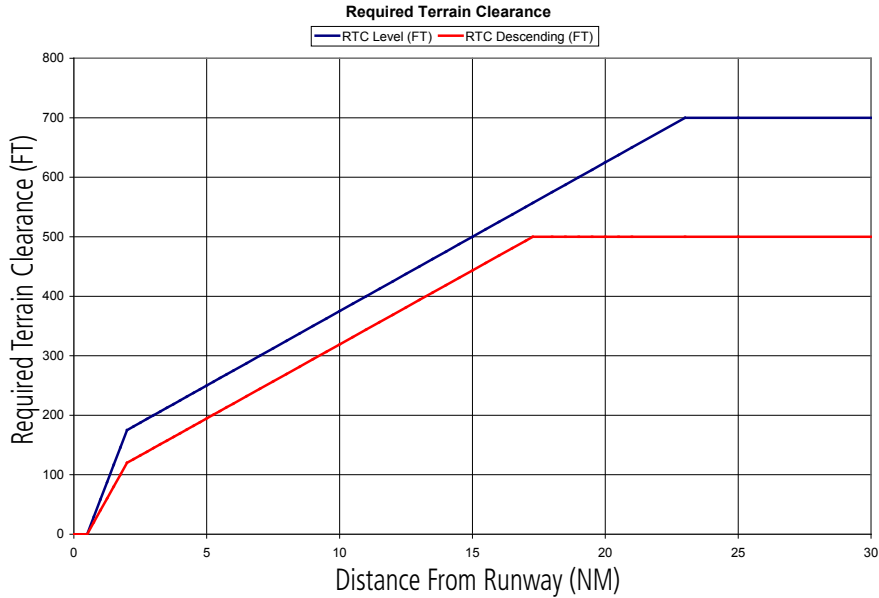
Required Terrain Clearance

Figure 6-147 FLTA Alert Minimum Terrain and Obstacle Clearance Values

FLTA alerts are automatically inhibited when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends.

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** is issued when the system detects that the aircraft is significantly below the normal approach path to a runway (Figure 6-148).

PDA alerting begins when the aircraft is below 700 feet AGL within 15 nm of the destination airport and ends when the aircraft is 0.5 nm from the runway threshold.
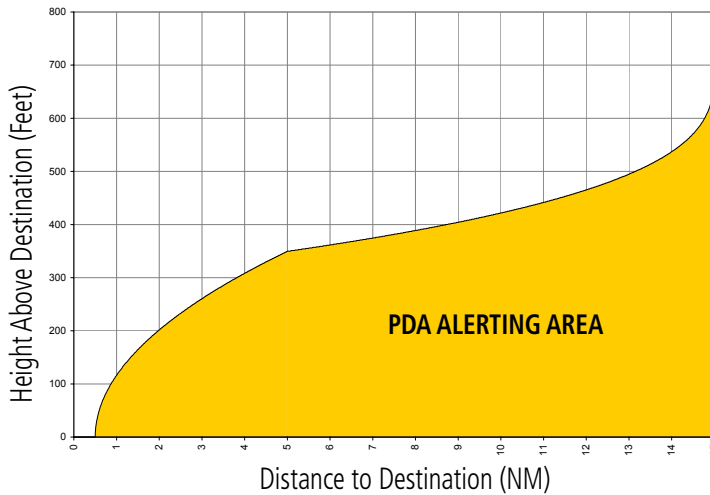
PDA ALERTING AREA

Figure 6-148 PDA Alerting Threshold

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PDA and FLTA aural and visual alerts can be manually inhibited. Discretion should be used when inhibiting TAWS-B and the system should be enabled when appropriate. When TAWS-B is inhibited, the alert annunciation 'TAWS INH' is shown on the PFD and MFD (Figure 6-149).

```
TAWS INH
```

Figure 6-149 TAWS-B Alerting Disabled (TAWS-B Inhibited) Annunciation

Inhibiting/enabling TAWS-B alerting:

1) Select the TAWS-B Page.

2) Press the **INHIBIT** Softkey to inhibit or enable TAWS (choice dependent on current state).

Or:

a) Press the **MENU** Key.

b) Select 'Inhibit TAWS' or 'Enable TAWS' (choice dependent on current state) and press the **ENT** Key.

If TAWS-B alerts are inhibited when the Final Approach Fix is the active waypoint in a GPS SBAS approach, a 'LOW ALT' annunciation may appear on the PFD next to the Altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix. See the Flight Instruments Section for details.

FIVE-HUNDRED AURAL ALERT

The purpose of the aural alert message **"Five-hundred"** is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the **"Five Hundred"** aural alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the **"Five Hundred"** aural alert is based on the height above terrain (as determined by the GPS altitude and Terrain Database).

There are no display annunciations or pop-up alerts that accompany the aural message

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as "Altitude Loss After Takeoff") provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The aural message "Don't Sink" is given for NCR alerts, accompanied by an annunciation and a pop-up terrain alert on the display. NCR alerting is only active when departing from an airport and when the following conditions are met:

- Height above the terrain is less than 700 feet

- Distance from the departure airport is 2 nm or less

- Heading change from the departure heading is less than 110 degrees

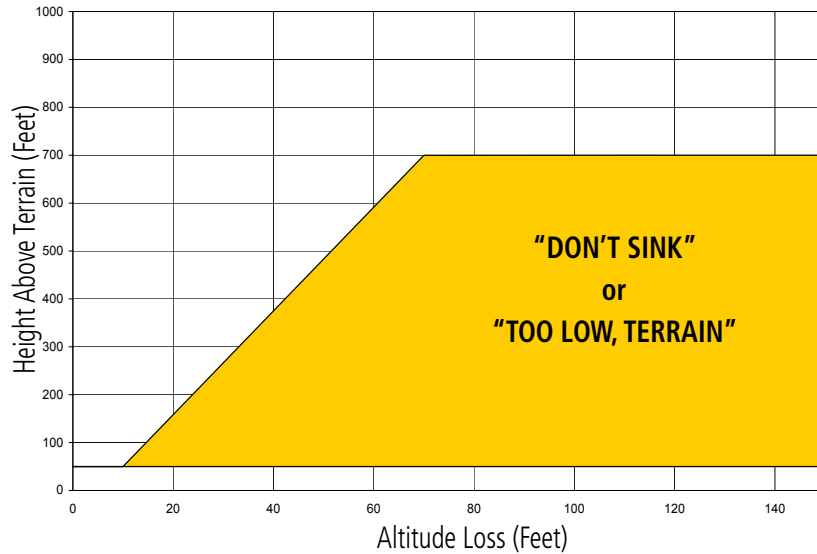Figures 6-81 and 6-82 shows the NCR alerting parameters as defined by TSO-C151b.

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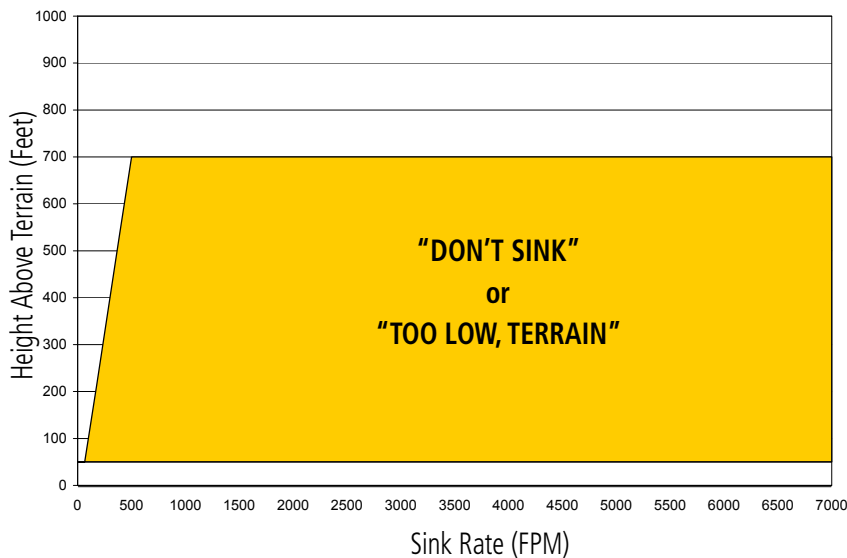**Figure 6-150 Negative Climb Rate (NCR) Altitude Loss**

Figure 6-151 Negative Climb Rate (NCR) Sink Rate

SYSTEM STATUS

During power-up, TAWS-B conducts a self-test of its aural and visual annunciations. The system test can also be manually initiated. An aural message is issued at test completion. TAWS-B System Testing is disabled when ground speed exceeds 30 knots.

Manually testing the TAWS-B System:

1)   Select the TAWS-B Page.

2)   Press the **MENU** Key (Figure 6-152).

3)   Select 'Test TAWS System' and press the **ENT** Key to confirm the selection.

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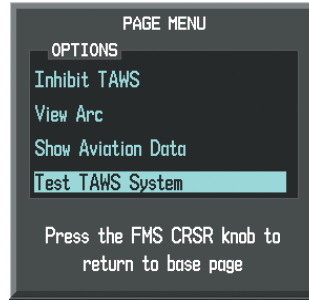AFCS

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Figure 6-152 TAWS-B Page Menu

TAWS-B continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the aural message **“TAWS System Failure”** is generated along with the ‘TAWS FAIL’ alert annunciation.

TAWS-B requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation ‘TAWS N/A’ is generated in the annunciation window and on the TAWS-B Page. The aural message **“TAWS Not Available”** is generated.

Alert Type	PFD/MFD* Alert Annunciation	TAWS-B Page Center Banner Annunciation	Aural Message
System Test in progress	TAWS TEST	**TAWS TEST**	None
System Test pass	None	None	“TAWS System Test Test OK”
TAWS-B FLTA Alerting Inhibited	TAWS INH	None	None
No GPS position	TAWS N/A	**NO GPS POSITION**	“TAWS Not Available”
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	“TAWS Not Available”
TAWS-B System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	**TAWS FAIL**	“TAWS System Failure”
MFD Terrain or Obstacle database unavailable or invalid, and TAWS operating with PFD Terrain or Obstacle databases.	None	**TERRAIN DATABASE FAILURE**	None

† *Annunciation is shown on TAWS-B Page and the Navigation Map Page when Terrain is enabled.*
* *“TAWS Available” will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.*

Table 6-22 TAWS-B System Status Annunciations

6.9 TRAFFIC INFORMATION SERVICE (TIS)

⚠️ **WARNING:** *The Traffic Information Service (TIS) is intended for advisory use only. TIS is intended to help the pilot locate traffic visually. It is the responsibility of the pilot to see and maneuver to avoid traffic.*

✅ **NOTE:** *TIS is available only when the aircraft is within the service volume of a TIS-capable terminal radar site. Aircraft without an operating transponder are invisible to both Traffic Advisory Systems (TAS) and TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication.*

✅ **NOTE:** *TIS is disabled if a Traffic Advisory System (TAS) is installed.*

Traffic Information Service (TIS) is designed to help in detection and avoidance of other aircraft. TIS uses the Mode S transponder for the traffic data link. TIS receives traffic information from ground stations, and is updated every 5 seconds. The G1000 displays up to eight traffic targets within a 7.5-nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. Traffic is displayed using the symbology shown in Table 6-23.

TIS Symbol	Description
◆	Non-Threat Traffic
⬤	Traffic Advisory (TA)
◐	Traffic Advisory Off Scale

Table 6-23 TIS Traffic Symbols

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, a solid yellow circle symbol is generated. A TA which is detected but is outside the range of the map on which traffic is displayed are indicated with a message in the lower left corner of the map.

TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°. Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page (Figure 6-157) or in a banner at the lower left corner of maps other than the Traffic Map Page on which traffic can be displayed.

The altitude difference between the requesting aircraft and other intruder aircraft is displayed above/below the traffic symbol in hundreds of feet. If the other aircraft is above the requesting aircraft, the altitude separation appears above the traffic symbol; if below, the altitude separation appears below. Altitude trend is displayed as an up/down arrow (for speeds greater than 500 fpm in either direction) to the right of the target symbol. Traffic symbols for aircraft without altitude reporting capability appear without altitude separation or climb/descent information.

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DISPLAYING TRAFFIC DATA

The Map - Traffic Map Page is the principal page for viewing traffic information. Additional displays of traffic information are available as map overlays while TIS is operating, and serve as additional reference to the Traffic Map Page. Traffic information can be displayed on the following maps and pages:

- PFD Inset Map
- Navigation Map Page
- Traffic Map Page
- Trip Planning Page

- Nearest Pages
- Active Flight Plan Page
- Video Page

Traffic information is also displayed on the PFD when the Synthetic Vision System (SVS) option is installed and enabled. See the Additional Features Section for details.

Displaying traffic information (maps other than the Traffic Map Page):

1) Press the **MAP** Softkey.

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, an icon is shown to indicate the feature is enabled for display.
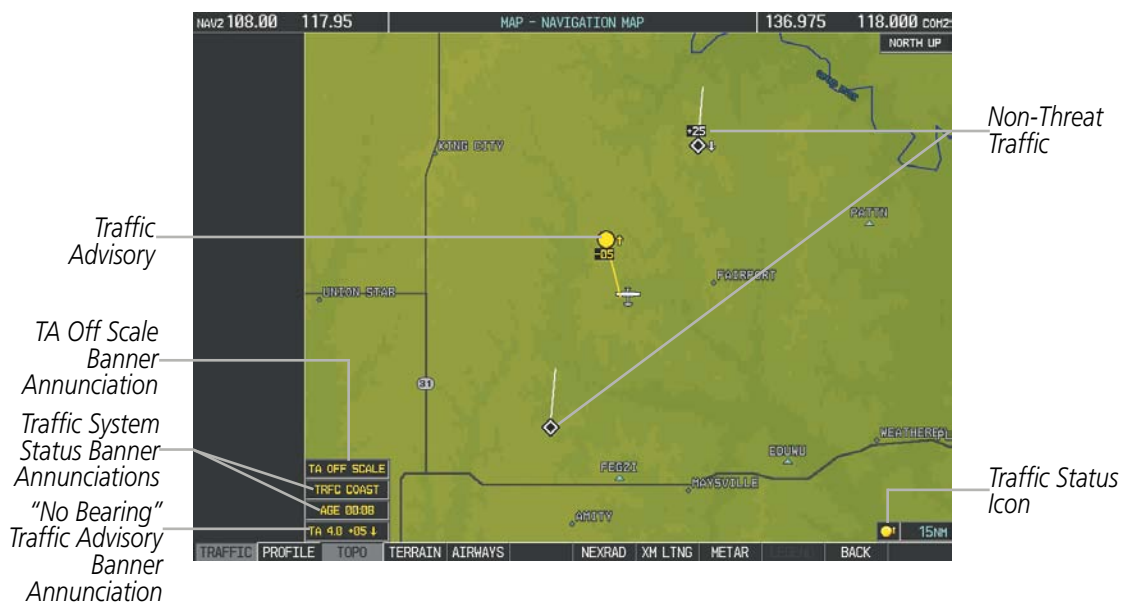

Figure 6-153 TIS Traffic on Navigation Map Page

Displaying traffic information (PFD Inset Map):

1) Select the **INSET** Softkey.

2) Select the **TRAFFIC** Softkey to display traffic data on the inset map (TRFC-1).

3) Select the softkey again to display the traffic-only inset (TRFC-2).

4) Select the softkey again to remove traffic data.

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of traffic. The setup menu also controls the map range settings above which traffic data (symbols and labels) are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Customizing traffic display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-154).

4) Turn the small **FMS** Knob to select the 'Traffic' Group and press the **ENT** Key (Figure 6-155).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-156).

   • TRAFFIC – Turns the display of traffic data on or off

   • TRAFFIC MODE – Selects the traffic mode for display; select from:

      - All Traffic - Displays all traffic

      - TA ONLY - Displays Traffic Alerts only

   • TRAFFIC SMBL – Selects the maximum range at which traffic symbols are shown

   • TRAFFIC LBL – Selects the maximum range at which traffic labels are shown (with the option to turn off)

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

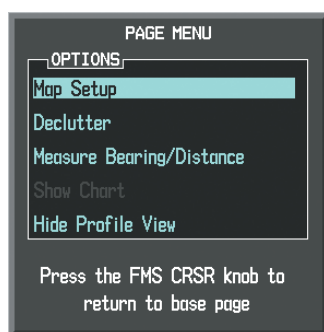8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

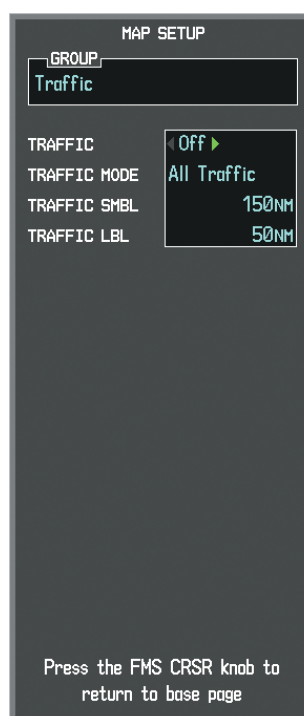**Figure 6-154 Navigation Map Page Menu**

Figure 6-155 Navigation Map Page Setup Menu

Figure 6-156 Navigation Map Page Setup Menu, Traffic Group

TRAFFIC MAP PAGE

The Traffic Map Page is the principal map page for viewing TIS traffic data in relation to the aircraft's current position and altitude, without clutter from the basemap. Aircraft orientation on this map is always heading up unless there is no valid heading. Map range is adjustable with the **RANGE** Knob from 2 to 12 nm, as indicated by the map range rings.

The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. Once the aircraft is airborne, TIS switches from Standby to Operating Mode and the system begins to display traffic information. Refer to the System Status discussion for more information.

> **Displaying traffic on the Traffic Map Page:**
>
> 1) Turn the large **FMS** Knob to select the Map Page Group.
>
> 2) Turn the small **FMS** Knob to select the Traffic Map Page.
>
> 3) Confirm TIS is in Operating Mode:
>
>   Press the **OPERATE** Softkey to begin displaying traffic.
>
>   **Or**:
>
>   a) Press the **MENU** Key.
>
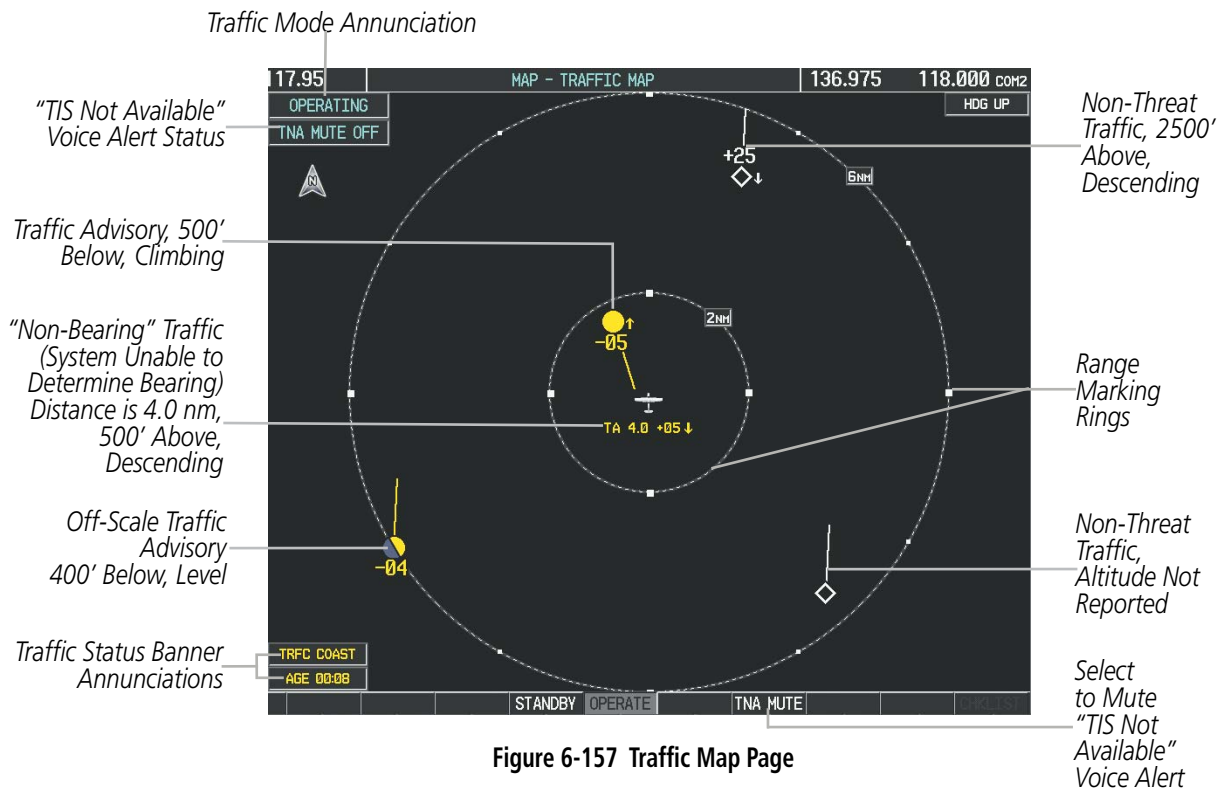>   b) Select 'Operate Mode' (shown if TIS is in Standby Mode) and press the **ENT** Key.

Figure 6-157 Traffic Map Page

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TIS ALERTS

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur:

- A single *"Traffic"* voice alert is generated.

- A 'TRAFFIC' Annunciation appears to the top left of the Attitude Indicator on the PFD, flashing for 5 seconds and remaining displayed until no TAs are detected in the area.

- The PFD Inset Map is automatically displayed with traffic.

To reduce the number of nuisance alerts due to proximate aircraft, the *"Traffic"* voice alert is generated only when the number of TAs increases. For example, when the first TA is displayed, a voice and visual annunciation are generated. As long as a single TA remains on the display, no additional voice alerts are generated. If a second TA appears on the display or if the number of TAs initially decreases and then subsequently increases, another voice alert is generated.
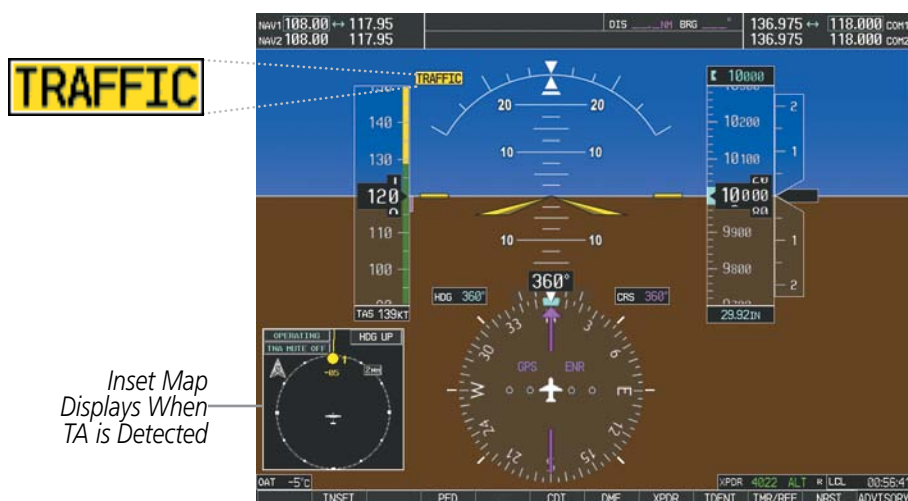

Inset Map Displays When TA is Detected

Figure 6-158 Traffic Annunciation (PFD)

A *"TIS Not Available"* (TNA) voice alert is generated when the TIS service becomes unavailable or is out of range. TIS may be unavailable in the radar coverage area due to the following:

- Radar site TIS Mode S sensor is not operational or is out of service

- Traffic or requesting aircraft is beyond the maximum range of the TIS-capable Mode S radar site.

- Traffic or requesting aircraft is above the radar site in the cone of silence and out of range of an adjacent site.

- Traffic or requesting aircraft is below radar coverage. In flat terrain, the coverage extends from about 3000 feet upward at 55 miles. Terrain and obstacles around the radar site can further decrease radar coverage in all directions.

- Traffic does not have an operating transponder.

The *"TIS Not Available"* (TNA) voice alert can be manually muted to reduce nuisance alerting. TNA muting status is shown in the upper left corner of the Traffic Map Page.

Muting the "TIS Not Available" voice alert:

1) Select the Traffic Map Page.

2) Press the **TNA MUTE** Softkey. The status is displayed in the upper left corner of the Traffic Map Page.

Or:

a) Press the **MENU** Key.

**b)** Select "'Not Available" Mute On' (shown if TNA muting is currently off) and press the **ENT** Key.

SYSTEM STATUS

The G1000 performs an automatic test of TIS during power-up. If TIS passes the test, TIS enters Standby Mode (on the ground) or Operating Mode (in the air). If TIS fails the power up test, an annunciation is shown in the center of the Traffic Map Page.

Traffic Map Page Annunciation	Description
NO DATA	Data is not being received from the transponder*
DATA FAILED	Data is being received from the transponder, but a failure is detected in the data stream*
FAILED	The transponder has failed*
UNAVAILABLE	TIS is unavailable or out of range

* Contact a service center or Garmin dealer for corrective action

Table 6-24 TIS Failure Annunciations
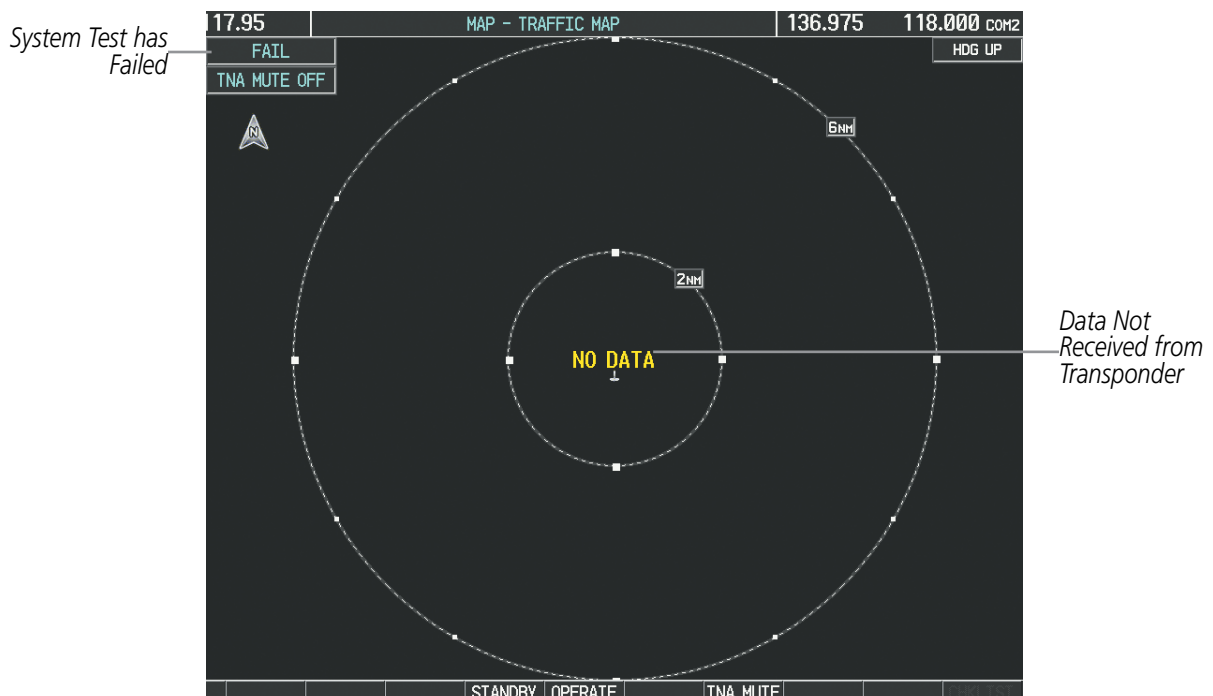
Figure 6-159 TIS Power-up Test Failure

The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. If traffic is selected for display on another map while Standby Mode is selected, the traffic display enabled icon is crossed out (also the case whenever TIS has failed). Once the aircraft is airborne, TIS switches to Operating Mode and traffic information is displayed. The mode can be changed manually using softkeys or the page menu.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Enabled Icon (Other Maps)
TIS Operating	**OPERATING**	
TIS Standby	**STANDBY** (also shown in white in center of page)	
TIS Failed*	**FAIL**	

* See Table 6-26 for additional failure annunciations

Table 6-25 TIS Modes

Switching between TIS modes:

1) Select the Traffic Map Page.

2) Press the **STANDBY** or **OPERATE** Softkey to switch between modes. The mode is displayed in the upper left corner of the Traffic Map Page.

   Or:

   a) Press the **MENU** Key.

   b) Select 'Operate Mode' or 'Standby Mode' (choice dependent on current state) and press the **ENT** Key. The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed (Table 6-26).

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range* Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending)
AGE MM:SS	Appears if traffic data is not refreshed within 6 seconds If after another 6 seconds data is not received, traffic is removed from the display The quality of displayed traffic information is reduced as the age increases
TRFC COAST	The displayed data is not current (6 to 12 seconds since last message) The quality of displayed traffic information is reduced when this message is displayed
TRFC RMVD	Traffic is removed because it is too old for coasting (12 to 60 seconds since last message) Traffic may exist within the selected display range, but it is not displayed
TRFC FAIL	Traffic data has failed
NO TRFC DATA	Traffic has not been detected
TRFC UNAVAIL	The traffic service is unavailable or out of range

*Shown as symbol on Traffic Map Page
**Shown in center of Traffic Map Page

Table 6-26 TIS Traffic Status Annunciations

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6.10 GARMIN GTS 800 TRAFFIC

⚠️ *WARNING:* *The GTS 800 Traffic Advisory System (TAS) is intended for advisory use only to aid the pilot in visually acquiring traffic. No avoidance maneuvers should be based solely upon TAS traffic information. It is the responsibility of the pilot in command to see and maneuver to avoid traffic.*

✓ *NOTE:* *Pilots should be aware of TAS system limitations. TAS systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due phenomena such as antenna shading or marginal transponder performance, traffic may be displayed intermittently, or not at all. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication. Pilots should remain vigilant for traffic at all times.*

✓ *NOTE:* *TIS is disabled when TAS installed.*

The optional Garmin GTS 800 is a Traffic Advisory System (TAS). It enhances flight crew situational awareness by displaying traffic information for transponder-equipped aircraft. The system also provides visual and aural traffic alerts including voice announcements to assist in visually acquiring traffic.

The GTS 800 is capable of tracking up to 45 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruding aircraft equipped with Mode S transponders. A maximum of 30 aircraft with the highest threat potential can be displayed simultaneously. No TAS surveillance is provided for aircraft without operating transponders.

THEORY OF OPERATION

When the GTS 800 is in Operating Mode, the unit interrogates the transponders of intruding aircraft while monitoring transponder replies. The system uses this information to derive the distance, relative bearing, and if reported, the altitude and vertical trend for each aircraft within its surveillance range. The GTS 800 then calculates a closure rate to each intruder based on the projected Closest Point of Approach (CPA). If the closure rate meets the threat criteria for a Traffic Advisory (TA), visual and aural alerting is provided.

TAS SURVEILLANCE VOLUME

The GTS 800 surveillance system monitors the airspace within ±10,000 feet of own altitude. Under ideal conditions, the GTS 800 unit scans transponder traffic up to 12 nm in the forward direction. The range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. In areas of greater transponder traffic density or when TCAS II (Traffic Alert and Collision Avoidance System II) systems are detected, the GTS 800 automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.

When paired with a 1090 MHz extended squitter transponder, the GTS 800 uses Automatic Dependent Surveillance - Broadcast (ADS-B) data from participating airborne aircraft transponders to enhance the positional accuracy and display of traffic within the TAS surveillance range. Traffic data supplied only by ADS-B Ground Based Transceivers (GBTs) is not displayed.

TAS SYMBOLOGY

The GTS 800 uses symbology to depict intruding traffic using the symbols shown in Table 6-27.

Symbol	Description
▷	Traffic Advisory (TA) arrow with ADS-B directional information. Points in the direction of the intruder aircraft track. (Not available in all installations.)
●	Traffic Advisory without ADS-B directional information.
◐	Traffic Advisory out of the selected display range. Displayed at outer range ring at proper bearing.
▷	Proximity Advisory (PA) arrow with ADS-B directional information. Points in the direction of the aircraft track. (Not available in all installations.)
◇	Proximity Advisory without ADS-B directional information.
▷	Non-threat traffic arrow with ADS-B directional information. Points in the direction of the intruder aircraft track. (Not available in all installations.)
◈	Non-Threat Traffic without ADS-B directional information
⟂	PA or Non-threat traffic arrow with ADS-B directional information, but positional accuracy is degraded. Points in the direction of the aircraft track. (Not available in all installations.)

Table 6-27 GTS 800 Traffic Symbols

A Traffic Advisory (TA), displayed as a yellow circle or triangle, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or triangle, indicates the intruding aircraft is within ±1200 feet and is within a 6 nm range, but is still not considered a TA threat.

A Non-threat Advisory, shown as an open white diamond or triangle, is displayed for traffic beyond 6 nm that is neither a TA or PA.

A solid white rounded arrow indicates either a PA or Non-Threat traffic with ADS-B directional information, but the position of the traffic is shown with degraded accuracy.

Relative altitude, when available, is displayed above or below the corresponding intruder symbol in hundreds of feet (Figure 6-160). When this altitude is above own aircraft, it is preceded by a '+' symbol; a minus sign '-' indicates traffic is below own aircraft.

A vertical trend arrow to the right of the intruder symbol (Figure 6-160) indicates climbing or descending traffic with an upward or downward-pointing arrow respectively.

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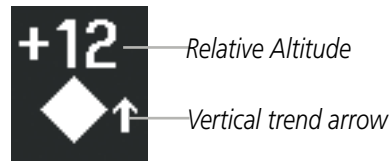
Figure 6-160 Intruder Altitude and Vertical Trend Arrow

If the intruding aircraft is providing ADS-B track information, this is displayed as a vector line extending beyond the traffic symbol in the direction of the track (Figure 6-161).
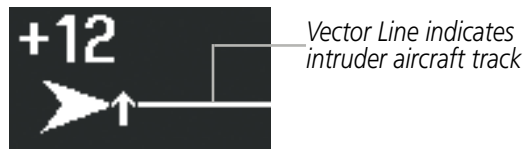
Figure 6-161 Intruder Traffic with ADS-B Directional Information and Track

Flight IDs may also be displayed with traffic symbols; see the Flight IDs discussion in this section for more information.

On-ground aircraft with Mode S transponders are not displayed.

TA ALERTING CONDITIONS

The GTS 800 automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting during flight phases likely to be near airports. The system uses Level A TA sensitivity when the groundspeed is less than 120 knots; Level B TA sensitivity applies in all other conditions.

| Sensitivity Level	Intruder Altitude Available	TA Alerting Conditions
A	Yes	Intruder closing rate provides less than 20 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 20 seconds of horizontal separation and vertical separation is within 600 feet. Or: Intruder range is within 0.2 nm and vertical separation is within 600 feet.
A	No	Intruder closing rate provides less than 15 seconds of separation.
B	Yes	Intruder closing rate provides less than 30 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 30 seconds of horizontal separation and vertical separation is within 800 feet. Or: Intruder range is within 0.55 nm and vertical separation is within 800 feet.
B	No	Intruder range is less than 20 seconds.

Table 6-28 TA Sensitivity Level and TA Alerting Criteria

TAS ALERTS

NOTE: *Aural traffic alerts do not occur when the landing gear is extended. Only visual traffic annunciations are issued.*

When the GTS 800 detects a new TA, the following occur:

• A single **"*Traffic!*"** voice alert is generated, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA (Table 6-29). The announcement "***Traffic! 12 o'clock, high, four miles***," would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.

• A TRAFFIC Annunciation appears at the top right of the airspeed on the PFD, flashing for five seconds and remains displayed until no TAs are detected in the area (Figure 6-162).

• The PFD Inset Map is automatically displayed with TA traffic.

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If the bearing of TA traffic cannot be determined, a yellow text banner will be displayed in the center of the Traffic Map Page and in the lower-left of the PFD inset map instead of a TA symbol. The text will indicate "TA" followed by the distance, relative altitude, and vertical trend arrow for the TA traffic, if known.

A TA will be displayed for at least eight seconds, even if the condition(s) that initially triggered the TA are no longer present.
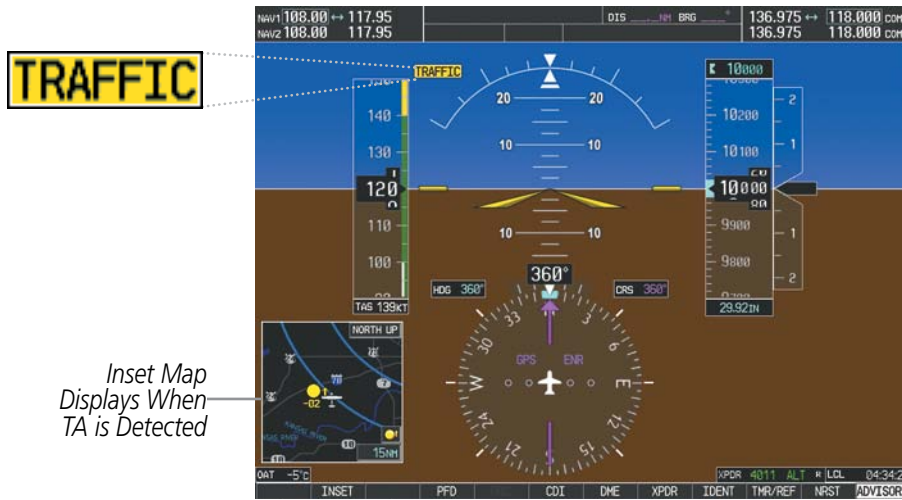

Figure 6-162 Traffic Annunciation (PFD)

Bearing	Relative Altitude	Distance (nm)
"One o'clock" through "Twelve o'clock" or "No Bearing"	"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"

Table 6-29 TA Descriptive Voice Announcements

SYSTEM TEST

> **NOTE:** *Traffic surveillance is not available during the system test. Use caution when performing a system test during flight.*

The GTS 800 provides a system test mode to verify the TAS system is operating normally. The test takes ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols is displayed on the Traffic Map Page (Figure 6-163). If the system test passes, the aural announcement **"TAS System Test Passed"** is heard, otherwise the system announces **"TAS System Test Failed."** When the system test is complete, the traffic system enters Standby Mode.

Testing the traffic system:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Traffic Map Page.

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3) Turn the **Range** knob to set the range to 2/6 nm to allow for full test pattern to be displayed during test.

4) Press the **TEST** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Test Mode'.
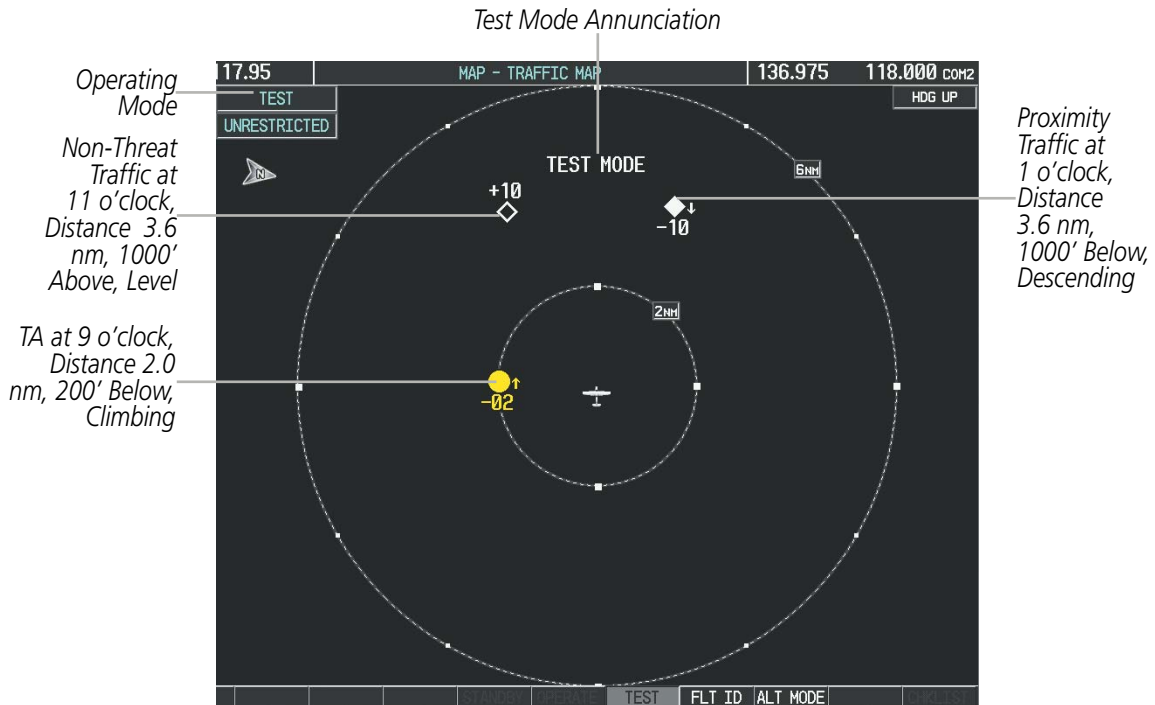
2) Press the **ENT** Key.

Figure 6-163 System Test in Progress with Test Pattern

OPERATION

NOTE: *The GTS 800 automatically transitions from **STANDBY** to **OPERATE** mode eight seconds after takeoff. The unit also automatically transitions from **OPERATE** to **STANDBY** mode 24 seconds after landing.*

After power-up, the GTS 800 is in Standby Mode. The GTS 800 must be in Operating Mode for traffic to be displayed and for TAs to be issued.

Selecting the **OPERATE** Softkey allows the traffic unit to switch from Standby Mode to Operating Mode as necessary. Selecting the **STANDBY** Softkey forces the unit into Standby Mode.

Switching from operating mode to standby mode:

On the Traffic Page, select the **STANDBY** Softkey

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Standby Mode'.

2) Press the **ENT** Key.

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Switching from standby mode to operating mode:

On the Traffic Page, select the **OPERATE** Softkey

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Operate Mode'.

2) Press the **ENT** Key. The traffic unit switches from Standby Mode to Operating Mode as necessary.

TRAFFIC MAP PAGE

The Traffic Map Page shows surrounding TAS traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal map page for viewing traffic information. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **RANGE** Knob, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper left corner of the page.
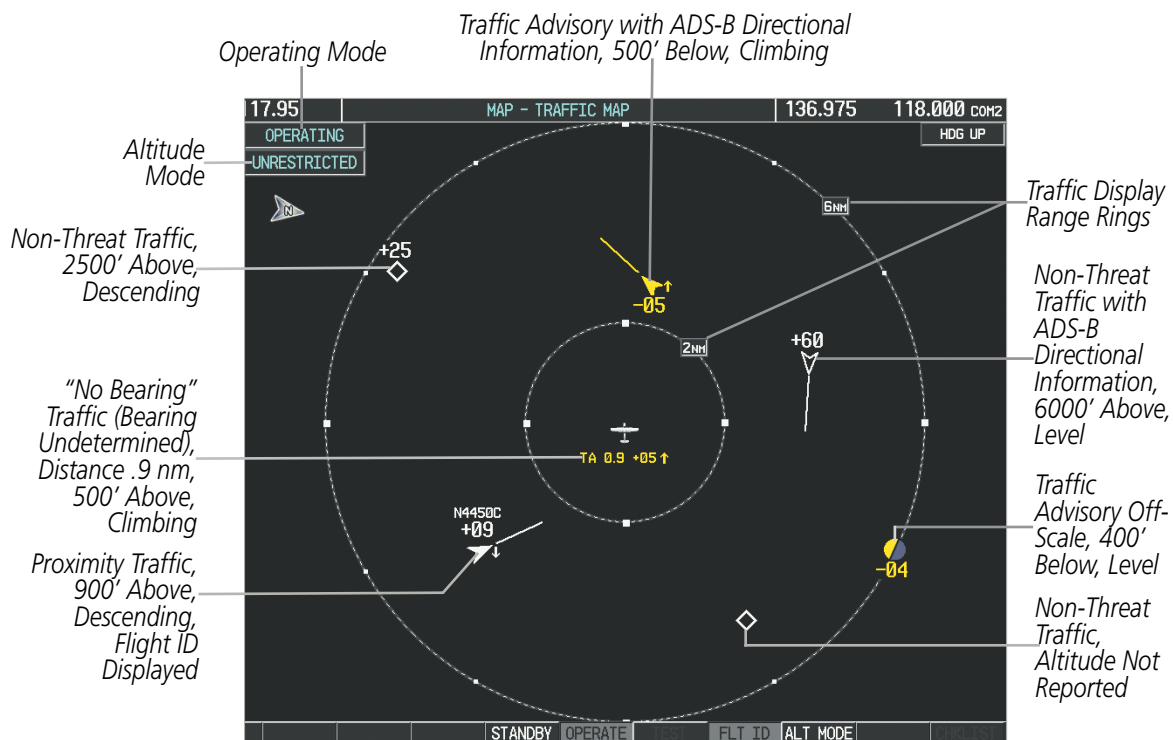
Figure 6-164 Traffic Map Page

Displaying traffic on the Traffic Map Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Traffic Map Page.

3) Press the **OPERATE** Softkey to begin displaying traffic. OPERATING is displayed in the Traffic mode field.

4) Press the **STANDBY** Softkey to place the system in the Standby mode. STANDBY is displayed in the Traffic mode field.

5) Turn the **RANGE** Knob clockwise to display a larger area or counter-clockwise to display a smaller area.

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ALTITUDE DISPLAY

The pilot can select the volume of airspace in which non-threat and proximity traffic is displayed. TAs occurring outside of these limits will always be shown.

Changing the altitude range:

1) On the Traffic Map Page, select the **ALT MODE** Softkey.

2) PressS one of the following Softkeys:

- **ABOVE:** Displays non-threat and proximity traffic from 9000 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.

- **NORMAL:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.

- **BELOW:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 9000 feet below the aircraft. Typically used during descent phase of flight.

- **UNREST** (unrestricted)**:** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.

3) To return to the Traffic Page, press the **BACK** Softkey.

Or:

1) Press the **MENU** Key.

2) Turn the small **FMS** Knob to select one of the following (see softkey description in step 2 above):

- ABOVE
- NORMAL
- BELOW
- UNRESTRICTED

3) Press the **ENT** Key.

FLIGHT ID DISPLAY

The Flight IDs of other aircraft (when available) can be enabled for display on the Traffic Map Page (Figure 6-165). When a flight ID is received, it will appear above or below the corresponding traffic symbol on the Traffic Map Page when this option is enabled.

Flight ID

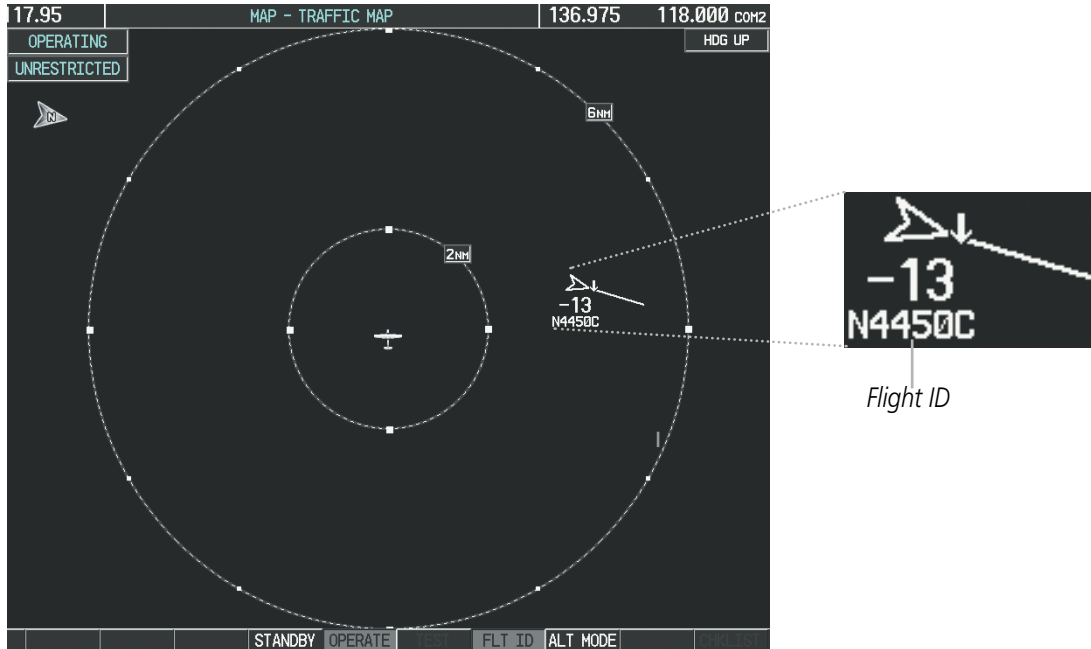**Figure 6-165 Traffic Map Page with Flight ID Enabled**

Enabling/Disabling Flight ID Display:

> **On** the Traffic Map Page, press the **FLT ID** Softkey.

> **Or**:

1) Press the **MENU** Key.

2) Turn the small **FMS** Knob to choose 'Show Flight IDs' or 'Hide Flight IDs' (choice dependent on current state) (Figure 6-166).
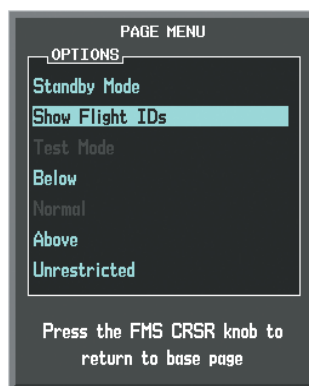
3) Press the **ENT** Key.

Figure 6-166 Traffic Map Page Menu

Traffic Map Page Display Range

The display range on the Traffic Map Page can be changed at any time. Map range is adjustable with the **RANGE** Knob, as indicated by the map range rings.

Changing the display range on the Traffic Map Page:

1) Turn the **RANGE** Knob.

2) The following range options are available:

    •   2 nm

    •   2 and 6 nm

    •   6 and 12 nm

ADDITIONAL TRAFFIC DISPLAYS

Traffic information can be displayed on the following maps on the MFD when the unit is operating:

- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page
- System Pages
- Video Page

Traffic information can also be displayed on the PFD when the Synthetic Vision System (SVS) option is installed and enabled. See the Additional Features Section for details.

Displaying traffic information (MFD maps other than the Traffic Map Page):

1) Select the **MAP** Softkey.

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, a traffic icon is shown to indicate traffic is enabled for display (Figure 6-167).

Displaying traffic on the Navigation Map

1) Ensure the traffic system is operating. With the Navigation Map displayed, press the **MAP** Softkey.

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map as shown in the figure.

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Figure 6-167 TAS Traffic on Navigation Map

Customizing the traffic display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-168).

4) Turn the small **FMS** Knob to select the Traffic Group and press the **ENT** Key (Figure 6-169.

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through the selections (Figure 6-170).

    • TRAFFIC – Turns the display of traffic data on or off

    • TRAFFIC MODE – Selects the traffic mode for display; select from:

        - All Traffic - Displays all traffic

        - TA/PA - Displays Traffic Advisories and Proximity Advisories

        - TA ONLY - Displays Traffic Advisories only

    • TRAFFIC SMBL – Selects the maximum range at which traffic symbols are shown

    • TRAFFIC LBL – Selects the maximum range at which traffic labels are shown with the option to turn off

6) Turn the small **FMS** Knob to scroll through options (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

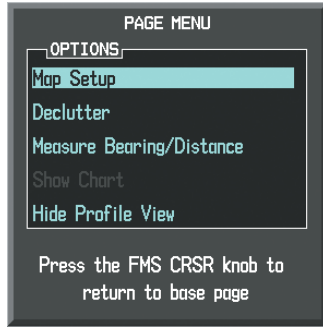8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page.
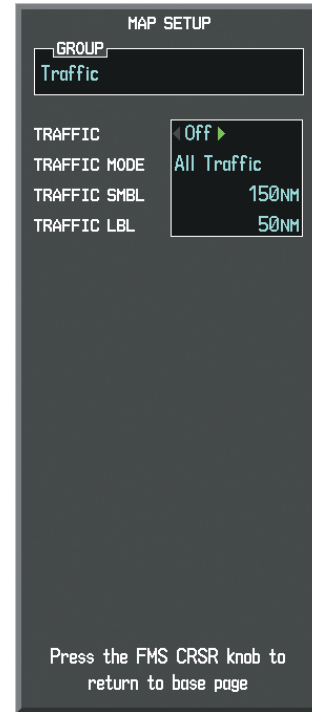
Figure 6-168 Navigation Map Page Menu

Figure 6-169 Navigation Map Page Setup Menu

Figure 6-170 Navigation Map Page Setup Menu, Traffic Group

The Navigation Map Page Setup Menu also controls the display of traffic. The setup menu controls the map range settings. Traffic data symbols and labels can be decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Traffic information can also be displayed on the PFD Inset Map by pressing the **INSET** Softkey. A traffic map will appear in heading up orientation. Traffic information can also be overlaid with navigation, topographic and optional XM Weather data.

Displaying traffic information (PFD Inset Map):

1) Press the **INSET** Softkey.

2) Press the **TRAFFIC** Softkey to display traffic data on the inset map (TRFC-1).

3) Select the softkey again to display the traffic-only inset (TRFC-2).

4) Select the softkey again to remove traffic data.

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SYSTEM STATUS

The traffic mode is annunciated in the upper left corner of the Traffic Map Page.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Status Icon (Other Maps)
TAS System Test Initiated	**TEST** (also shown in white in center of page)	
TAS Operating	**OPERATING**	
TAS Standby	**STANDBY** (also shown in white in center of page)	
TAS Failed*	**FAIL**	

* See Table 6-31 for additional failure annunciations

Table 6-30 TAS Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Page Center Annunciation	Description
NO DATA	Data is not being received from the TAS unit
DATA FAILED	Data is being received from the TAS unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the TAS unit

Table 6-31 TAS Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	TAS unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the TAS unit

*Shown as symbol on Traffic Map Page
**Shown in center of Traffic Map Page

Table 6-32 TAS Traffic Status Annunciations

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6.11 HONEYWELL KTA870 TRAFFIC

NOTE: *TIS is disabled when Traffic Advisory System (TAS) is installed.*

NOTE: *Refer to the Honeywell® KTA 870 Pilot's Guide for a detailed discussion of the KTA 870 TAS.*

TAS SYMBOLOGY

The Traffic Advisory System (TAS) is designed to help in detection and avoidance of other aircraft. TAS uses an on-board interrogator-processor and the Mode S transponder for the air-to-air traffic data link. Traffic is displayed with the symbology shown in Table 6-33.

TAS Symbol	Description
◈	Non-Threat Traffic
◇	Proximity Advisory (PA)
●	Traffic Advisory (TA)
◐	Traffic Advisory Off Scale

Table 6-33 TAS Symbol Description

A Non-threat Advisory, shown as an open white diamond, indicates that an intruding aircraft is at greater than ±1200 feet relative altitude or the distance is beyond 5 nm.

A Proximity Advisory indicates that the intruding aircraft is within ±1200 feet and is within 5 nm range, but is still not considered a threat.

A Traffic Advisory (TA) alerts the crew to a potentially hazardous intruding aircraft. Closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

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OPERATION

The KTA 870 must be in Operating Mode for traffic to be displayed. The unit starts in Operating Mode upon power-up.

Selecting the **STANDBY** Softkey places the unit into Standby Mode. Selecting the **NORMAL** Softkey allows the KTA 870 to switch from Standby Mode to Operating Mode as necessary.

Switching from operating mode to standby mode:

1) Select the Traffic Map Page.

2) Select the **STANDBY** Softkey.

   Or:

1) Select the Traffic Map Page.

2) Press the **MENU** Key and turn the small **FMS** knob to select Standby Mode.

3) Press the **ENT** Key.

Switching from standby mode to operating mode:

   On the Traffic Page, select the **NORMAL** Softkey

   Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Normal Mode'.

2) Press the **ENT** Key. The KTA 870 switches from Standby Mode to Operating Mode as necessary.

System Self Test

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Traffic Map Page.

3) Turn the **Range** knob to set the range to 2/6 nm allow for display of full traffic test pattern.

4) Select the **TEST** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Test Mode'.

2) Press the **ENT** Key.

Self Test takes approximately eight seconds to complete. When completed successfully, traffic symbols are displayed and a voice alert *"TAS System Test OK"* is heard. In the event that the system test fails, the system enters Standby Mode and a voice alert *"TAS System Test Fail"* is heard.

Displaying traffic on the Traffic Map Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Traffic Map Page.

3) Select the **NORMAL** Softkey to begin displaying traffic. 'OPERATING' is displayed in the Traffic mode field.

4) Select the **ALT MODE** Softkey to change the altitude volume.

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5) Select the **STANDBY** Softkey to place the system in the Standby mode. STANDBY is displayed in the Traffic mode field.

6) Turn the **RANGE** Knob clockwise to display a larger area or counter-clockwise to display a smaller area.

Figure 6-171 Traffic Map Page

The Traffic Map Page shows surrounding TAS traffic data in relation to the aircraft's current position and altitude, without basemap clutter. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **RANGE** Knob from 2 to 40 nm, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper left corner.

DISPLAYING TRAFFIC DATA

The Map - Traffic Map Page is the principal page for viewing traffic information. Additional displays of traffic information are available as map overlays while the traffic system is operating, and serve as additional reference to the Traffic Map Page. Traffic information can be displayed on the following maps and pages:

- PFD Inset Map
- Navigation Map Page
- Traffic Map Page
- Trip Planning Page

- Nearest Pages
- Active Flight Plan Page
- Video Page

Traffic information can also be displayed on the PFD when the Synthetic Vision System (SVS) option is installed and enabled. See the Additional Features Section for details.

Displaying traffic information (maps other than the Traffic Map Page):

1) Select the **MAP** Softkey.

2) Select the **TRAFFIC** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, a traffic icon is shown to indicate TAS is enabled for display.

Displaying traffic on the Navigation Map

1) Ensure that the TAS system is operating. With the Navigation Map displayed, select the **MAP** Softkey.

2) Select the **TRAFFIC** Softkey. Traffic is now displayed on the map as shown in the figure.

Figure 6-172 TAS Traffic on Navigation Map

Displaying traffic information (PFD Inset Map):

1) Select the **INSET** Softkey.

2) Select the **TRAFFIC** Softkey to display traffic data on the inset map (TRFC-1).

3) Select the softkey again to display the traffic-only inset (TRFC-2).

4) Select the softkey again to remove traffic data.

ALTITUDE DISPLAY

The pilot can select the volume of airspace in which traffic is displayed. Traffic Advisories (TAs) outside of these limits will still be shown. Refer to the KTA 870 Pilot's Guide for specific display thresholds.

Changing the altitude display mode:

1) On the Traffic Page, select the **ALT MODE** Softkey.

2) Select one of the following Softkeys:

- **BELOW**
- **NORMAL**
- **ABOVE**
- **UNREST** (unrestricted)

3) To return to the Traffic Page, select the **BACK** Softkey.

Or:

1) Press the **MENU** Key.

2) Turn the small **FMS** Knob to select one of the following:

- BELOW
- NORMAL
- ABOVE
- UNREST (unrestricted)

3) Select the **ENT** Softkey.

TRAFFIC MAP PAGE DISPLAY RANGE

The display range on the Traffic Map Page can be changed at any time. Map range is adjustable with the **RANGE** Knob from 2 to 40 nm, as indicated by the map range rings.

Changing the display range on the Traffic Page:

1) Turn the **RANGE** Knob.

2) The following range options are available:

- 2 nm
- 2 and 6 nm
- 6 and 12 nm
- 12 and 24 nm
- 24 and 40 nm

Customizing the traffic display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-173).

4) Turn the small **FMS** Knob to select the Traffic Group and press the **ENT** Key (Figure 6-174).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through the selections (Figure 6-175).

- TRAFFIC – Turns the display of traffic data on or off

- TRAFFIC MODE – Selects the traffic mode for display; select from:

    - All Traffic - Displays all traffic

    - TA/PA - Displays Traffic Alerts and Proximity Advisories

    - TA ONLY - Displays Traffic Alerts only

- TRAFFIC SMBL – Selects the maximum range at which traffic symbols are shown

- TRAFFIC LBL – Selects the maximum range at which traffic labels are shown with the option to turn off

6) Turn the small **FMS** Knob to scroll through options (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page.

Figure 6-173 Navigation Map Page Menu

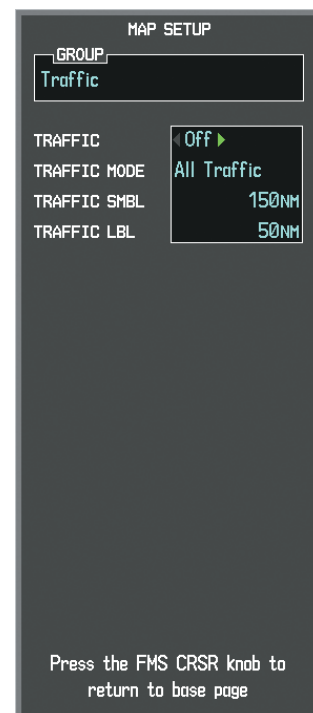**Figure 6-174 Navigation Map Page Setup Menu**

Figure 6-175 Navigation Map Page Setup Menu, Traffic Group

The Navigation Map Page Setup Menu also controls the display of traffic. The setup menu controls the map range settings. Traffic data symbols and labels can be decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

TAS ALERTS

NOTE: *Refer to the KTA 870 documentation for information on alerts generated by the TAS equipment.*

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur:

- A **"Traffic, Traffic"** voice alert is generated when the first TA is displayed.

- A TRAFFIC Annunciation appears at the top right of the airspeed on the PFD, flashing for 5 seconds and remaining displayed until no TAs are detected in the area.

- The PFD Inset Map is automatically displayed with TA traffic.

- A single **"Traffic"** voice alert is generated when the number of TAs increases.
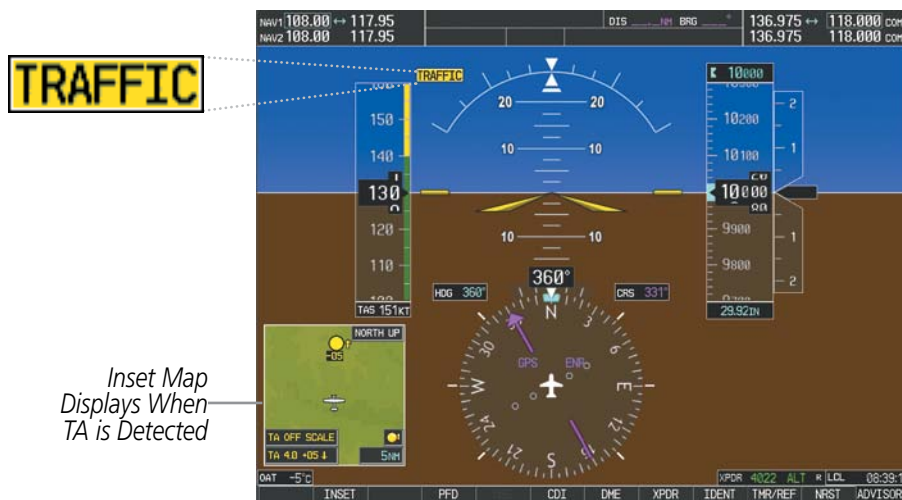

Inset Map Displays When TA is Detected

Figure 6-176 Traffic Annunciation (PFD)

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SYSTEM STATUS

The traffic mode is annunciated in the upper left corner of the Traffic Map Page.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Enabled Icon (Other Maps)
TAS Self-test Initiated	**TEST** (also shown in white in center of page)	
TAS Operating	**OPERATING**	
TAS Standby	**STANDBY** (also shown in white in center of page)	
TAS Failed*	**FAIL**	

* See Table 6-35 for additional failure annunciations

Table 6-34 TAS Modes

If the unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page.

Traffic Map Page Annunciation	Description
NO DATA	Data is not being received from the TAS unit
DATA FAILED	Data is being received from the TAS unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the TAS unit

Table 6-35 TAS Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range* Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending)
TRFC FAIL	TAS unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the TAS unit

*Shown as symbol on Traffic Map Page
**Shown in center of Traffic Map Page

Table 6-36 TAS Traffic Status Annunciations

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6.12 ADS-B TRAFFIC

The Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic function allows you to view other traffic in the area, when a GDL 90 data link radio is installed.

Figure 6-177 ADS-B System

ADS-B is a surveillance technology being deployed in selected areas. ADS-B broadcasts a radio transmission approximately once per second containing the aircraft's position, velocity, identification, and other information. ADS-B can also receive reports from other suitably equipped aircraft within reception range. Additionally, these broadcasts can be received by Ground Based Transceivers (GBTs) and used to provide air traffic surveillance services. No ground infrastructure is necessary for ADS-B equipped aircraft to detect each other.

In the United States, two different data links have been adopted for use with ADS-B: 1090 MHz Extended Squitter (1090 ES) and the Universal Access Transceiver (UAT). The GDL 90 is a Universal Access Transceiver (UAT). The UAT link is intended for use by aircraft that primarily operate at 18,000 feet and below. The UAT link supports Flight Information Services-Broadcast (FIS-B).

ADS-B enables improved surveillance services, both air-to-air and air-to-ground, especially in areas where radar is ineffective due to terrain or where it is impractical or cost prohibitive. Initial applications of air-to-air ADS-B are for "advisory" use only, enhancing a pilot's visual acquisition of other nearby equipped aircraft either when airborne or on the airport surface.

ADS-B is intended to be used both in-flight and on the airport surface. ADS-B systems should be turned "on" -- and remain "on" -- whenever operating in the air and on the airport surface, unless a change to "standby" was requested by ATC.

The ADS-B cockpit display of traffic is NOT intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft. ADS-B shall not be used for avoidance maneuvers during IMC or other times when there is no visual contact with the other target aircraft. ADS-B is intended only to assist in visual acquisition of other aircraft. **No avoidance maneuvers are provided for, nor authorized, as a direct result of an ADS-B target being displayed in the cockpit.**

> **NOTE:** *Use of ADS-B surveillance services is limited to the service volume of the Ground-Based Transceiver (GBT). The coverage volume of GBTs is limited to line-of-sight..*

TRAFFIC DESCRIPTION

ADS-B is limited to displaying traffic in the G1000. Operation is similar to the TAS system discussed previously, with the exception of symbology. The symbols used to display ADS-B traffic are shown in tables below. Above or below the traffic symbol is the traffic identifier, and altitude. A small up or down arrow next to the traffic symbol indicates that the traffic is climbing or descending at a rate of at least 500 feet per minute. The vector line that extends beyond the point of the traffic arrow is just further indication of the intruder aircraft track.

Symbol	Description
	Traffic Advisory with directional information. Points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory out of the selected display range. Displayed at outer range ring at proper bearing.
	Proximity Advisory with directional information. Points in the direction of the aircraft track.
	Non-threat traffic with no directional information.
	Non-threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Traffic located on the ground with directional information. Points in the direction of the aircraft track. Ground traffic is only displayed when own aircraft is below 1,000 feet AGL or on the ground.
	Ground traffic without directional information. Ground traffic is only displayed when own aircraft is below 1,000 feet AGL or on the ground.
	Non-aircraft ground traffic. Ground traffic is only displayed when own aircraft is below 1,000 feet AGL or on the ground.
	Traffic with directional information, but positional accuracy is degraded. Points in the direction of the aircraft track.

Table 6-37 ADS-B Traffic Symbology

The following Traffic symbols are displayed on the PFD when the Synthetic Vision System (SVS) option is installed and enabled. See the Additional Features Section for details.

ADS-B Symbol on the PFD (SVS Only)	Description
◇	Proximity Advisory (PA)
●	Traffic Advisory (TA)
◈	Non-threat traffic

Table 6-38 PFD ADS-B Symbology (SVS Only)

NOTE: *Traffic Alerts are only provided for target aircraft within 1.0 nautical mile. Traffic that is more than 1.0 nautical mile is depicted using the bullet symbol ⬠.*
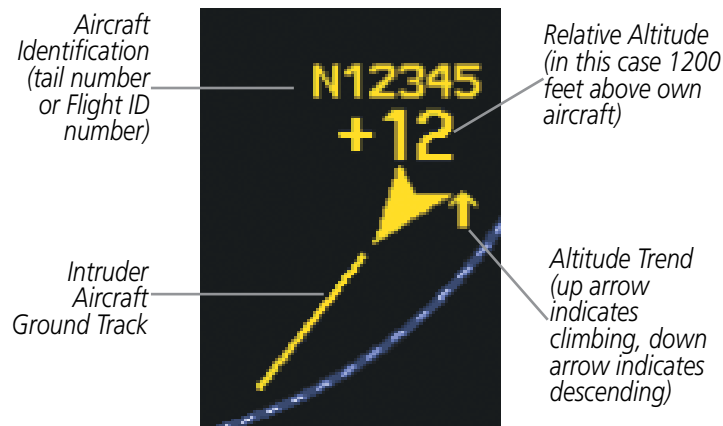

Aircraft Identification (tail number or Flight ID number)

Relative Altitude (in this case 1200 feet above own aircraft)

Intruder Aircraft Ground Track

Altitude Trend (up arrow indicates climbing, down arrow indicates descending)

Figure 6-178 Example ADS-B Traffic Advisory

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OPERATING MODES

The unit must be in operating mode for traffic to be displayed.

> **NOTE:** The GDL 90 listens to the transponder and follows the transponder mode. The only additional ADS-B mode control is altitude mode.
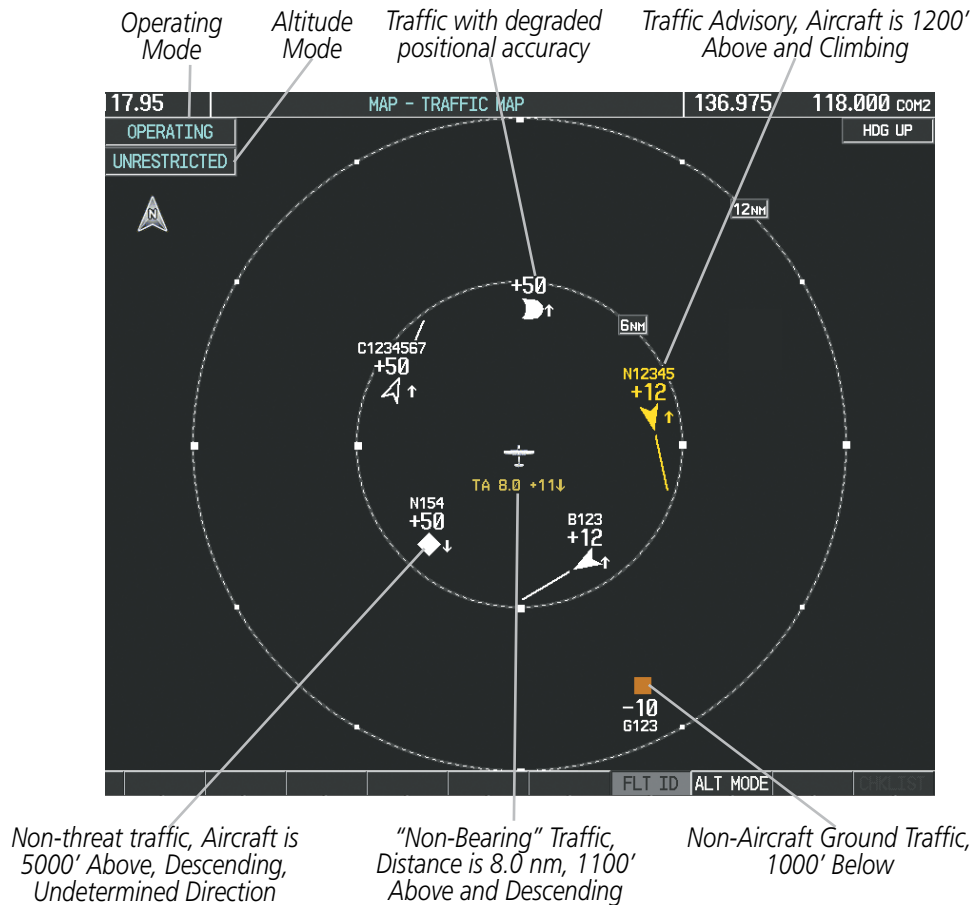

Figure 6-179 ADS-B Traffic Map Page

Displaying traffic on the Traffic Map Page:

1) Turn the large **FMS** knob to select the Map Page Group.

2) Turn the smalll **FMS** knob to select the Traffic Map Page.

Changing the altitude display mode:

1) On the Traffic Page, press the **ALT MODE** Softkey.

2) Press one of the following softkeys:

   • **BELOW**, **NORMAL**, **ABOVE**, or **UNREST** (unrestricted)

3) To return to the Traffic Page, press the **BACK** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** Knob to select one of the following:

- **BELOW**, **NORMAL**, **ABOVE**, or **UNREST** (unrestricted)

2) Press the **ENT** Key.

Changing the display range on the Traffic Page:

1) Turn the **RANGE** Knob.

2) The following range options are available:

- 2 nm
- 2 and 6 nm
- 6 and 12 nm
- 12 and 24 nm
- 24 and 40 nm

Showing/Hiding Flight IDs on the Traffic Map Page:

On the Traffic Map Page, press the **FLT ID** Softkey.

Or:

1) Press the **MENU** Key.

2) If necessary, turn the small **FMS** Knob to select 'Show Flight IDs' or 'Hide Flight IDs' (choice dependent on current state.)

3) Press the **ENT** Key.

The Traffic Map Page displays the following information:

- Current aircraft location
- Surrounding traffic
- Range marking rings
- Current traffic mode
  - OPERATING
  - FAIL
- Traffic alert messages
  - FAILED
  - DATA FAILED
  - NO DATA
  - UNAVAILABLE

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