5 Hazard Awareness

HAZARD AWARENESS APPS & FUNCTIONS

Menu selections vary based on features and optional equipment installed with Garmin avionics.

Traffic

- Display traffic
- Control traffic system
- Set up the traffic display

Terrain

- Display terrain & obstacles
- Inhibit alerting
- Test alerting

Weather

Access available weather apps. Depending on unit configuration these may include:

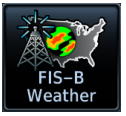
- SiriusXM WX
- FIS-B WX
- Connext WX
- Stormscope
- Radar

Weather Awareness

For installations with multiple weather sources, tapping the **Weather** icon on the Home page opens a menu. Available options are dependent upon the installed weather sources.

For installations with only a single weather source, tapping the icon takes you directly to the configured application.

Datalink Weather



GTN presents datalink weather data as overlays on the dedicated weather app. Available functions are dependent upon the active weather source(s).

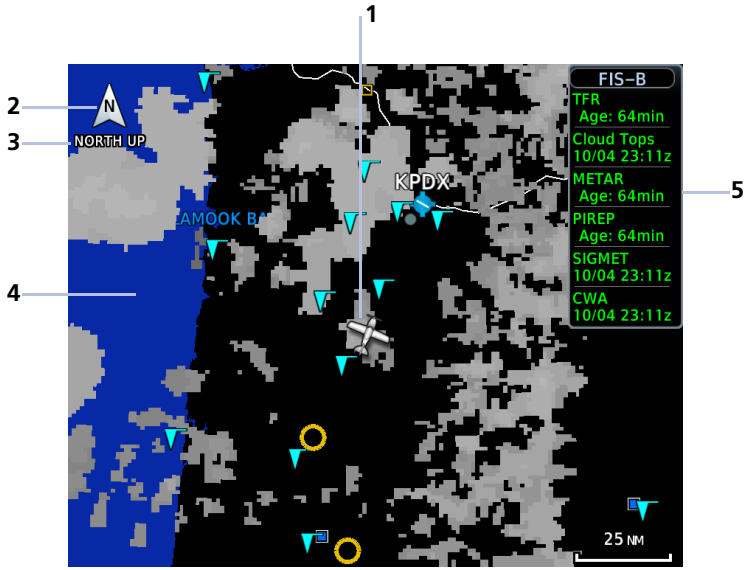
The unit allows up to three datalink weather options:

• SiriusXM • FIS-B • Connext

FEATURE REQUIREMENTS

- *FIS-B and GDL 88 or GTX 345 (FIS-B Weather)*
- *GSR 56 Iridium satellite transceiver (Connext Weather)*
- *GDL 69/69A SiriusXM receiver (SiriusXM Weather)*

All datalink weather apps share the same basic layout and features.

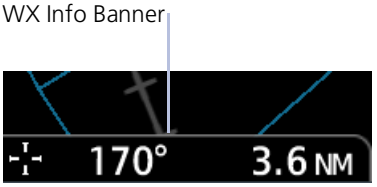


Common WX Display Features

1	**Ownship Icon** Depicts current aircraft position and orientation.
2	**North Indicator** Indicates True north.
3	**Page Orientation Label** Reflects the selected page orientation.
4	**Basemap** Presents a graphical depiction of land and water data.
5	**Product Timestamp** Approximate time of data collection for each active weather product.

WX Info Banner

Tapping any weather icon displays an information banner. When applicable, a pop-up window displays additional data.



Banner Information

- Pan mode symbol
- Bearing and distance to map pointer from aircraft's current position

WX Display Orientation

Each weather app allows you to set the orientation of the weather display.

Tap **Menu** > **Orientation**, and select from the following options.

North Up	Track Up	Heading Up
Orients page to True north	Orients page to current aircraft GPS track	Orients page to current aircraft heading (requires heading data source interface)

Page orientation label changes to reflect the selected orientation.

Ownship Icon Position & Orientation

- The tip represents actual aircraft location
- Symbol type is dependent upon configuration
- This feature is absent if a GPS source is not available

WX Display/Map Settings

Several weather map display settings are based on selections made in the setup menu of the primary Map application.

From the Home page:

Tap **Map** > **Menu** > **Map Setup**, and select the appropriate tab. Applicable map settings are as follows:

Map Tab	Aviation Tab	Land Tab
Settings: • North Up Above range	*Settings:* • Runway Extensions • Airport Range • Intersection Range • NDB Range • VOR Range • VRP Range • User Waypoint Range	*Settings:* • Road Detail • City Detail • State/Province Names • River/Lake Detail

Changes to these map settings take effect immediately on the configured datalink weather app(s).

Datalink Weather Products

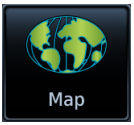
WARNING

Do not rely solely on datalink weather for weather information. Datalink weather provides a snapshot in time. It may not accurately reflect the current weather situation.

NOTE

Datalink weather is not intended to replace weather briefings or in-flight weather reports from AFSS or ATC.

In addition to the dedicated weather app, datalink weather products may display as one or more of the following, depending on weather source, product type and availability. For details, refer to the Datalink Weather Products List.

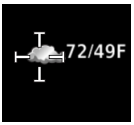


Map

Some product overlays are available for display on Map. For options, open the Map Setup menu.

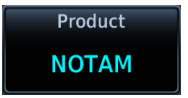
Airport Info

Textual information about local weather conditions is accessible on the WX Data tab.



WX Pop-up

Some product overlays display textual information when selected on Weather or Map.



Raw Text Reports

Textual reports are available for certain FIS-B weather products. These are accessible via the Datalink Status page.

DATALINK WEATHER PRODUCTS LIST

When available, datalink weather products display as follows.

DATALINK WEATHER PRODUCT	WEATHER DISPLAY				
	WX OVERLAY	WX POP-UP	MAP OVERLAY	AIRPORT INFO	RAW TEXT REPORT
AIREP	C, F, S	C, F, S			
AIRMET (Graphical)	F	F			
AIRMET (Textual)	C, S	C, S			
Cell Movement/SCIT	S	S	S		
Center Weather Advisory	F	F			F
City Forecast	S	S		S	
Cloud Top	F, S		S		
IR Satellite	C		C		
County Warnings	S	S			
Cyclone Track	S				
Echo Tops	S		S		
Freezing Levels	F, S				
Icing Potential/SLD	F, S				
Lightning (Datalink)	C, F, S		C, F, S		
METAR w/Decoding	C, F, S	C, F, S	C, F, S	C, F, S	F
NEXRAD/PRECIP	C, F, S		C, F, S		
NOTAM-D				F	F
NOTAM-FDC				F	F
PIREP	C, F, S	C, F, S			F
SIGMET	C, F, S	C, F, S			F
Surface Analysis	S				
TAF	C, F, S	C, F, S		F, S	F
Temps Aloft	F				F
TFR	C, F, S	C, F, S	C, F, S		F
Turbulence	F, S				
Winds Aloft	C, F, S				F

Connext Product: C **FIS-B Product:** F **SiriusXM Product:** S

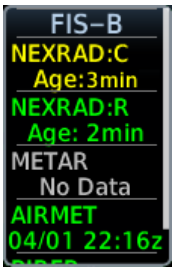
Product Age

NOTE

Data contained within a composite weather product may be older than its weather product age and should never be considered current.

A timestamp identifies the approximate time of data collection for each weather product. For quick reference, the age of each active weather product is calculated and shown in a color-coded side bar on Weather and Map.

TIMESTAMP COLOR DEFINITIONS



Yellow

Weather product considered stale. Its age is older than half its expiration time.
A weather product may be amber when its issue date and time occurs in the future by more than the complete expiration time for the requested weather product (e.g., some TFRs).

Green

Weather product considered current. Its age is newer than half its expiration time.

Tapping timestamp window displays the time for all green colored weather products.

Gray

Weather product data is one of the following:

- Expired
- Not received
- Not supported at the selected altitude

"No Data" or "ALT UNAVBL" displays next to the weather product title.

SiriusXM WX Product Age

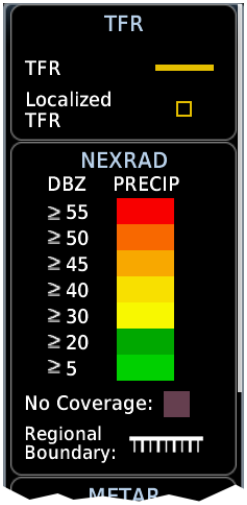
- Broadcast intervals are defined and controlled by SiriusXM Satellite Radio and its data vendors
- Data that does not refresh within its defined interval is considered expired and removed from the display
- Product age may not reflect the time difference between when the data was assembled by SiriusXM and the current GPS time. It is an indication of the time elapsed from when it is received by GTN
- Timestamp collapses when all WX products are current

Connext WX Product Age

- Product age is based on time difference between when the data was assembled by Connext and the current GPS time
- Product expiration is based on intervals defined for each product
- Pilot controls weather product requests
- Refresh intervals are defined and controlled by Connext Satellite Radio services and its data vendors
- Data is removed upon expiration, ensuring that displayed data is always consistent with what is currently being provided by Connext Satellite Radio services

FIS-B weather product update and transmission intervals are published in the SBS Description Document associated with TSO-C157b. This information is available electronically at the FAA's Regulatory and Guidance Library: https://rgl.faa.gov/

Product Legends



A scrollable legend provides relevant product colors and symbols. Definitions are organized by product function.

To display the legend for an active weather product, tap **Menu** > **Legend**.

Enabling this feature on one application does not enable it on all datalink weather apps.

GTN 650Xi SERIES

Toggling this feature on shows datalink weather product legends on a dedicated page.

GTN 750Xi SERIES

Toggling this feature on shows datalink product legends along the left side of the display.

Altitude Adjustment Keys

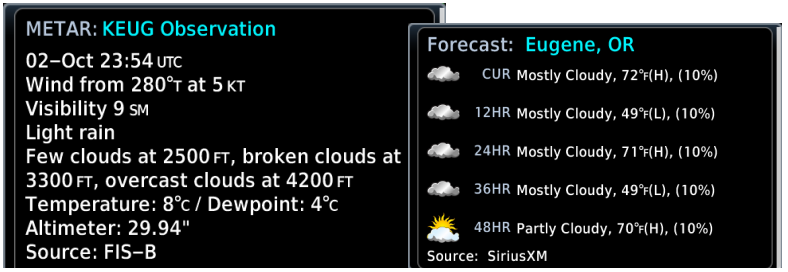
Directional keys adjust altitude for altitude-based weather products. Selectable altitude values vary by weather service and product. Includes:

• Icing • Turbulence • Winds Aloft

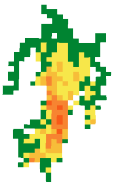
Airport Icons

Tapping the METAR symbol displays information about local weather conditions.

The same is true for airports containing the City Forecast product symbol (SiriusXM Weather only).



Precipitation

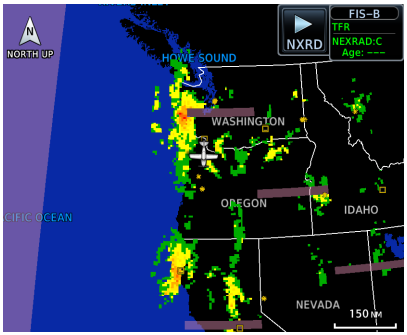


AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

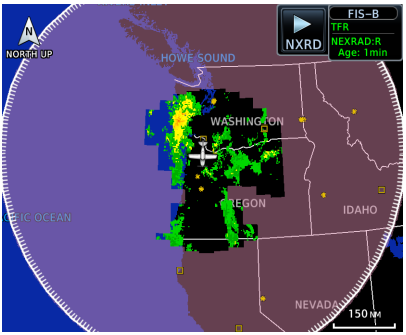
WARNING

Never use NEXRAD weather for maneuvering in, near, or around areas of hazardous weather. NEXRAD images are snapshots of past weather data. They are not safe for use as real time depictions of nearby weather activity.

FIS-B NEXRAD



CONUS NEXRAD



Regional NEXRAD

NEXRAD weather radar displays a mosaic of precipitation data, colored according to reflectivity. Composite reflectivity images depict the highest radar energy received from multiple antenna tilt angles at various altitudes. Base reflectivity images depict radar returns from the lowest antenna tilt angle. Per AC 00-63A, FIS-B CONUS and Regional NEXRAD are composite reflectivity images.

The precipitation intensity level reflected by each pixel represents the highest level of composite radar reflectivity data sampled in that location.

A clear understanding of ground-based Doppler weather radar capabilities will allow you to interpret the NEXRAD weather imagery in the safest way possible. The National Oceanic and Atmospheric Administration hosts a description of the technology on its website: https://www.weather.gov/jetstream/doppler_intro

RADAR DATA ANIMATIONS

To depict trending weather movements over time, an animation function stitches the last three to six received radar images together in sequence, from oldest to newest, and replays them on a continuous loop.

Play and stop controls are active when three or more images are available for playback.

CONNEXT PRECIP

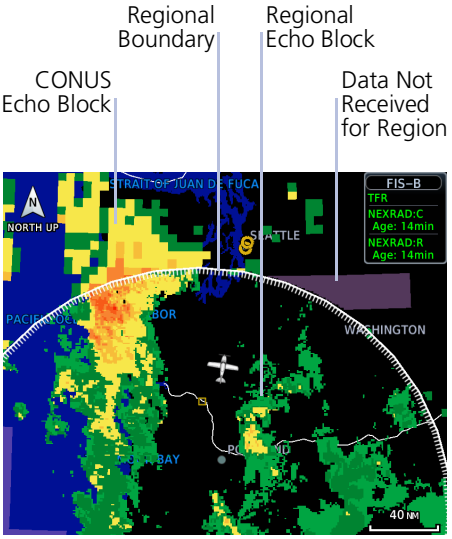
Precipitation products are available for areas around the world. For current coverage areas and product information, visit www.garmin.com/connext.

FIS-B NEXRAD

FIS-B NEXRAD is uplinked to the aircraft as two separate weather products: CONUS and Regional NEXRAD. Both products display individually or simultaneously, separated by a white hash-marked boundary, based on source selection.

Depending on the locations of received FIS-B ground stations, Regional NEXRAD coverage can extend more than 250 nm around an aircraft's position. Aircraft flying at higher altitudes typically receive data from more ground stations than aircraft flying at low altitudes.

FIS-B NEXRAD does not differentiate between liquid and frozen precipitation types.



CONUS & Regional NEXRAD Combined

Missing Data Indications

A semi-transparent mask indicates regions where data may be missing or incomplete. Color is dependent upon the presence of topographical data.

The mask is purple when there is no underlying topographical data, such as on the FIS-B weather display, or on Map when the TOPO overlay is off.

On Map, the mask is dark gray when the TOPO overlay is on, so that the underlying topographical features can still be interpreted.

Source Options:

Source options are selectable from the FIS-B Weather menu or the **NEXRAD** key located in the control bar. The key label changes to reflect the active source.

CONUS

- Large, low-resolution weather image for the entire continental U.S.
- Pixels are 7.5 min (7.5 nm = 13.89 km) wide by 5 min (5 nm = 9.26 km) wide

Regional

- High-resolution weather image with limited range, centered around each broadcasting ground station
- Pixels are 1.5 min (1.5 nm = 2.78 km) wide by 1 min (1 nm = 1.852 km) tall
- Each weather pixel varies with latitude. Above 60° latitude, pixel block width doubles to 3 min/nm for regional maps

Combined

- Both CONUS and Regional NEXRAD images display simultaneously
- White hash mark indicates regional boundary

SIRIUSXM NEXRAD

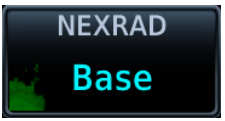
SiriusXM offers NEXRAD radar imagery from CONUS and non-CONUS sources. Weather menu options are Composite and Base.

Depending on the SXM service and installed GDL hardware, radar base reflectivity imaging may have broader coverage within North America or be limited to only Canada.

Source Options:

Composite (CONUS)

Composite reflectivity image of radar for the conterminous U.S.



Base

Base reflectivity image. Coverage and availability are dependent upon subscription.

Precipitation above 52° N may display as mixed precipitation regardless of actual precipitation type. Precipitation of an unknown type always displays as rain.

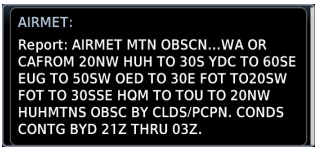
Textual AIRMETs

AVAILABLE WITH:
SIRIUSXM | CONNEXT

An AIRMET advises of weather that may be particularly hazardous to single engine, light aircraft and VFR pilots. Overlays draw the geographical boundaries of received AIRMETs on the dedicated weather page.

SiriusXM Textual AIRMETs

Tapping an AIRMET opens a detailed report.



AIRMET TYPES

Icing
Areas of moderate airframe icing including areal extent.

Turbulence
Areas of moderate turbulence including vertical extent.

IFR
Weather conditions with ceilings <1,000 ft and/or visibility <3 mi.

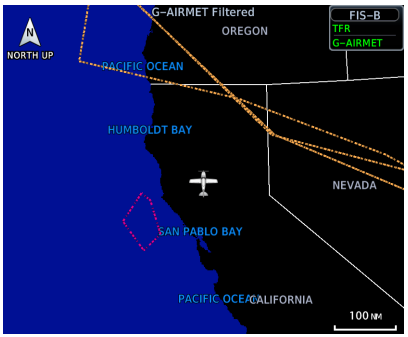
MTN OBSR
Widespread mountain obscuration due to clouds, precipitation, smoke, haze, mist, or fog.

Surface Winds
Sustained surface winds >30 kt and/or potential non-convective wind shear below 2,000 ft AGL.

Graphical AIRMETs

AVAILABLE WITH: FIS-B

Graphical AIRMETs (G-AIRMETs) display more weather phenomena than textual AIRMETs, while eliminating the need to interpret raw text.



Tapping a G-AIRMET displays textual details.

Updates occur four times daily.

Filtering options allow you to mitigate page clutter. Forecast and filter selections are accessible from the FIS-B Weather menu.

Forecast Settings:

Off	Current (Auto)	All Forecasts
Disables automatic functionality. Filter options not available.	Displays active graphical records based on the current UTC. Function automatically switches from 0 hr to 3 hr forecasts.	Displays the most recent, non-expired graphical records.

Forecast periods include 0 hr, 3 hr, and 6 hr.

G-AIRMET FILTERS

	Freezing Level		MTN OBSCR
	Icing		Surface Winds
	IFR		Turbulence
	Low-level Wind Shear		

To enable graphical AIRMETs:

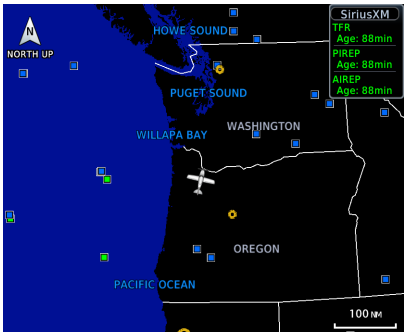
1. Home > **Weather** > **FIS-B Weather** > **Menu**.
2. Tap **G-AIRMET** and select between **Current (Auto)** and **All Forecasts**.
3. Tap **G-AIRMET Filters** and select one or more filters.

AIREPs

AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

AIREPs are routine, automated reports of in-flight weather conditions such as wind and temperature.

SiriusXM AIREPs

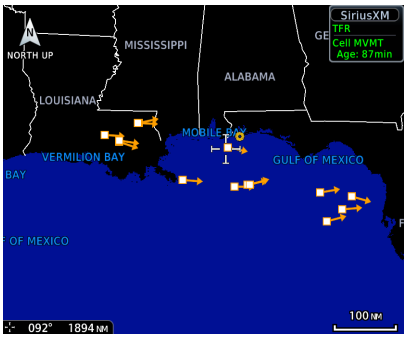


AIREPs display as a green map icon. Tapping this icon displays a report.

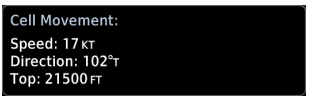
Cell Movements

AVAILABLE WITH: SIRIUSXM

Information derived from NEXRAD displays the location of storm cells within a strong storm. Vector symbols represent cell position and direction of movement.



Tapping one of these symbols displays details about the cell's speed and direction as well as the storm's top altitude.



Top Heights

Top height is reported as maximum altitude of reflected precipitation. Storm height may be higher than radar reflections.

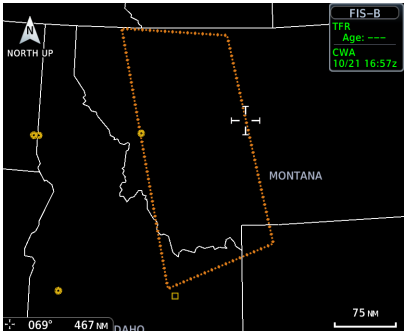
Top heights are reported in MSL.

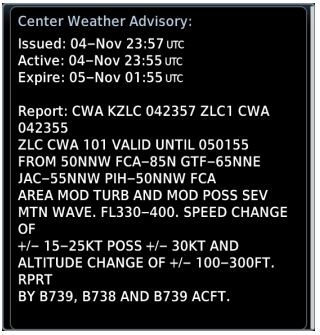
Center Weather Advisory

AVAILABLE WITH: FIS-B

These advisories communicate en route and terminal weather conditions expected to occur within the next two hours. Information is valid for up to 2 hours.

Tapping a CWA symbol displays textual details.



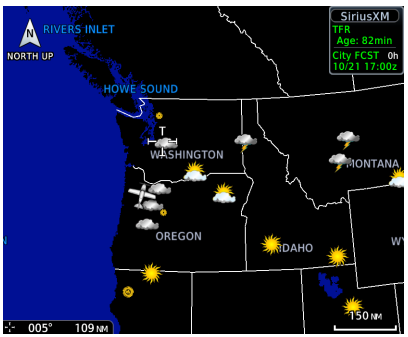


City Forecast

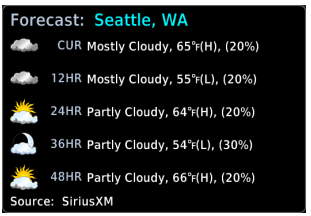
AVAILABLE WITH: SIRIUSXM

Provides two-day forecasts for major U.S. cities, including daily forecast high and low temperatures, chance of precipitation, and sky conditions.

City Forecast offers a 48 hour look ahead.



Tapping a City Forecast symbol displays weather details.



Forecast Period Options:

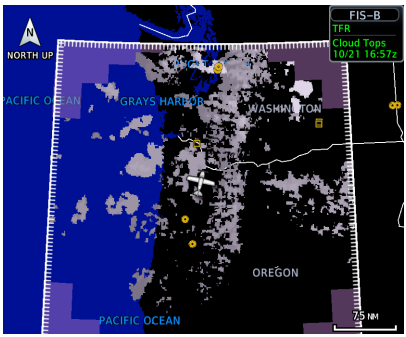
• Current • 12 hour • 24 hour • 36 hour • 48 hour

Clouds

CLOUD TOPS

AVAILABLE WITH:
FIS-B | SIRIUSXM

FIS-B Cloud Tops

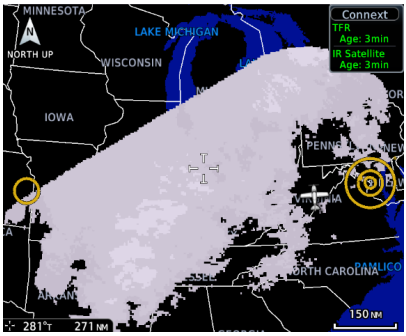


Indicates the altitude of the highest visible portions of a cloud at the time of measurement.

- SiriusXM cloud top altitude data is estimated from IR satellite imagery
- FIS-B cloud top data is generated by a computer model and has limited accuracy compared to actual conditions

IR SATELLITE

AVAILABLE WITH: CONNEXT



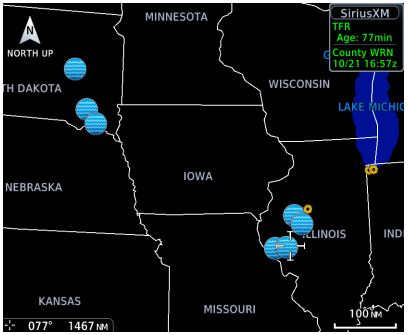
Infrared Satellite weather information is available for North America and Europe. Updates occur every 30 minutes.

- Lighter grays depict colder temperatures
- Darker grays depict warmer temperatures

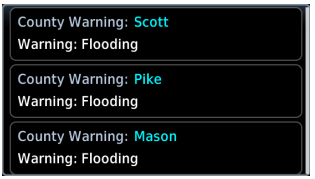
County Warnings

AVAILABLE WITH: SIRIUSXM

County warnings are provided for the counties within the continental United States. Specific public awareness and protection alerts, such as fires and natural disasters, are included with warnings for tornadoes, thunderstorms, floods and flash floods.



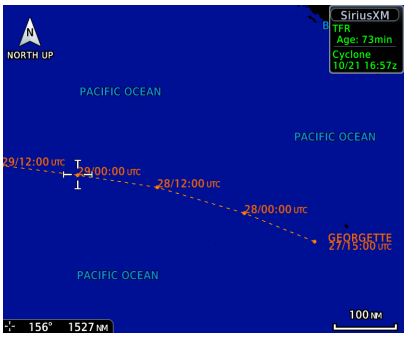
Tapping a County Warning symbol displays weather details.



Symbols include: • Severe T-Storm • Tornado • Flooding

Cyclone

AVAILABLE WITH: SIRIUSXM



Displays tropical storm information as issued by the National Hurricane Center. Includes the cyclone's location, projected path, date, and time.

Echo Tops

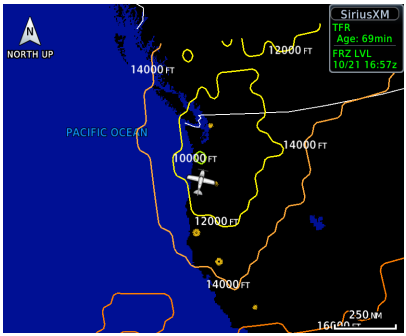
AVAILABLE WITH: SIRIUSXM

Depicts the location, elevation, and direction of NEXRAD radar echoes. This information is useful for gauging storm intensity in a relative sense. A higher radar echo means a stronger storm updraft.

Freezing Levels

AVAILABLE WITH:
FIS-B | SIRIUSXM

SiriusXM Freezing Level



Color-coded contour lines indicate the altitude of the freezing level.

When freezing data is absent at a given altitude, it means:

- the system has not received data for the altitude, or
- the data is expired

FIS-B Weather:

To view freezing altitude, select the freezing level G-AIRMET. Updates occur four times daily.

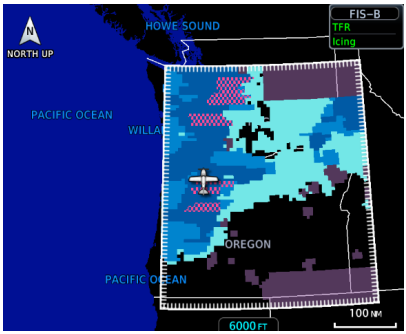
Icing

AVAILABLE WITH:
FIS-B | SIRIUSXM

NOTE

Due to the incremental and overlapping nature of the FIS broadcast, timestamps, regional coverage, and map data availability may vary with altitude for computer generated FIS-B icing forecasts.

FIS-B Icing



Icing potential provides a graphic view of current icing conditions. SLD threat areas are depicted as black and pink blocks over the icing colors.

Directional keys allow you to adjust the reporting altitude within product-specific limits.

	FIS-B	SIRIUSXM
Timestamp shows:	Valid time in UTC	Time of data compilation
Altitude Range:	2,000 to 24,000 ft (at 2,000 ft intervals)	1,000 ft 3,000 ft 6,000 ft 9,000 to 30,000 ft (at 3,000 ft intervals)

ICING CATEGORIES

SLD Threat

Heavy

Moderate

Light

Trace[1]

No Coverage[2]

Categories vary depending on the configured weather source.

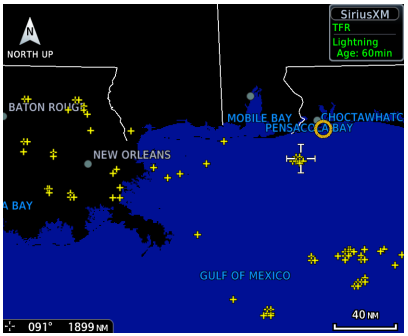
Icing potential is not a forecast, but a presentation of icing potential at the time of analysis. Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft.

[1] Available only from certain weather sources. [2] FIS-B Weather only.

Lightning

AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

SiriusXM Lightning



SiriusXM Weather:

A yellow cross icon indicates a strike event occurring within a two kilometer region. Strike location is an estimate of its center.

Unlike Stormscope, the icon does not change shape or color as data ages.

Connext Weather:

Only cloud-to-ground strikes are reported through the Connext weather service.

FIS-B Weather:

Lightning strikes display as a bolt or cluster of bolts. The bolt color indicates the strike polarity.

METARs and TAFs

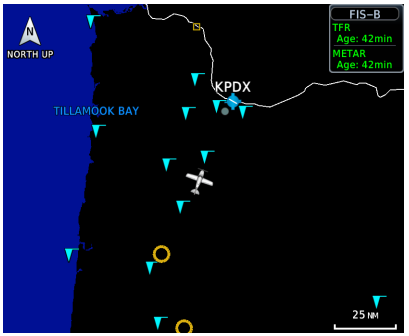
AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

METAR and TAF reports provide information on current and forecast conditions. Colored METAR flags display when a METAR reporting station is matched with a corresponding navigation database identifier.

When selected, the METAR is decoded and displayed above the original METAR text. METARs are provided only in areas covered by the currently loaded navigation database.

Tapping a METAR opens a detailed report.

FIS-B METARs



METAR SYMBOLS

VFR
Ceiling greater than 3,000 ft AGL and visibility greater than five miles.

Marginal VFR
Ceiling 1,000 to 3,000 ft AGL and/or visibility three to five miles.

IFR
Ceiling 500 to 1,000 ft AGL and/or visibility one to three miles.

Low IFR
Ceiling below 500 ft AGL and/or visibility less than one mile.

Unknown
Ceiling and/or visibility data unavailable.

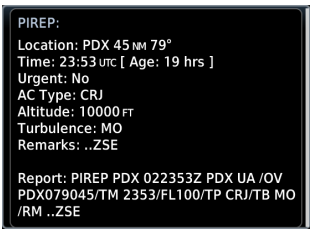
PIREPs

AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

PIREPs are pilot-generated weather reports that may contain non-forecast adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, and turbulence.

FIS-B PIREPs

Selecting a PIREP displays a report.



PIREP SYMBOLS

	Routine (UA)
	Urgent (UUA)
	Route

PIREPs are issued as either Routine (UA) or Urgent (UUA).

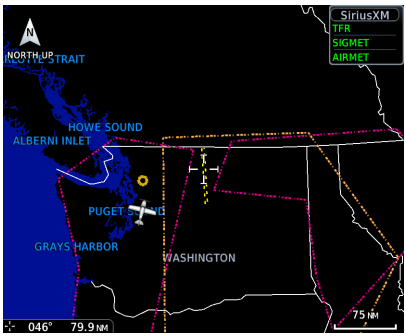
Tapping a PIREP symbol displays textual details.

SIGMETs

AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

The SIGMET overlay draws the geographical boundaries of received SIGMETs on the dedicated weather page. Convective and non-convective SIGnificant METerological Information combine in a textual report and display graphically for the observed or forecast region.

SiriusXM SIGMETs & AIRMETs

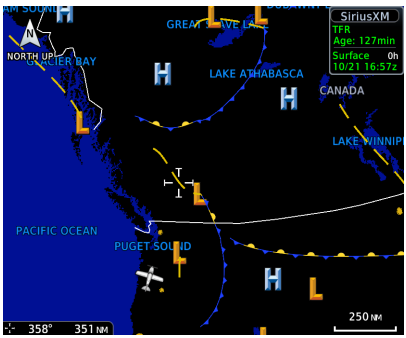


Tapping a SIGMET opens a detailed report.

SIGMET:
Report: CONVECTIVE SIGMET 36WVALID UNTIL 1955ZWAFROM 30SSE YDC–40NW EPHDVLPG LINE TS 30 NM WIDE MOV FROM 25020KT. TOPS TO FL340..

Surface Analysis

AVAILABLE WITH: SIRIUSXM



Displays weather fronts, high (H) and low (L) pressure centers, and isobars.

Forecast Period Options:

- Current • 12 hour • 24 hour
- 36 hour • 48 hour

TFRs

AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

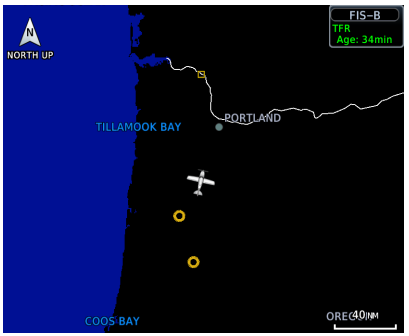
WARNING

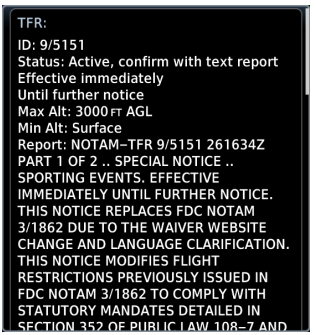
Do not exclusively use datalink services for TFR information. TFR Depictions may not be a complete listing and may vary between cockpit devices. Always confirm TFR information with official sources such as Flight Service Stations or Air Traffic Control.

TFRs identify areas of airspace where aircraft are temporarily restricted from operating. They are routinely issued for occurrences such as dignitary visits, military activities, and forest fires.

Tapping a TFR displays textual details.

FIS-B TFRs





FIS-B Weather:

Latest TFR data transmit every 10 to 20 minutes.

For FIS-B datalink weather, TFRs and NOTAMs that do not include geographical locations are viewable from the FIS-B Raw Text Reports page.

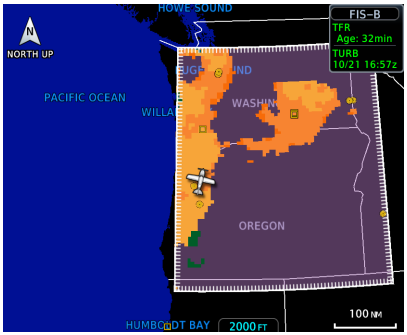
Turbulence

AVAILABLE WITH:
FIS-B | SIRIUSXM

NOTE

Due to the incremental and overlapping nature of the FIS broadcast, timestamps, regional coverage, and map data availability may vary with altitude for FIS-B turbulence forecasts.

FIS-B Turbulence



Turbulence data identifies the potential for erratic movement of high-altitude air mass associated winds. This information is intended to supplement AIRMETs and SIGMETs.

Turbulence is classified as light, moderate, severe or extreme.

Directional keys allow you to adjust the reporting altitude within product-specific limits.

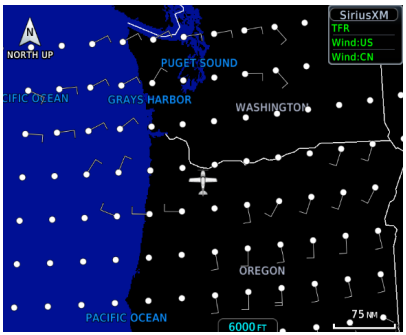
	FIS-B	SIRIUSXM
Timestamp shows:	Valid time in UTC	Time of data compilation
Altitude Range:	2,000 to 24,000 ft (at 2,000 ft intervals)	21,000 to 45,000 ft (at 3,000 ft intervals)

Data may not be available for all regions at all altitudes.

Winds Aloft

AVAILABLE WITH:
FIS-B | SIRIUSXM | CONNEXT

SiriusXM Winds Aloft

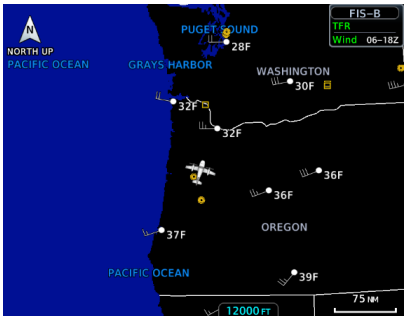


Indicates wind speed and direction, and temperature forecast for the specified altitude.

The wind barb extends outward from the reporting location dot in the direction of wind origination.

Directional keys allow you to adjust the reporting altitude within product-specific limits. Reporting altitudes vary depending on the weather provider.

FIS-B Winds & Temps Aloft



FIS-B Winds & Temperatures Aloft:

FIS-B wind forecasts also provide temperature data for the selected altitude. These forecasts update every 12 hours.

Altitude Range:

FIS-B	SIRIUSXM & CONNEXT
1,000 ft	
1,500 ft	
2,000 ft	
3,000 ft	
6,000 ft	
9,000 ft	Surface to 45,000 ft (at 3,000 ft intervals)
12,000 ft	
15,000 ft	
18,000 ft	SiriusXM data not available at 45,000 ft
24,000 ft	
30,000 ft	
34,000 ft	
39,000 ft	
45,000 ft	
53,000 ft	

Not all altitudes provide winds and temperatures aloft forecasts for all regions.

SiriusXM Weather

SiriusXM satellites deliver high bandwidth (S-band) data to provide high-resolution images. Available data is received within a few minutes after the aircraft satellite receiver comes into view of the SiriusXM satellite network.

FEATURE REQUIREMENTS

- *SiriusXM receiver (GDL 69 or GDL 69A)*
- *Active SiriusXM Aviation Weather subscription*

FEATURE LIMITATIONS

- *For Icing Potential, Winds Aloft (U.S.), and Turbulence, the valid time displays instead of product age*
- *For Freezing Level and Winds Aloft (Canada), the generation time displays instead of valid time*

Activate SiriusXM Services

Before you can access SiriusXM Weather, you must contact SiriusXM customer service and provide them with either one or two coded IDs:

- Data Radio ID (Weather)
- Audio Radio ID (Entertainment).

These coded IDs are used to send an activation signal, which allows the use of weather and entertainment products received by the GDL 69/69A.

When SiriusXM weather services are not activated:

- All weather product boxes are cleared on the GDL 69 Status page
- A yellow "Activation Required" message appears at the center of the page

Service Class refers to the groupings of weather products available for subscription.

SiriusXM Customer Service:
https://www.siriusxm.com/sxmaviation.

COMPLETE SUBSCRIPTION ACTIVATION

1. Contact SiriusXM using the customer service telephone number listed on the website.
2. Provide the customer service agent with your Data Radio ID and Audio Radio ID.
3. Position aircraft within the satellite reception area and power on the unit.
4. Navigate to the GDL 69 Status page.
   - *From the Home page:* Tap **System** > **External LRUs**, locate GDL 69 and tap **More Info**.
   - *From the Music page:* Tap **Status**.
5. Verify activation. For weather subscriptions, the status page displays your Data Radio ID, Subscription Level, and a list of weather products.
6. Tap **Menu** > **Lock Activation** > **OK**.

Troubleshooting the GDL 69/69A Datalink Receiver

GTN serves as the control head for your remotely mounted GDL 69/69A. In the event of a receiver failure:

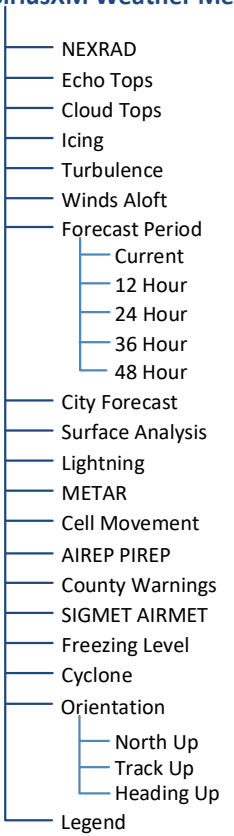
- View datalink receiver status on the GDL 69 Status page
- Verify the SiriusXM Satellite Radio subscription is active
- Check circuit breakers to ensure power is applied to the receiver

It may take several minutes for all subscription data to become available after unit power up.

For more information, consult *GDL 69/69A SiriusXM Satellite Radio Activation Instructions*. For subscription activation instructions, visit https://www.siriusxm.com/sxmaviation.

SiriusXM Weather Setup

SiriusXM Weather Menu



Tap **Menu** to access weather product overlay controls and pilot settings. Changes to an overlay setting take effect immediately.

- Enable/disable weather overlays
- Specify a forecast period
- Change the orientation of the weather display
- Display the product legend

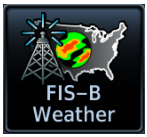
Map WX Overlays

SiriusXM Weather overlay controls reside in the Map Setup menu.

From the Home page, tap **Map** > **Menu**, **Map Setup**, and select the **Weathe**r tab.

If another weather source is active, tap **Weather Source** and select **SiriusXM**.

FIS-B Weather



FIS-B weather data displays on the dedicated weather page and as overlays on Map. No pilot action is required to receive FIS-B weather information.

FEATURE REQUIREMENTS

- *UAT receiver (GDL 88 or GTX 345)*

The FAA provides FIS-B as a Surveillance and Broadcast Service operating on the UAT (978 MHz) frequency band. FIS-B uses a network of FAA-operated ground-based transceivers to transmit weather datalink information to the aircraft's receiver on a scheduled continuous basis.

The Flight Information Service-Broadcast (FIS-B) Weather service is freely available for aircraft equipped with a capable datalink universal access transceiver (UAT). Ground stations provide uninterrupted services for the majority of the contiguous U.S., Hawaii, Guam, Puerto Rico, and parts of Alaska. No weather subscription service is required. For the latest FAA ground station coverage information, visit: www.faa.gov/nextgen/programs/adsb/

Data Transmission Limitations

FIS-B broadcasts provide weather data in a repeating cycle which may take several minutes to completely transmit all available weather data. Therefore, not all weather data may be immediately present upon initial FIS-B signal acquisition.

LINE OF SIGHT RECEPTION

To receive FIS-B weather information, the aircraft's datalink receiver must be within range and line-of-sight of an operating ground-based transceiver. Reception may be affected by altitude, terrain, and other factors. Per the FAA, much of the United States has FIS-B In airborne coverage at and above 3,000 feet AGL. Terminal coverage is available at altitudes below 3,000 feet AGL and is available when flying near approximately 235 major U.S. airports. Surface coverage allows FIS-B ground reception at approximately 36 major U.S. airports.

PER FAA TSO-C157B

FIS-B information may be used for pilot planning decisions focused on updating the pilot's awareness of the dynamic flight environment; including avoiding areas of inclement weather that are beyond visual range and pilot near-term decisions where poor visibility precludes visual acquisition of inclement weather. FIS-B weather and NAS status information may be used as follows:

a. To promote pilot awareness of ownship location with respect to reported weather, including hazardous meteorological conditions; NAS status indicators to enhance pilot planning decisions; and pilot near-term decision-making.

b. To cue the pilot to communicate with Air Traffic Control, Flight Service Station specialist, operator dispatch, or airline operations control center for general and mission critical meteorological information, NAS status conditions, or both.
FIS-B information, including weather information, NOTAMs, and TFR areas, are intended for the sole purpose of assisting in long-/near-term planning and decision making. The system lacks sufficient resolution and updating capability necessary for aerial maneuvering associated with immediate decisions. In extreme scenarios, the oldest weather radar data on the display can be up to 15 to 20 minutes older than the display's age indication for that weather radar data. Therefore, do not attempt to use FIS-B weather information to maneuver the aircraft at minimum safe distances from hazardous weather.
FIS-B information must not be used in lieu of a standard preflight briefing.

c. FIS-B uplink is a subscription-free FIS broadcast managed by FAA SBS. It provides an FAA approved source for METAR, TAF, WINDS, PIREPs, NEXRAD, AIRMET, SIGMET, and TFR information, and is subject to the broadcast range limits for these products.
FIS-B uplink is not an FAA approved source for NOTAMs.

NOTAM 30-DAY LIMITATION

NOTAMs received via FIS-B may not be a complete listing. Active NOTAMs are removed from the FIS-B data stream 30 days after issuance. Before flight, review all necessary aeronautical and meteorological information from official sources.

For more information, consult AC 00-63A or latest revision.

FIS-B Product Status

View the status of all FIS-B weather products. States include:

- Unavailable
- Awaiting Data
- Data Available

You may access this page one of two ways.

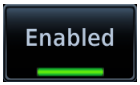
From the External LRUs list:

Home > **System** > **External LRUs**, locate GDL 88 or GTX 345, and tap **More Info**

From the FIS-B Weather menu:

Home > **Weather** > **FIS-B Weather** > **Menu** > **Datalink Status**

FIS-B WEATHER ENABLED



To mitigate any possibility of the avionics receiving unexpected data formats in the FIS broadcast, you may disable FIS-B Weather by toggling the **Enabled** key to off.

This key is active by default. It is not intended for use under normal broadcast conditions.

FIS-B Weather Setup

FIS-B Weather Menu

- NEXRAD
  - Off
  - CONUS
  - Regional
  - Combined
- Cloud Tops
- Icing
- Turbulence
- Wind/Temp Aloft
- Lightning
- METAR
- PIREP
- SIGMET
- Center WX Advisory
- G-AIRMET
  - Off
  - Current (Auto)
  - All Forecasts
- G-AIRMET Filters
  - Freezing Level
  - Icing
  - IFR
  - LL Wind Shear
  - Mountain Obscuration
  - Surface Winds
  - Turbulence
- Orientation
  - North Up
  - Track Up
  - Heading Up
- Datalink Status
  - Raw Text Reports
  - Radio Stations
- Icing
- Turbulence
- Freezing Levels
- Legend

Tap **Menu** to access weather product overlay controls and pilot settings. Changes to an overlay setting take effect immediately.

- Enable/disable weather overlays
- Select a NEXRAD source
- Filter G-AIRMETs and specify a forecast period
- Change the orientation of the weather display
- View datalink status and enable/disable the FIS-B Weather function
- Display the product legend

The Datalink Status page provides controls for enabling/disabling the FIS-B Weather function, viewing raw text reports, and checking ground reception status.

Map WX Overlays

FIS-B Weather overlay controls reside in the Map Setup menu.

From the Home page, tap **Map** > **Menu** > **Map Setup**, and select the Weather tab.

If another weather source is active, tap **Weather Source** and select **FIS-B**.

Raw Text Reports

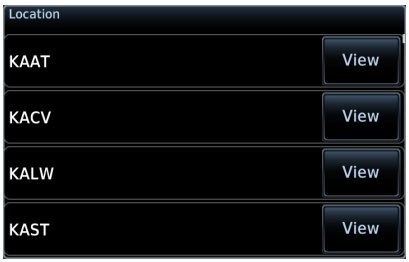
Product Selections

- CWA
- METAR
- NOTAM
- PIREP
- SIGMET
- TAF
- Winds/Temps Aloft
- UNAVAIL FIS-B Products

View raw textual data for a FIS-B product.

1. Open the FIS-B WX Status page.
2. Tap **Raw Text Reports**.
3. Select a weather product.

The latest uploaded data for the product displays on a dedicated page.



Multiple reporting stations appear in a list. Tapping **View** displays raw text for the corresponding identifier.

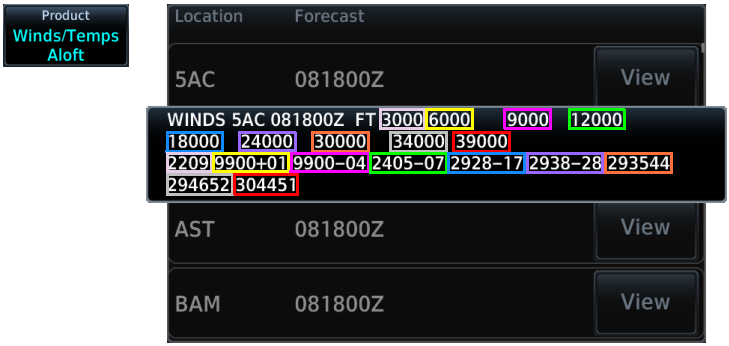
To view information about products not available due to a service outage, select **Unavailable Products**.

READING WINDS/TEMPS ALOFT REPORTS

Tapping **Winds/Temps Aloft** displays a forecast of winds and temperatures for different altitudes. Temperature forecasts are not included for altitudes below 2,500 ft AGL.

On the raw text report, altitude values do not align with the corresponding forecast. Match the color of the altitude and forecast to interpret the information.

Color markings are for reference only.

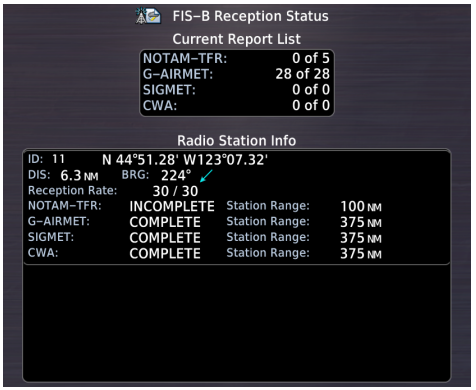


ALTITUDE (FT)

3,000	6,000	9,000	12,000	18,000	24,000	30,000	34,000	39,000
2209	9900+01	9900-04	2405-07	2928-17	2938-28	293544	294652	304451

FIS-B Ground Reception Status

Monitor FIS-B ground station transmission status from the FIS-B Reception Status page.



Current Report List shows the completeness of NOTAM-TFR, AIRMET, and SIGMET data for all received ground stations.

Station Range field indicates complete/incomplete status for only the products within the received ground station's range.

OPEN FIS-B RECEPTION STATUS PAGE

Datalink Weather Menu

- Raw Text Reports
- Radio Stations

This page is accessible from the Datalink Weather menu. You can access this menu one of two ways:

From FIS-B Weather:

Tap **Menu** > **Datalink Status** > **Menu** > **Radio Stations**.

From the External LRU list:

Home > **System** > **External LRUs** > Locate GDL 88 and tap **More Info** > **Datalink Status** > **Menu** > **Radio Stations**.

Connext Weather

Garmin provides Connext datalink, on-demand weather products through the Iridium satellite system via a GSR 56 transceiver and L-band frequencies. An Iridium satellite data subscription service is required for worldwide Connext weather coverage.

FEATURE REQUIREMENTS

- *GSR 56 transceiver*
- *Active Connext subscription*

Connext Weather coverage is available throughout most of Europe, Canada, and the U.S. Additional radar coverage areas are added continuously. Various world-wide weather subscription package options provide weather reporting for most of Europe, Canada, Australia, and the U.S.

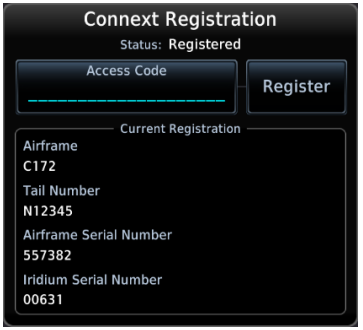
For the latest radar coverage information, visit:
https://fly.garmin.com/fly-garmin/connext/worldwide-weather/

Activate Connext Satellite Services

To access Connext Weather, visit flyGarmin.com and create a Connext Satellite Services account. Garmin will issue an access code for entry in the Connext Registration pop-up.

When completing your application for Connext Satellite Services, be ready to provide the following information.

- GTN ID
- Iridium serial number
- Airframe info:
  - Model
  - Tail number
  - Serial number



If access code and system ID are correct, the airframe registration details will display.

Current Registration Detail

To complete activation:

1. Move aircraft within satellite range and power on the unit.
2. Tap **Weather** > **Connext Weather** > **Menu** > **Connext Settings** > **Datalink Status** > **Connext Registration** > **Access Code**.
3. Enter the required code, then tap **Register**.

Deactivate Connext Unit Registration

You can deactivate your registration by entering an invalid access code in the Connext Registration pop-up window. This prevents the unit from making any further requests from Connext. Requests made after deactivation will fail.

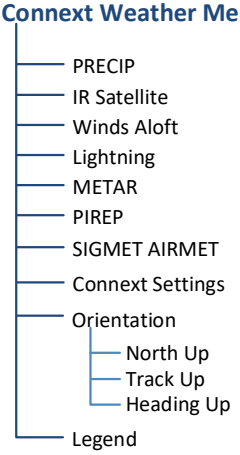
From the GSR Status page:

1. Tap **Connext Registration** > **Access Code**.
2. Tap **CLR** to remove the current access code.
3. Enter an invalid code, then tap **Register**.

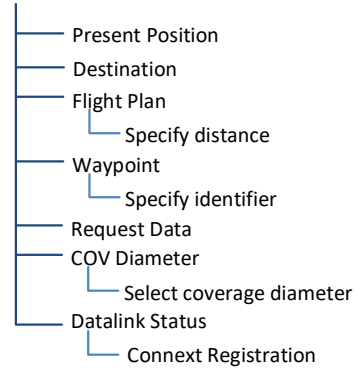
Deactivating your Connext registration does not cancel your subscription.

Connext Weather Setup

Connext Weather Menu



Connext Settings Menu



Tap **Menu** to access weather product overlay controls and pilot settings. Changes to an overlay setting take effect immediately.

- Enable/disable weather overlays
- View Iridium satellite datalink status and signal strength
- Change the orientation of the weather display
- Display the product legend

Tap **Connext Settings** to access the Data Request function and various coverage region options. From here you may access the GSR Status page, where the Connext Registration function resides.

Map WX Overlays

Connext Weather overlay controls reside in the Map Setup menu.

From the Home page, tap **Map** > **Menu** > **Map Setup**, and select the Weather tab.

If another weather source is active, tap **Weather Source** and select **Connext**.

Connext Data Requests

FEATURE REQUIREMENTS

- *Direct connection to GSR 56 (Auto Request function)*

Download selected weather products for a specific waypoint, flight plan, destination, or your current position. A request must be sent in order for downloading to occur.

WHERE TO FIND IT

Connext Weather Menu
- Connext Settings
  - Request Data

Weather data request controls reside in the Connext Settings menu.

Requests may be sent manually or set to occur automatically within a specified time interval.

DATA REQUEST CONTROLS

Request Data

Request weather data at any time regardless of predetermined automatic update frequency.

Once the request is sent, you may reset the Auto Request timer (if active) for the next request interval.

Auto Request

Select a weather request period to enable automatic updates.

Options: • Off • 5 min • 10 min

A timer counts down to the next update. The **Cancel Request** key becomes available.

Multiple Weather Requests

To accommodate multiple weather requests, Connext merges the following products with stale data, while discarding the stale data of other products.

- AIRMETs
- METARs
- SIGMETs
- TAFs
- TFRs

Use these controls when you want to:

- *Set automatic updates:*
  Tap **Auto Request** and select the automatic weather request period.
- *Request a manual update:*
  Tap **Menu** > **Connext Settings** > **Request Data**.
- *Cancel a request in progress:*
  Tap **Cancel Request**.

COVERAGE REGION OPTIONS

Present Position	Request weather information around aircraft's present position. COV diameter determines extent of request.
Destination	Request weather information for the destination airport.
Flight Plan	Request weather information for the active fight plan route.
Distance	Enter requested weather information for a specified distance along the active flight plan. Range: 10 nm to 500 nm
Waypoint	Request weather information for a specified waypoint.
COV Diameter	Define the diameter of coverage. Range: 10 nm to 500 nm

GTN 650Xi SERIES

Coverage region controls reside in a dedicated submenu.

Tap **Menu** > **Connext Settings** > **Coverage Region**.

Stormscope

Stormscope lightning information displays on a dedicated weather page and as overlays on Map.

WARNING

Do not exclusively use the lightning detection system for weather avoidance. The system may display inaccurate or incomplete information. For additional information, consult the lightning detection system documentation.

FEATURE REQUIREMENTS

- *WX-500 Stormscope Weather Mapping Sensor*

FEATURE LIMITATIONS

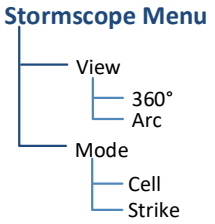
- *Stormscope lightning information cannot display concurrently with any datalink weather product (SiriusXM, Connext, or FIS-B)*

Stormscope Features

- Passive weather avoidance system
- Detects electrical discharges from thunderstorms within 200 nm of current position
- Plots strike count and relative bearing location every two seconds
- Heading and distance from aircraft
- Arc and 360° viewing options

For more information, consult the WX-500 pilot's guide.

Stormscope Setup



Tap **Menu** to access Stormscope setup options.

From here, you can change the current display view and mode settings.

Changes in mode selection also reflect on the associated Map overlay.

Stormscope Map Overlay

Stormscope overlay controls reside in the Map menu.

From the Home page, tap **Map** > **Menu** > **Stormscope**.

Changes in overlay mode selection also reflect on the Stormscope display. The same is true for clearing strikes on Map.

Stormscope Modes & Symbols

Cell Mode

Identifies clusters of electrical activity, grouping individual strikes together.

When to use:

During heavy storm activity to identify where storm cells are located.

Strike Mode

Displays individual discharge points in relation to where they are detected.

When to use:

During periods of light electrical activity to plot the initial strikes associated with a building thunderstorm.

Less than 6 strikes (initial strike)

Less than 60 strikes

Less than 120 strikes

Less than 180 strikes

Strike Rate

Strike Rate reports the approximate number of strikes per minute for a given view range. Refer here when trying to determine if storm cells are building or decaying.

Strikes occur at a higher rate as a storm matures. They are less frequent as the storm dissipates.

CLEAR STRIKES

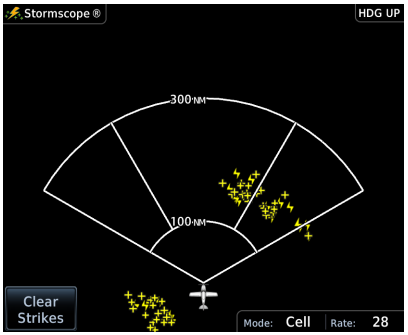
Tapping this key resets the rate value and clears the display of all strikes. Clearing strikes on the Stormscope display also clears them on Map.

Stormscope data displays with or without a heading source. If flying without a heading source, you must clear all strikes following each heading change

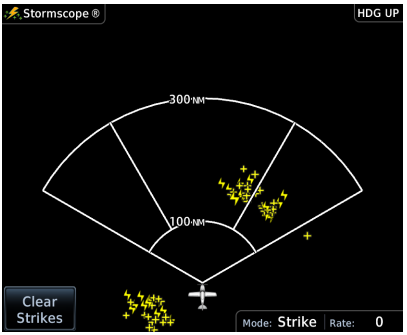
Views

Stormscope provides both arc and 360° views of lightning data.

ARC VIEW

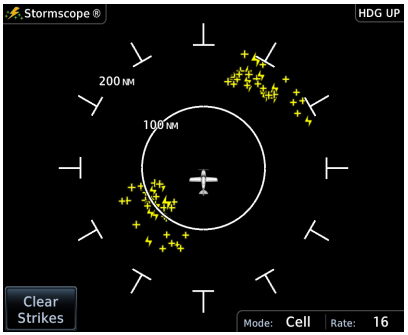


Cell Mode

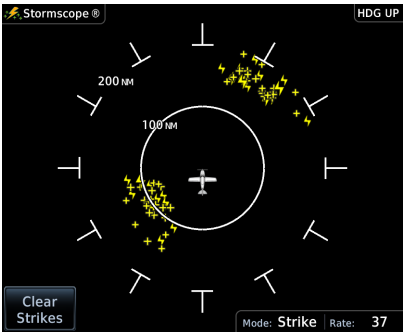


Strike Mode

360° VIEW



Cell Mode



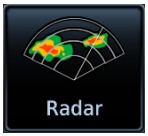
Strike Mode

Stormscope Display Orientation

Heading Up is the normal display orientation. If no heading source is available, the page orientation label changes to "HDG N/A."

Airborne Weather Radar

AVAILABLE WITH:
GTN 750Xi SERIES



Weather radar information displays on a dedicated weather page and as overlays on Map.

WARNING

Use weather radar to avoid severe weather, not to enter it.

FEATURE REQUIREMENTS

- *GTN 725Xi or GTN 750Xi*

FEATURE LIMITATIONS

- *Available modes and intensity levels depend on the installed radar type*
- *Not available on GTN 650Xi Series units*

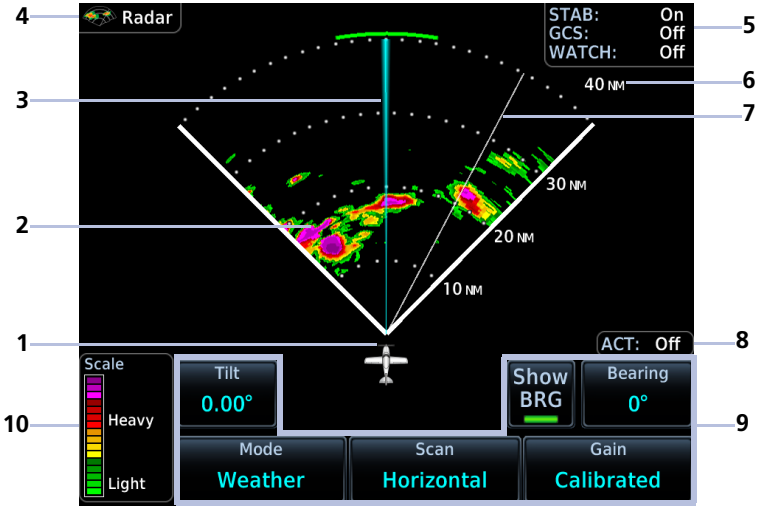
Maximum Permissible Exposure Level, GWX 68

Radiation exceeds the U.S. Government standard level of 1 mW/cm^2 11 feet from the antenna. All personnel must a minimum safe distance while the radar is in operation.

Average power density at the MPEL boundary significantly reduces with a scanning or rotating beam.

For information on safe distance determination, refer to Advisory Circular 20-68B.

For maximum permissible exposure levels, consult the appropriate radar documentation.



Weather Radar Features

1	Ownship Icon	**6**	Radar Display Range
2	Weather Depiction	**7**	Scan
3	Bearing/Tilt Line	**8**	ACT Status Field
4	WX App Label	**9**	Radar Controls
5	Feature Status Display	**10**	Intensity Scale

RADAR UNITS

Distance units on the radar display are determined by the pilot selectable Distance/Speed setting on the System Units page (Home > **System** > **Units** > **Distance/Speed**).

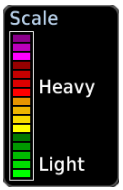
DISPLAY ADJUSTMENTS

Tapping **In** and **Out** changes the radar display range.

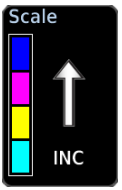
TILT AND BEARING ADJUSTMENTS

To adjust tilt and bearing angle, tap and drag the line indicator as necessary, or use the associated control keys.

INTENSITY SCALE



Weather



Ground

Each operating mode uses a unique color palette to depict increasing intensity levels.

WARM-UP COUNTDOWN TIMER

A warm-up period initiates upon power up (GWX 68 only). Duration varies depending on how long the radar is off. The radar begins transmitting once warm-up is complete.

Weather Radar Setup

Weather Radar Menu

- Turbulence Detection [1, 2]
- Ground Clutter Suppression [1, 2]
- Altitude Compensated Tilt [2]
- WATCH Shading [3]
- Stabilization
- Weather Messages [3]
- Sector Scan [3]
  - Select scan width

[1] Requires feature enablement.
[2] GWX 70/75/80 only.
[3] Not available for third-party radars.

Tap **Menu** to access weather radar setup options. Available features are dependent upon configuration.

With the exception of Sector Scan, all selections are on/off only.

Map WX Overlays

The Radar overlay control resides in the Map Setup menu.

From the Home page, tap **Map** > **Menu** > **Radar**.

Radar and NEXRAD overlays are mutually exclusive. Selecting one automatically turns the other off.

ALTITUDE COMPENSATED TILT

AVAILABLE WITH:
GWX 70/75/80

FEATURE LIMITATIONS

- *Not available for third-party radars*

This feature adjusts the tilt to compensate for altitude changes as the aircraft climbs and descends.

Status displays above the radar controls.

GROUND CLUTTER SUPPRESSION

AVAILABLE WITH:
GWX 70/75/80

FEATURE REQUIREMENTS

- *Purchased GWX Ground Clutter Suppression feature enabled on unit*

FEATURE LIMITATIONS

- *Not available for third-party radars*
- *Horizontal scans only*

This feature reduces the amount of returns of highly reflective objects on the ground, while maintaining the intensity and size of weather returns.

SECTOR SCAN

FEATURE LIMITATIONS

- *Not available for third-party radars*
- *Horizontal scans only*

The sector scan option focuses the scan on a smaller segment of the radar sweep. This is useful when monitoring priority weather targets.

GWX	INCREMENTS
68	20°, 40°, 60°, Full
70/75/80	20°, 40°, 60°, 90°, Full
The 90° horizontal scan option is available only for radars with extended scan capabilities (120° sweep).	

Horizontal sector scans center on the bearing line.

Increments vary according to radar.

STABILIZATION

This feature helps stabilize the antenna so the scan is parallel to the ground when active. When off, the antenna scan is relative to the aircraft lateral axis.

TURBULENCE DETECTION

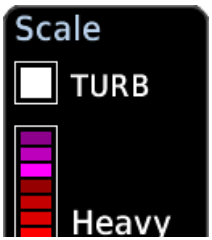
AVAILABLE WITH:
GWX 70/75/80

FEATURE REQUIREMENTS

- *Purchased GWX Turbulence Detection feature enabled on unit*

FEATURE LIMITATIONS

- *Not available for third-party radars*
- *Horizontal scans only*

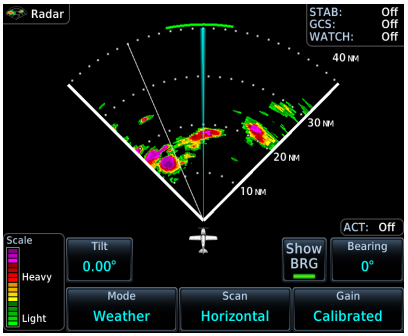


This feature detects and displays severe turbulence.

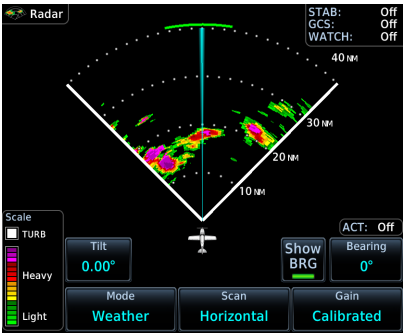
A legend shows when turbulence detection is active. Status reports as inactive when:

- Current scan range is greater than 160 nm
- Radar is not in weather mode
- Vertical scan is active

Turbulence Off



Turbulence On



The decision to fly into an area of radar targets depends on target intensity, spacing between targets, aircraft capabilities, and pilot experience.

Some weather radars detect only precipitation, not clouds or turbulence. While GTN may indicate clear areas between intense returns, this does not mean it is safe to fly between them.

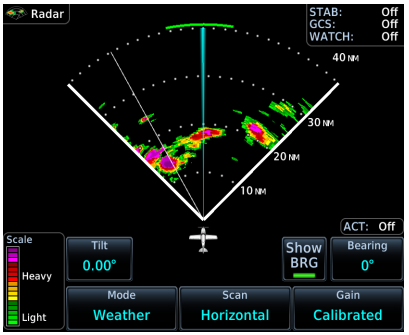
WATCH

FEATURE LIMITATIONS

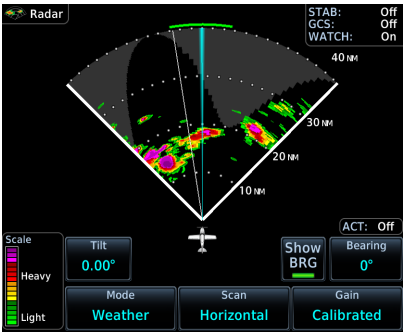
- *Not available for third-party radars*
- *Horizontal scans only*

Use WATCH to determine areas of inaccuracies in displayed intensity from attenuation while in horizontal scan mode. Adjust tilt to determine the extent of attenuation in a shaded area. WATCH displays only in horizontal scans.

WATCH Off



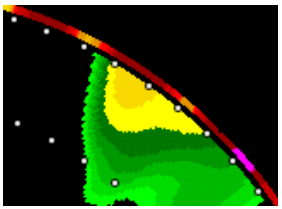
WATCH On



WEATHER MESSAGES

FEATURE LIMITATIONS

- *Not available for third-party radars*
- *Not available during ground mode*
- *Horizontal scans only*



These alerts indicate the presence of heavy precipitation beyond the current display range (80 nm to 320 nm from current position).

Red bands on the outer range ring display at the approximate azimuth of severe weather targets.

- If the antenna tilt is adjusted too low, a weather alert is generated by ground returns.
- If a weather alert is detected within +10 degrees of the aircraft heading, an advisory displays in the message list.

Radar Modes

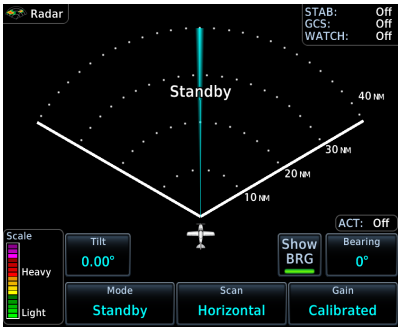
WARNING

Do not transmit when personnel or objects are within 11 feet of the antenna.

Tapping **Mode** opens a list of available mode options.

A confirmation pop-up alerts the pilot when attempting to scan while on the ground.

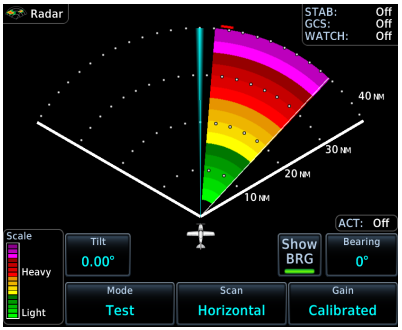
STANDBY



- Parks the antenna at the centerline
- Automatic standby occurs during power up and landing

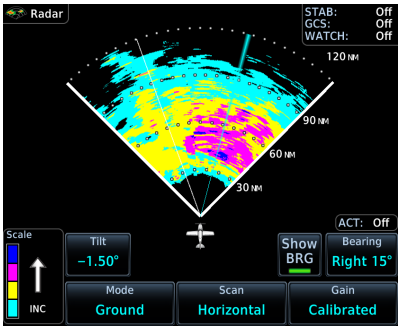
During weather and ground modes, the system automatically switches to standby upon landing.

TEST



- Places transmitter in standby as the display simulates a radar sweep
- Data verifies communication between the weather radar and display
- Radar pulses do not transmit from the antenna during this mode

GROUND



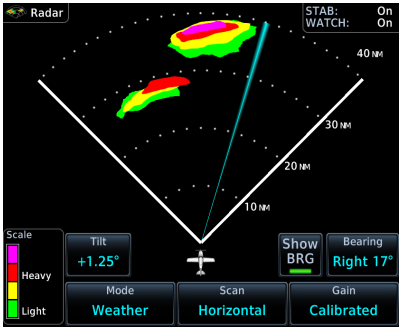
- Presents a depiction of terrain similar to that of a topographical map
- Useful when trying to verify aircraft position

GROUND MAP MODE COLOR	GROUND TARGET INTENSITY LEVELS	
	GWX RADAR INTENSITY	THIRD-PARTY RADAR LEVEL
Black	0 dB	0
Light Blue	> 0 dBZ to < 9 dBZ	1
Yellow	9 dBZ to < 18 dBZ	2
Magenta	18 dBZ to < 27 dBZ	3 and above
Blue	27 dBZ and greater	Not used

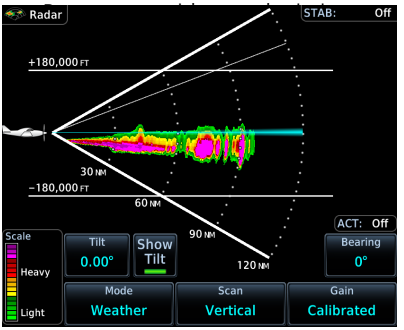
WEATHER

- Presents an airborne depiction of precipitation
- Colors represent approximate rainfall intensity and rates for weather radar targets.

GWX 68 Radar



GWX 75 Radar



WEATHER MODE COLOR	GWX 68/70/75/80 RADAR		THIRD-PARTY RADAR
	APPROXIMATE INTENSITY	APPROXIMATE RAINFALL RATE (IN/HR)	RADAR RETURN LEVEL[1]
Black	< 23 dBZ	< .01	0
Green	23 dBZ to < 33 dBZ	.01 to < 0.1	1
Yellow	33 dBZ to < 41 dBZ	0.1 to < 0.5	2
Red	41 dBZ to < 49 dBZ	0.5 to < 2.0	3
Magenta	49 dBZ and greater	2.0 and greater	4
White	Turbulence Detection[2]		

[1] Consult third-party radar documentation. [2] GWX 70, GWX 75, and GWX 80 only.

Radar Controls

Weather Radar Page

- Show Bearing/Tilt [1]
- Bearing
  - Set bearing
- Tilt
  - Set tilt
- Mode
  - Standby
  - Weather
  - Ground
  - Test
- Scan
  - Horizontal
  - Vertical [2]
- Gain
  - Set to Calibrated

Some radars allow independent sweeps when connected to multiple displays.

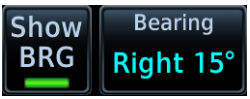
GWX 68 synchronizes the controls from all connected displays. All other GWX radars receive commands from each display independently and perform a separate sweep for each.

[1] Dependent on scan type selection. [2] Not available for RS 181 and RS 811 radars.

SHOW BEARING/TILT

Display the tilt or bearing line depending on the current scan selection. This feature is useful when making horizontal or vertical scan adjustments.

Horizontal Scan Active

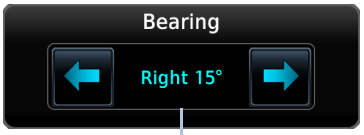


Vertical Scan Active

BEARING

FEATURE LIMITATIONS

- *Bearing angle not available on RS 181A and RS 811A radars*

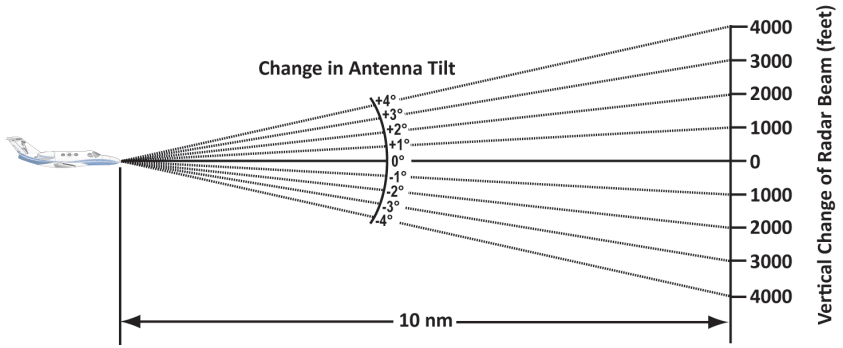


Bearing Direction & Value

Directional keys allow fine adjustment of the bearing line angle. This method is optional to tapping and dragging.

TILT

Use antenna tilt to locate the top and bottom of storm cells and to increase intensity of ground target returns. One degree of tilt equals 100 feet of altitude per nautical mile.



Basic Antenna Tilt Setup

In a typical tilt setup, the bottom of the radar beam is adjusted to 4° below parallel with the ground. To achieve this:

1. Fly the aircraft level.
2. Adjust antenna tilt so ground returns display at a distance equal to the aircraft's current altitude (AGL) divided by 1,000.

Remember the following points when flying with the antenna at this basic angle setting.

Altitudes between 2,000 and 30,000 ft AGL:

- Avoid target returns at 5 nm. These may be either weather or ground returns that are 2,000 ft or less below the aircraft.
- Raise the antenna tilt 4° to separate ground returns from weather returns in flat terrain. Return the antenna to the previous setting after a few sweeps of the radar.
- Set the display range to 60 nm for aircraft flying at 15,000 ft or lower. Monitor ground returns for possible threats.

Altitudes above 29,000 ft:

Be cautious of targets 30 nm or closer. This may indicate a thunderstorm that the aircraft cannot fly over safely.

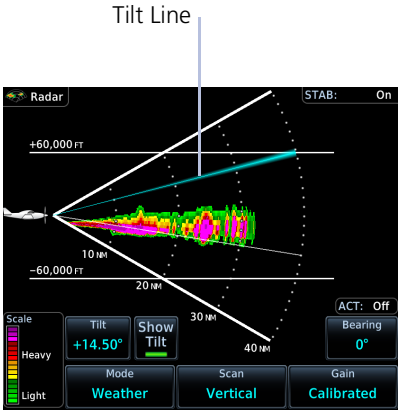
For a more accurate view of target coverage and intensity, center the tilt angle on the strongest return area, aiming below the freezing level of the storm.

In areas of multiple heavy cells, use the vertical scan feature along with antenna tilt to examine the cells. Avoid shadowed areas behind targets.

VERTICAL SCAN

FEATURE LIMITATIONS

- *Vertical scan not available on RS 181A and RS 811A radars*



Vertical scans focus the radar on a particular vertical target.

- *Enable tilt line visibility:* Tap **Show Tilt**.
- *Adjust tilt of vertical scan:* Tap and drag tilt line up or down. Or tap **Tilt** and adjust angle using the directional keys.
- *Adjust horizontal angle for the vertical scan:* Tap **Bearing** and adjust angle using the directional keys.

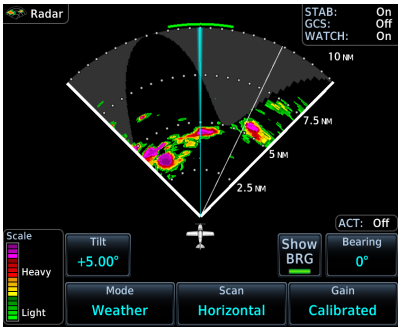
Vertical Scan with Stabilization

When vertically scanning with stabilization on, the physical area that the radar is sweeping may not match the displayed vertical scan. This occurs when the aircraft pitch is not at 0°. To compensate, the GDU does not draw the unscanned portion.

To avoid constant adjustment of the bearing line, ensure that the aircraft wings are level when performing a vertical scan of a storm cell.

HORIZONTAL SCAN

Horizontal scans provide a visual depiction of weather in front of the aircraft.



- *Enable bearing line visibility:* Tap **Show BRG**.
- *Adjust the horizontal scan bearing:* Tap and drag bearing line left or right. Or tap **Bearing** and adjust angle using the directional keys.
- *Adjust vertical angle for the horizontal scan:* Tap **Tilt** and adjust angle using the directional keys.

GAIN

NOTE

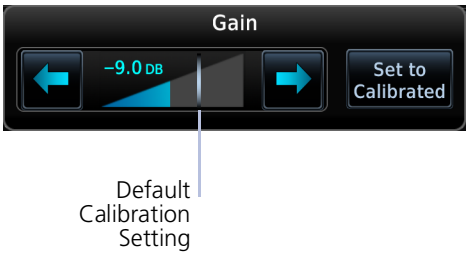
Precipitation intensity may not be accurate if the gain is changed.

FEATURE LIMITATIONS

- *For third-party radars, this control is active only during ground mode*

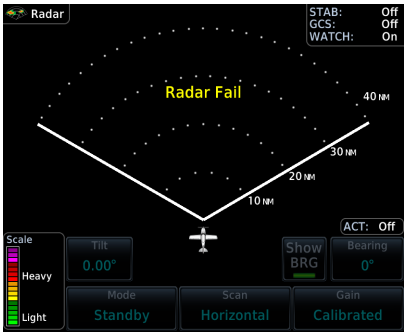
This feature controls the sensitivity of the radar receiver. Adjustments to receiver sensitivity automatically change the intensity of radar targets.

Directional keys allow sensitivity adjustments.



Tapping **Set to Calibrated** restores the calibrated gain setting and returns intensity depictions to their actual colors.

Radar Alerts



Caution messages alert you when there is a weather radar failure. For a list of possible radar alerts, refer to the annunciations table in this segment.

Radar Alert Annunciation

When a radar alert occurs:

- A textual annunciation appears over the radar sweep
- Scan depictions do not display
- Weather radar overlay detail is absent from Map if heading input is lost

ALERT ANNUNCIATIONS

ANNUNCIATION	ALERT TYPE | CONDITION
Radar Fault	**Alert Type:** Caution **Condition:** Data contains a fault unrelated to attitude.
Radar Fail	**Alert Type:** Caution **Condition:** Weather radar product status is timed out.
Radar Controls Disagree	**Alert Type:** Caution (Third-party radars only) **Condition:** Radar's actual state does not match the commanded state.
Radar Active	**Alert Type:** Caution **Condition:** Radar is in standby, but remains active due to another interfacing controller.
Off	**Alert Type:** Advisory (GWX only) **Condition:** Radar is off.
Warm Up XX	**Alert Type:** Advisory (GWX 68 only) **Condition:** Radar is warming up. Countdown timer displays number of seconds remaining ("XX").
Standby	**Alert Type:** Advisory **Condition:** Radar is in standby mode.

Traffic Awareness

WARNING

DO NOT RELY SOLELY UPON THE DISPLAY OF TRAFFIC INFORMATION FOR COLLISION AVOIDANCE MANEUVERING. THE TRAFFIC DISPLAY DOES NOT PROVIDE COLLISION AVOIDANCE RESOLUTION ADVISORIES AND DOES NOT UNDER ANY CIRCUMSTANCES OR CONDITIONS RELIEVE THE PILOT'S RESPONSIBILITY TO SEE AND AVOID OTHER AIRCRAFT.

FEATURE LIMITATIONS

- *Traffic symbols vary according to traffic source (e.g., TIS-A, TAS, ADS-B)*
- *Intruding aircraft without altitude reporting capabilities do not display altitude separation data or climb /descent indications*
- *Available display ranges and vector types are dependent upon traffic source*

Available Traffic Sources

- TIS-A
- TCAD 9900B
- TCAD 9900BX
- Ryan TCAD 9900BX w/GDL 88
- TAS/TCAS I
- TCAS II
- ADS-B

The availability of functions, alerting features, and options depend on the traffic system source.

ADS-B controls are accessible from the Traffic setup menu. Controls for other traffic systems reside in a control menu and/or on the Traffic page.

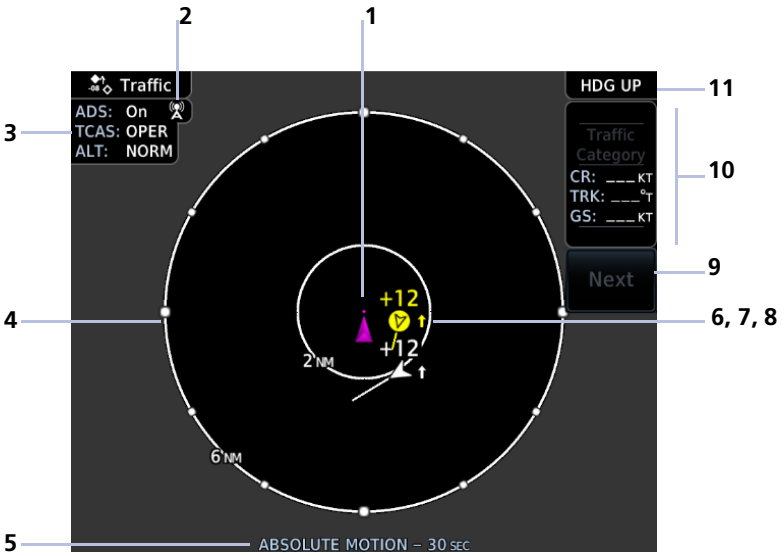
Traffic Display

Collision avoidance and traffic surveillance data display on the dedicated Traffic page and as overlays on Map.

The Traffic page displays intruding traffic in relation to the current position and altitude of the aircraft without clutter from other data.

WARNING

Do not rely solely upon the display of traffic information to accurately depict all of the traffic within range of the aircraft. Due to lack of equipment, poor signal reception, and/or inaccurate information from aircraft or ground stations, traffic may be present that is not represented on the display.



Traffic Display Features

1	**Ownship Icon** Depicts current aircraft position. • Nose of the ownship is the actual ownship location • Unlike the configured ownship icon on map displays, this icon is always a directional arrow
2	**Ground Station Transmitter Status Icon**

3	**Traffic Status & Active Applications**
	• Status indications:
	  • **On** means the AIRB and ATAS traffic applications are active
	  • **Off** means that air and ground applications are inactive
	  • **Test** means the traffic test function is active
	  • **Fail** means that ADS-B reports a failure
	• **+SURF** means that ground targets displays in addition to airborne targets
	• Altitude filter setting (NORM, ABV, BLW, UNR)

4	**Range Ring** • Outer ring represents selected range • Range options vary according to traffic application
5	**Selected Vector Type and Duration** Types: Absolute and Relative Refer to *Motion Vectors* for more information.
6	**Intruding Aircraft Symbol** Actual intruder location varies according to symbol type. • Tip of directional symbols • Center of non-directional symbols
7	**Altitude Separation Value** Indicates when an intruder is above or below the ownship. • Value appears above or below the traffic symbol, depending on relative altitude • Plus or minus sign denotes higher or lower altitude in hundreds of feet
8	**Vertical Trend Arrow** Active when an intruder is climbing or descending at a vertical speed greater than 500 fpm.
9	**Next Key** Available when multiple targets are spaced closely together.
10	**Selected Traffic Information Window** Select and view aircraft information for multiple traffic symbols. Refer to *Traffic Interactions* for more information.
11	**Page Orientation Label** • **Track Up** orients page to current aircraft GPS track • **Heading Up** orients page to current aircraft heading (requires heading data source interface)

GROUND STATION TRANSMITTER STATUS ICON

TIS-B ground station transmitter is providing a traffic picture specific to the ownship aircraft.

Traffic picture may be incomplete in the vicinity of the ownship. A partial traffic picture may be available due to:

- aircraft-to-aircraft ADS-B and/or
- traffic pictures from the ground station customized for other nearby aircraft

TRAFFIC UNITS

PARAMETER	UNITS
Altitude	ft
Distance	nm

Traffic units are always uniform.

Selections on the System Units page do not affect the traffic display.

TRAFFIC GROUPS

When the Traffic Grouping function is active, traffic within close proximity of each other may display as a group.

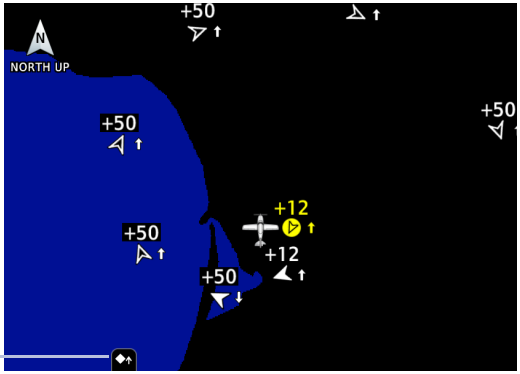
- Asterisk indicates that the target belongs to a group
- Relative proximity of the closest target determines color
- Depiction is of the most immediate threat

OFF SCALE TRAFFIC ALERTS

Off scale (out of range) traffic alerts are depicted as half yellow symbols on the outermost range ring at the correct bearing.

TRAFFIC OVERLAY STATUS ICON (MAP ONLY)

This icon appears on map when the traffic overlay is active. It is absent when the overlay function is off.

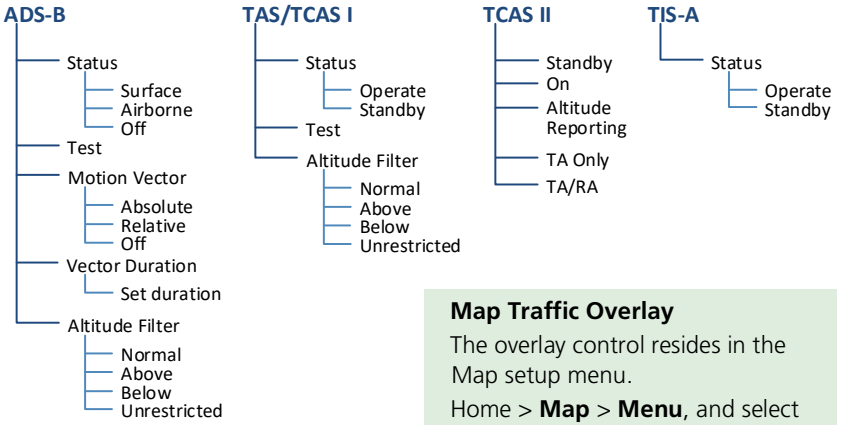


Map Traffic Overlay

An "X" appears over the icon when the overlay is on but unavailable.

Traffic Setup

Tap **Menu** to access pilot selectable settings and the self-test functions.



Map Traffic Overlay

The overlay control resides in the Map setup menu.

Home > **Map** > **Menu**, and select **Traffic**.

Traffic Test

FEATURE LIMITATIONS

- *ADS-B, TAS, and TCAS applications only*
- *Available only when the aircraft is on ground (i.e., standby mode)*
- *Test pattern depiction is dependent upon the active traffic system*

The test function displays a test pattern on the Traffic page. For ADS-B, this option is accessible via the Traffic menu.

Altitude Filtering

FEATURE LIMITATIONS

- *ADS-B, TAS, and TCAS applications only*

Pilot selectable filters limit the display of traffic to a specific altitude range relative to the altitude of the ownship.

Filter selections apply to both the Traffic page and the traffic overlay on Map.

SELECTION	LABEL	ALTITUDE RANGE
Normal	NORM	-2,700 ft to 2,700 ft
Above	ABV	-2,700 ft to 9,900 ft
Below	BLW	-9,900 ft to 2,700 ft
Unrestricted	UNR	-9,900 ft to 9,900 ft

Traffic Interactions

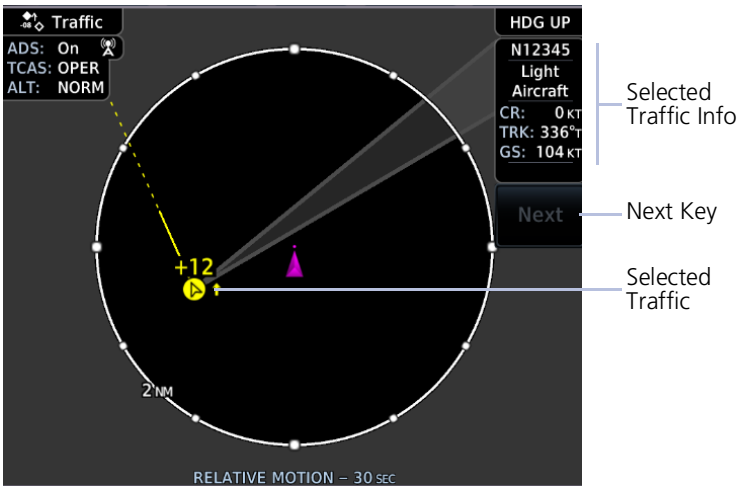
Selected Traffic Information

- Registration/call sign
- Vehicle type
- Closure rate
- Track
- Ground speed

Selecting a traffic symbol displays information about the aircraft in the upper right corner of the page.

Selections remain active through altitude filtering, zoom scale, and page changes.

Tapping **Next** repeatedly steps through multiple symbols spaced closely together.



Mute Alert

FEATURE LIMITATIONS

- *Available only with GTX 345 and ADS-B software v3.20 or later*

When a traffic alert occurs, the Mute Alert option temporarily replaces the Next key.

Traffic Types

TIS-A

NOTE

Garmin is not responsible for Mode S geographical coverage. Operation of the ground stations is the responsibility of the FAA. Refer to the AIM for a terminal Mode S radar site map covering the U.S.

FEATURE REQUIREMENTS

- *Aircraft location is within the service volume of a Mode S terminal radar site*
- *TIS-capable Mode S transponder is interfaced to the GTN*

FEATURE LIMITATIONS

- *Except for GDL 88 or GTX 345 equipped aircraft, TIS and TAS may not both be displayed at the same time*

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 System (TAS) and TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb/descent indication.

TIS will be unavailable at low altitudes in many areas of the U.S., particularly in mountainous regions. Also, when flying near the "floor" of radar coverage in a particular area, intruders below the client aircraft may not be detected by TIS.

For information about TIS-A functions and limitations, consult the Aeronautical Information Manual (AIM).

TIS-A Features

- 2D graphical depiction of proximate traffic based on data received from terminal radars
- Track vector depicts intruder trajectory over the ground
- Vertical coverage: +3,500/ -3,000 ft from ownship
- Eight intruder maximum within an 8 nm radius
- Five second update cycle
- Normal and standby mode options

TIS-A SETUP SELECTIONS

Select an operating mode: Tap **Status** and choose Operate or Standby.

TIS-A TRAFFIC SYMBOLS

Traffic information is for advisory use only. The pilot is responsible for identifying and avoiding traffic.

	Non-threat Traffic
	Traffic Advisory (TA)
	TA Off-scale

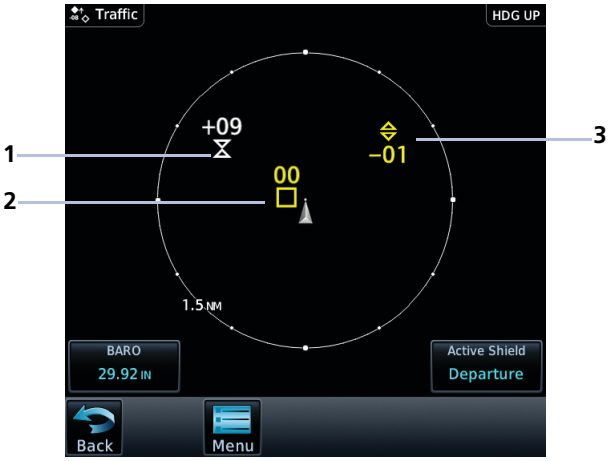
TIS-A STATUS INDICATIONS

ANNUNCIATION	DESCRIPTION
Data Failed	GTN receives data from the transponder, but a failure exists in the data stream.
Failed	Transponder failure.
No Data	GTN is not receiving valid data from the transponder.
TA X.X NM ±XX ↕	System cannot determine TA bearing. Intruder depiction not available. Annunciation includes: • Distance in nautical miles • Altitude separation in hundreds of feet • Altitude trend arrow (climbing/descending)
TA OFF SCALE	TA is outside the selected display range.
Traffic Coast x SEC	Intruder depictions are more than 6 seconds old.
Traffic Removed	Intruder depictions are more than 12 seconds old. Traffic symbols no longer display.
Unavailable	Transponder not receiving TIS-A data from ground station.

TCAD 9900B

The Traffic and Collision Alert Device (TCAD) 9900B provides a passive system that uses transponder replies from other aircraft to acquire traffic information.

Ryan TCAD 9900B



1	Altitude Separation 900 ft, Closing
2	Traffic Advisory, Altitude Separation 0 ft, Steady Altitude Separation
3	Traffic Advisory, Separation 100 ft, Diverging

TCAD 9900B SYMBOLS

IMMINENT TRAFFIC[1]	NON-IMMINENT TRAFFIC	
		Traffic Closing Vertically
		Traffic Diverging Vertically
		Traffic not Closing or Diverging Vertically

[1] Traffic within ±500 feet and 1.0 nm or no altitude and within 1.0 nm.

TCAD 9900B PAGE SELECTIONS

- *Set local barometric pressure:* Tap **BARO** and specify a barometric pressure value.
- *Set the active shield:* Tap **Active Shield** and choose En route, Standard, or Terminal.

TCAD 9900B MENU SELECTIONS

Traffic Audio	Set volume level of traffic alerts.
Shield Setup	Set the active shield. Options are Approach or Standard.
Approach Mode	Set the shield height.
Shield Range	Set the shield range.

SHIELD SETUP

The Shield Setup function allows you to set the type (mode of operation) and volume of the shield that will provide alerts when entered by other aircraft.

Set an approach shield:

1. Select En route, Standard, or Terminal
2. Ensure **Use DEST APT** is deselected and then tap **Field Elevation**.
3. Specify the field elevation value for traffic reporting.

Use DEST APT to automatically use the field elevation of the destination airport of the active flight plan for traffic reporting. If a destination airport is not present in the GTN Xi system, TCAD will not receive a field elevation and therefore not automatically enter approach mode.

Set an En Route, Standard, or Terminal shield:

1. Tap **Shield Type** and select the preferred shield type.
2. Tap **Shield Height** and specify the shield height value.
3. Tap **Shield Range** and specify the shield range value.

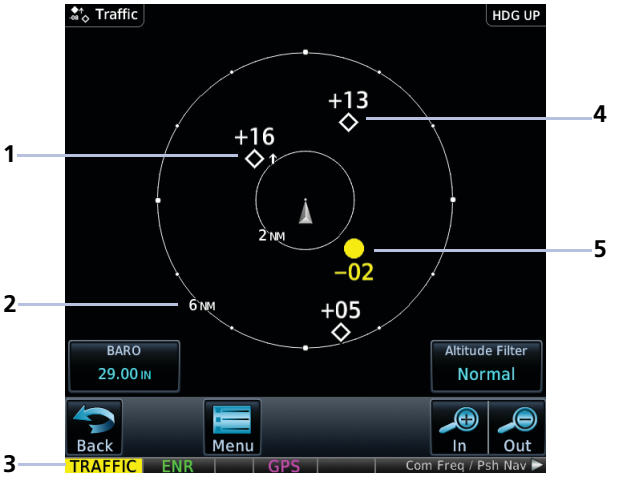
Select a mode:

- *Approach mode:* Toggle the **Approach** key to choose between Set, Armed, or Active.
- *Ground mode:* Toggle the **Ground** key on or off.

TCAD 9900BX

The TCAD 9900BX provides an active system that interrogates other aircraft to acquire traffic information. System setup is identical to TCAD 9900B.

Ryan TCAD 9900BX



1	Altitude Separation 1,600 ft and Ascending	**4**	Other Traffic, Separation 1,300 ft Above
2	Range Ring Radius	**5**	Traffic Advisory, Altitude Separation 200 ft and Descending
3	Traffic Annunciation		

TCAD 9900BX SYMBOLS

	Traffic Advisory
	Proximity Advisory (color may be configured as cyan)
	Other Traffic (color may be configured as cyan)
	Out-of-Range Traffic Advisory

Ryan TCAD 9900BX with GDL 88

Ryan TCAD is a system that provides audio and visual alerts for traffic near your aircraft. The information from this system can be interfaced through GTN Xi.

Ryan TCAD Features

- TCAS-like symbols are used in the 9900BX
- Altitude modes are available (normal, look up, look down, unrestricted)
- Ranges are manually controlled for the current shield

TRAFFIC DISPLAY RANGE

Options include: • 1 nm • 2 nm • 2 and 6 nm • 6 and 12 nm • 12 and 24 nm

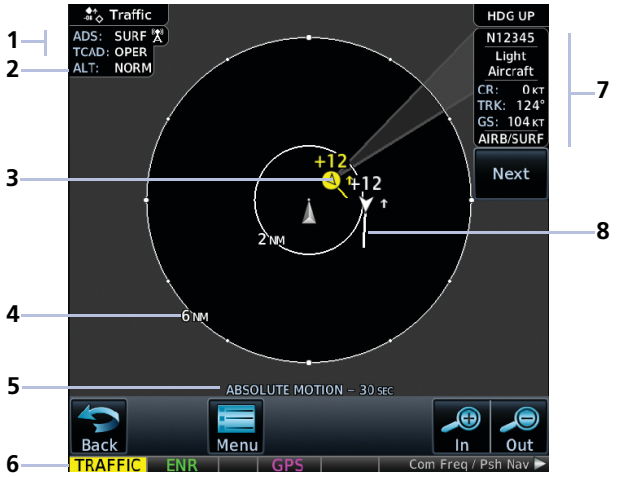
RYAN TCAD ALERT TYPES

The Ryan TCAD on-board air traffic display identifies potential collision threats. It computes the relative altitude and range of threats from nearby Mode C and Mode S-equipped aircraft. TCAD will not detect aircraft that are not equipped with operating transponders or that are beyond radar coverage. When within the defined limits, TCAD creates a *shield* of airspace around the aircraft that detected traffic cannot penetrate without triggering an alert.

- **TA:** Traffic Advisory. Traffic with 500 feet, or less, of altitude separation that is converging or maintaining altitude separation.
- **PA:** Proximity Advisory. Traffic with 500 feet of altitude separation that is not a TA.
- **TRFC:** Other traffic.

When TCAD is connected to GTX 345, the available controls will appear as described for TCAS. For details about the Ryan TCAD system, consult the associated pilot's guide.

Ryan TCAD with GDL 88



1	ADS-B/TCAD Status	**5**	Selected Vector Type & Duration
2	Altitude Filter Setting Indication	**6**	Traffic Annunciation
3	Alerted Target, 1,200 ft Above and Climbing	**7**	Selected Traffic Information
4	Range Ring Radius	**8**	Traffic Motion Vector

TCAD SETUP SELECTIONS

Tapping **TCAD Control** provides access to setup controls for the TCAD Traffic display.

Traffic Audio	Set volume level of traffic audio.
Field Elevation	Set the elevation.
BARO	Set the barometric pressure.
Operate	Toggle TCAD traffic on and off.
Ground Mode	Toggle TCAD ground mode on and off.
Approach Mode	Toggle TCAD approach mode on and off.

TAS/TCAS I

FEATURE LIMITATIONS

Pilots should be aware of TAS limitations. TAS requires transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due to 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.

TAS/TCAS I Features

- Airborne traffic system independent of ground radar
- 2D graphical depiction of traffic relative to aircraft position and altitude

TAS/TCAS I SETUP SELECTIONS

Status	Select operating mode. Options are Operate and Standby.
Test	Initiate a test of the traffic system.
Altitude Filter	Select filter range. Options include: • Normal • Below • Above • Unrestricted

TAS/TCAS I TRAFFIC SYMBOLS

Traffic information is for advisory use only. The pilot is responsible for identifying and avoiding traffic conflict.

	Other Traffic
	Proximity Advisory
	Traffic Advisory
	TA Off-scale

TAS/TCAS I STATUS INDICATIONS

ANNUNCIATION	DESCRIPTION
Data Failed	GTN receives traffic data, but the TAS unit is reporting a failure.
Failed	Traffic data failure.
No Data	GTN is not receiving valid data from the TAS unit.
TA X.X NM ±XX ↕	System cannot determine TA bearing. Intruder depiction not available. Annunciation includes: • Distance in nautical miles • Altitude separation in hundreds of feet • Altitude trend arrow (climbing/descending)

TCAS II

FEATURE LIMITATIONS

- *GTS 8000 or third-party TCAS II system*

If the installed TCAS II traffic system is not a GTS 8000, refer to the applicable documentation for system-specific information.

TCAS II Features

- Monitors nearby airspace for aircraft flying with operating transponders
- Issues TAs to assist in visual identification of traffic
- Issues RAs to provide recommended vertical guidance maneuvers to resolve traffic conflicts

TCAS II STATUS INDICATIONS

SELECTION	TRAFFIC PAGE ANNUNCIATIONS
TCAS II Self-Test Initiated (TEST)	Test
Traffic and Resolution Advisory (TA/RA)	TA/RA
Traffic Advisory Only	TA Only
TCAS II Standby	STBY
TCAS II Failed	Fail

TCAS II ALERTS

When the TCAS II unit issues a TA or RA,"TRAFFIC" flashes for 5 seconds in the annunciator bar. It remains until no TAs or RAs are detected.

- RA "TRAFFIC" annunciations are white text with red backgrounds
- TA "TRAFFIC" annunciations are black text with yellow backgrounds
- If a TA and RA occur simultaneously, only the red and white RA "TRAFFIC" annunciation displays

If GTN Xi is not displaying the Traffic page, the system displays a traffic alert pop-up.

- During a TA event, the system issues a single "Traffic, Traffic" voice alert each time the system detects a new TA threat
- During an RA event, voice alert(s) provide vertical guidance to resolve the traffic conflict
  - The VSI displays a range of vertical speeds to fly to or avoid as applicable
  - Additional voice alerts occur if the RA status changes and when the aircraft is clear of the conflict

If the traffic system cannot determine the bearing of a traffic or RA, the alert displays as a traffic alert banner.

Warning banner

RA X.X ± XX <UP> OR <DN>

- Displays when the system is unable to determine the bearing of an RA and extreme pilot vigilance is required
- Indicates distance in nm and altitude separation in hundreds of feet
- Indicates altitude trend up <UP> for climbing and down <DN> for descending traffic[1]

Caution Banner

TA X.X ± XX <UP> OR <DN>

- Displays when the system is unable to determine the bearing of a TA and pilot vigilance is required
- Indicates distance in nm and altitude separation in hundreds of feet
- Indicates altitude trend up <UP> for climbing and down <DN> for descending traffic[1]

[1] If altitude trend is available.

TCAS II TRAFFIC SYMBOLS

Traffic information is for advisory use only. The pilot is responsible for identifying and avoiding traffic conflict. The TCAS II system categorizes detected traffic into four groups of increasing collision threat potential. Lowest threat is OT and the highest is RA.

	**OT** Other non-threatening traffic.
	**PA** Traffic is not currently a threat, but is within 6 nm and ±1,200 feet of the own-aircraft altitude.
	**TA** Indicates traffic is within 20-48 seconds of a potential collision area.
	**Off-scale TA** Traffic is beyond the selected map range and the system displays a half-TA symbol at the edge of the map at the approximate relative bearing of the TA traffic. If TA traffic subsequently meets the criteria for an RA, the system issues an RA.
	**RA** Indicates traffic is within 15-35 seconds of a potential collision area.
	**Off-scale RA** If RA traffic is beyond the selected map range, the system displays a half-RA symbol at the edge of the map positioned at the approximate relative bearing to the RA traffic.

TCAS II WITH ADS-B

NOTE

Aircraft that are surveilled only by ADS-B In will not trigger a TCAS resolution advisory.

TCAS II interrogates Mode-S transponder data while automatically receiving ADS-B position and velocity information directly from a comparably equipped aircraft target. For preciseness, the system correlates between two data sources and the system displays the traffic information for the source determined to be the most accurate. Traffic that is not correlated (i.e., only detected by one system but not the other) is also displays for the flight crew. This may occur, for example, if another aircraft is beyond the surveillance range of the TCAS II, but it is still receiving position and velocity information from other ADS-B equipped aircraft. The traffic correlation feature improves the accuracy of the traffic displayed, while reducing the occurrence of displaying a single target twice.

ADS-B

FEATURE REQUIREMENTS

- *GTN with external ADS-B In product (GDL 88, GTX 345, or GTS)*

FEATURE LIMITATIONS

- *Available functions and alerting features are dependent upon the ADS-B traffic system source*

ADS-B Features

- Runway and taxiway depiction during SURF mode (< 2 nm range scale)
- Selectable traffic icons display intruder and vector information
- Customizable motion vectors (type, duration)
- Airborne and surface mode options
- On-scene mode option (rotorcraft only)

ADS-B SETUP SELECTIONS

ADS-B Status	Enable automatic mode selection. System selects between Surface and Airborne depending on the state of the aircraft. Selecting Off disables the function.
Test	Initiate a test of the traffic system.
Motion Vector	Select motion vector type. Selecting Off removes all motion vectors from the display. • Absolute • Relative • Off
Vector Duration	Select the amount of time represented by the endpoint. Options range from 0 seconds to 5 minutes. A longer duration results in a longer vector.
Altitude Filter	Select filter range. Options include: • Normal • Above • Below • Unrestricted

ADS-B TRAFFIC SYMBOLS

Traffic Information is for advisory use only. The pilot is responsible for identifying and avoiding traffic conflict.

	Basic Directional		Proximate Directional
	Basic Non-directional		Proximate Non-directional
	Basic Off-scale Selected		Proximate Off-scale Selected
	Directional (On-Ground)		Non-directional Alerted
	Non-directional (On-Ground)		Off-scale Non-directional Alerted Traffic
	Proximate Directional (On-Ground)		Directional Alerted Traffic
	Proximate Non-directional (On-Ground)		Off-scale Directional Alerted Traffic
	Directional Surface Vehicle		Non-directional Surface Vehicle

ADS-B TRAFFIC APPLICATIONS

FEATURE REQUIREMENTS

- *Aviation database (SURF only)*

FEATURE LIMITATIONS

- *ATAS does not alert to traffic on ground*

ADS-B In traffic supports three applications:

AIRB: Basic Airborne Application

ATAS: ADS-B Traffic Advisory System

SURF: Surface Situation Awareness

AIRB is considered the fundamental airborne traffic application. ATAS provides alerts when airborne traffic trajectories pose a potential collision risk. SURF provides additional situational awareness when you are on ground or within the terminal environment.

TRAFFIC APPLICATIONS	
AIRB & ATAS	• Both active when ADS-B is "On" (airborne traffic indications are available; ATAS arms to provide airborne alerts) • Alerts occur when potential collision risks are determined based on current airborne position and trajectory and the position and trajectories of other airborne traffic • Airborne traffic alerts only (no alerts on ground or for traffic on the ground) • Nominally allow 20 to 40 seconds for flight crew response • Provide aural alerting when traffic alerts occur
SURF	• Active on ground or within the terminal environment (<5 nm and <1,500 ft above field elevation) • Traffic on ground may display when SURF is active • Runway and taxiway depictions when the zoom scale is <2 nm (Traffic page only) • Depicts only traffic and ground vehicles equipped with ADS-B Out

Traffic Application Failures

During normal operation, the "ADS: On" status annunciation means that both AIRB and ATAS applications are active. In the rare event of an application failure, it is possible that only one of the applications may be active. The unit provides indications to reflect which application is no longer operational.

- ADS field indicates "On"
- If AIRB is active and ATAS is failed, the unit displays the system message: "ADS-B traffic alerting function inoperative"
- If AIRB is failed and ATAS is active (and still capable of providing a no-bearing aural alert), "Unavailable" annunciates across the traffic display

MOTION VECTORS

FEATURE LIMITATIONS

- *Motion vectors display on the Traffic page only*

A motion vector is a line extending from the nose of an intruder icon. Its orientation represents the intruder's direction and movement. A yellow vector indicates when traffic meets intruding TA criteria (i.e., closing rate, distance, vertical separation).

MOTION VECTOR TYPES	
Absolute	• Cyan or white vector depending on configuration • Depicts intruder ground track • Calculations based on intruder direction and ground speed • Endpoint depicts intruder's position over the ground at the end of the selected duration • Airborne and ground functionality
Relative	• Green vector • Depicts intruder movement relative to the ownship • Calculations based on track and ground speed of both intruder and ownship • Endpoint depicts intruder's location relative to the ownship at the end of the selected duration • Airborne functionality only • "Relative Motion - Unavailable" annunciates during ground operations

ADS-B STATUS INDICATIONS

ANNUNCIATION	DESCRIPTION
Absolute Motion - XX SEC/MIN	Active motion vector type is absolute.
Failed	ADS data failure.
No Data	GTN is not receiving valid traffic data.
No GPS Position	ADS-B LRU detects that GPS unit is initializing.
Relative Motion - XX SEC/MIN	Active motion vector type is relative.
Relative Motion - UNAVAILABLE	Aircraft is not airborne and the active motion vector type is relative.
Unavailable	Necessary traffic data not available.

ADS-B TRAFFIC INTERACTIONS

Selected Traffic Information

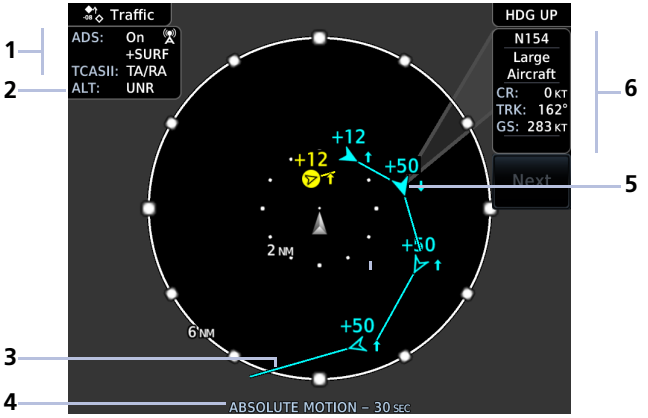
- Registration/call sign
- Vehicle type
- Closure rate
- Track
- Ground speed
- AIRB/SURF eligibility

Selecting a traffic symbol displays information about the aircraft in the upper right corner of the page.

Selections remain active through altitude filtering, zoom scale, and page changes.

Tapping **Next** repeatedly steps through multiple symbols spaced closely together.

ADS-B Traffic



1	ADS-B/TCAS Status & AIRB/SURF Eligibility Indications	**4**	Selected Vector Type & Duration
2	Altitude Filter Setting Indication	**5**	Selected Traffic
3	Traffic Motion Vector	**6**	Selected Traffic Information

Traffic Alerting

Traffic Alert Types

- Textual annunciations at the bottom of the screen
- Color-coded target icons on Traffic page
- Pop-up window when another page is active

Traffic alerts occur anytime there is an increase in the number of traffic advisories. They remain active until the area is clear of all TAs.

Traffic Alert Annunciation

GTN 750Xi Series

Traffic pop-ups do not display when the aircraft is on ground.

GTN 650Xi Series

Traffic Alert Pop-up

ANNUNCIATION	ALERT TYPE | POP-UP | CONDITION | VOICE MESSAGE
TRAFFIC	**Alert Type:** Caution **Pop-up Alert:** Yes **Condition:** • Traffic reports a traffic advisory **Voice Message:** • Message content depends on current traffic system configuration

For installations with GTX 345 and ADS-B software v3.20 or later, tapping the **Mute Alert** key silences the active traffic alert voice message. This function is applicable only to the active aural alert (does not mute future alerts). For more information, read *Aural Alerts* in section 2.

Alerting Parameters

Alerting Parameter Considerations

- Altitude separation and trend
- Angle
- Speed
- Closure rate of each aircraft (ownship and target)

Traffic alerting parameters consider several factors in order to allow you enough time to acquire the target and maneuver the aircraft away from conflicting traffic.

To minimize nuisance alerts, traffic alerting sensitivity is adaptive, based on altitude above ground level. No aural alerts are given below 500 ft.

Terrain Awareness

WARNING

Do not use Terrain and obstacle data to navigate or maneuver around terrain. They are an aid to situational awareness only.

FEATURE REQUIREMENTS

All terrain functions require the following components to operate properly.

- *Valid 3D GPS position for terrain and obstacle data display*
- *Valid terrain/obstacle database*

FEATURE LIMITATIONS

- *Alerting functions are dependent upon the configured terrain alerting options*

Terrain Configurations

Available Terrain Modes

- (H)Terrain Proximity
- Terrain Alerting
- TAWS-B[1]
- TAWS-A[1]
- (H)Terrain Alerting
- HTAWS†

Terrain Proximity displays relative elevations on moving map depictions (Terrain page, Map). It does not provide visual alerts.

Terrain Alerting adds Forward Looking Terrain Alert (FLTA) and Premature Descent Alert (PDA) functions. These include visual alerts when the aircraft flies below an alerting threshold.

[1] Optional.

Terrain controls are accessible from the Terrain menu. Map overlay keys are accessible from the associated map menu.

GPS Altitude for Terrain

FEATURE REQUIREMENTS

GPS altitude is derived from satellite measurements. To acquire an accurate 3D fix (latitude, longitude, altitude), a minimum of four operating satellites must be in view of the GPS receiver antenna.

The terrain system uses GPS altitude and position data to:

- Create a 2D image of surrounding terrain and obstacles relative to the aircraft's position and altitude
- Calculate the aircraft's flight path in relation to surrounding terrain and obstacles
- Predict hazardous terrain conditions and issue alerts

GSL ALTITUDE & INDICATED ALTITUDE

The unit converts GPS altitude data to GSL altitude (i.e., the geometric altitude relative to MSL) for use in terrain functions. All Terrain page depictions and elevation indications are in GSL.

Variations between GSL altitude and the aircraft's corrected barometric altitude (or indicated altitude) are common. As a result, Terrain page altitude data may differ from current altimeter readings. Both GSL altitude and indicated altitude represent height above MSL, but differ in accuracy and reliability.

GSL Altitude	Indicated Altitude
• Highly accurate and reliable geometric altitude source • Does not require local altimeter settings to determine height above MSL • Not subject to pressure and temperature variations • Affected primarily by satellite geometry	• Barometric altitude source corrected for pressure variations • Requires frequent altimeter setting adjustment to determine height above MSL • Subject to local atmospheric conditions • Affected by variations in pressure, temperature, and lapse rate

Database Limitations

NOTE

Garmin cross-validates terrain and obstacle data in accordance with TSO-C151d. However, the information should never be considered all-inclusive. Database inaccuracies or omissions may exist.

Terrain and obstacle data are not available when the aircraft is operating outside of the installed database coverage area.

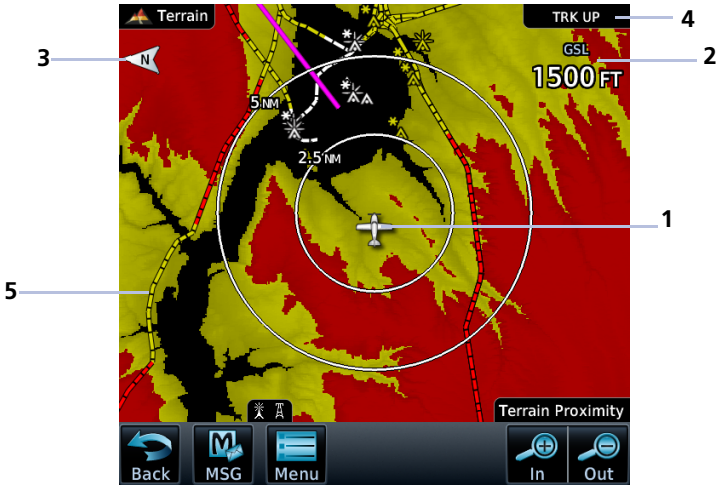
Garmin obtains terrain and obstacle data from government sources and cannot independently verify the accuracy and completeness of the information. Pilots must familiarize themselves with the appropriate charts and other data for safe flight.

DATABASE	LIMITATION
Terrain	• Not available north of 89° N latitude and south of 89° S latitude
Obstacle	• Coverage areas vary according to database type • Power line indications for the contiguous United States and small parts of Canada and Mexico • Regional definitions may change without notice • May not contain uncharted obstacles • May include power lines or only HOT lines depending on database type[1]

[1] HOT lines are power lines that share location with other obstacles identified by the FAA.

Terrain Display

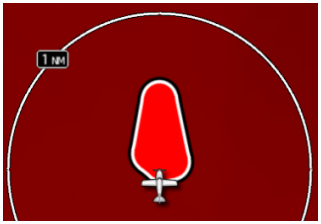
Terrain, obstacle, and wire data display as overlays on the dedicated Terrain page and as overlays on Map.



Terrain Display Features

1	**Ownship Icon** Depicts current aircraft position.
2	**GSL Altitude** Displays current GPS height above mean sea level.
3	**North Indicator** Indicates True north.
4	**Page Orientation Label** • **Track Up** orients page to current aircraft GPS track • **Heading Up** orients page to current aircraft heading (requires heading data source interface) Heading Up takes priority over Track Up when both orientation inputs are available.
5	**Overlay Icons** Indicates power line or obstacle presence at the current zoom scale.

AUTOMATIC ZOOM



In the event an alert occurs, the page automatically zooms to provide the best depiction of that alerted terrain, obstacle, or power line.

AUTOMATIC DATA REMOVAL

Automatic removal of obstacle and power line data occurs at range scales greater than 10 nm.

Terrain Setup

Terrain Page Menu

- View
  - 360
  - Arc
- Layers
  - Flight Plan
  - Legend
- (H)Terrain Alerting
  - (H)Terrain Test
  - (H)Terrain Inhibit
  - RP Mode [1]
- (H)TAWS (Optional)
  - TAWS Test
  - TAWS Inhibit
  - Flap Override [2]
  - G/S Inhibit [2]
  - GPWS Inhibit [2]

Tap **Menu** to access pilot selectable settings as well as self-test and alert inhibit functions.

Map Terrain Overlays

Overlay controls reside in the Map setup menu.

Home > **Map** > **Menu** > Select from **Terrain** and **OBST/Wires**.

(H) designates the function is applicable to rotorcraft.

[1] Helicopter alerting functions only.
[2] TAWS-A only.

TERRAIN SETUP SELECTIONS

View	**360**	• Changes view format to a 360° ring encircling the aircraft (default view)
	Arc	• Changes view format to a forward-looking 120° arc
Layers	**Flight Plan**	• Toggles the active flight plan overlay on or off (Terrain page only)
	Legend	• Toggles the Terrain and Obstacle/Wire legend on or off
HTAWS & (H)Terrain Alerting	**Test [NAME]**	• Performs a system test of the terrain alerting function • Verifies the validity of required databases
	[NAME] Inhibit	• Inhibits visual alerts for terrain, obstacles, and power lines • Inhibits the FLTA aural and visual alerts
	RP Mode	• Reduces alerting thresholds for low-level operations (rotorcraft only)
TAWS-A	**Flap Override**	• Overrides flap-based FIT alerting while other FIT alert functions remain in effect • Inhibits nuisance FIT alerts where flap extension is not desired
	G/S Inhibit	• Inhibits glideslope or glidepath alerts depending on current state • Use to prevent glideslope/glidepath deviation alerts (e.g., when flying a localizer backcourse approach) • Active only for a single approach
	GPWS Inhibit	• Inhibits GPWS audible and visual alerts • (i.e., EDR, ECR, FIT, and NCR)
TAWS A & B	**TAWS Test**	• Performs TAWS alerting system test • Verifies the validity of required databases
	TAWS Inhibit	• Inhibits the PDA/FLTA audible and visual alerts

Terrain Proximity

FEATURE LIMITATIONS

- *Terrain and obstacle depictions are relative to aircraft altitude.*
- *Obstacle depictions are dependent upon database*
- *Does not provide visual or aural alerts*

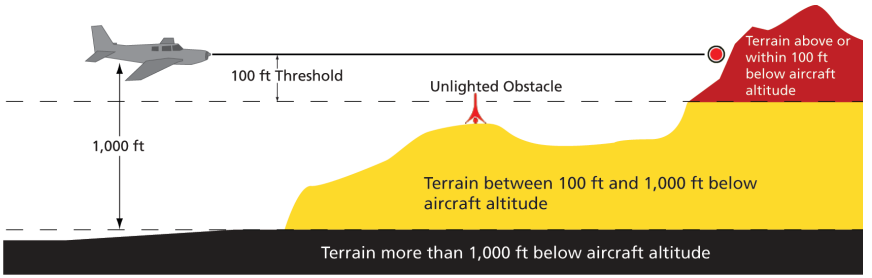
View color depictions of terrain and obstacle elevations relative to your current position and altitude.

Terrain Proximity Features

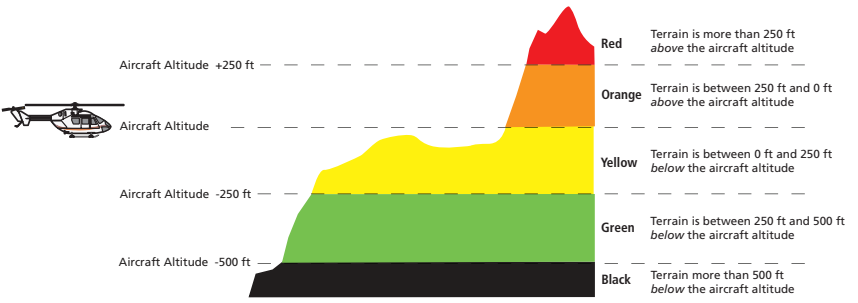
- Non-TSO C151d certified terrain display system
- 2D graphical representation of surrounding terrain, obstacles, and power lines relative to aircraft position and altitude
- Declutter automatically removes obstacle and power line data at large ranges
- Continuous monitoring of database validity, GPS and hardware status
- Displays when higher level terrain functions are active

Terrain Elevation Depictions

Color shading depicts terrain elevations relative to the aircraft's position and altitude. Colors automatically adjust as the aircraft's altitude changes.



Terrain Shading



Rotorcraft Terrain Shading

Obstacle Elevation Depictions

FEATURE LIMITATIONS

- *Obstacles more than 2,000 ft below current altitude do not display*

TOWER OBSTACLES

UNLIGHTED OBSTACLE		LIGHTED OBSTACLE		OBSTACLE LOCATION	
<1000' AGL	>1000' AGL	<1000' AGL	>1000' AGL	FIXED WING	ROTORCRAFT
				Red obstacle is above or within 100 ft below current altitude.	Red obstacle is at or above current altitude.
				Yellow obstacle is between 100 ft and 1000 ft below current altitude.	Yellow obstacle is within 250 ft below current altitude.
				White obstacle is between 1,000 ft and 2,000 ft below current altitude.	White obstacle more than 250 ft below current altitude.

WIND TURBINE OBSTACLES

UNLIGHTED WIND TURBINE OBSTACLE	LIGHTED WIND TURBINE OBSTACLE	OBSTACLE LOCATION	
		FIXED WING	ROTORCRAFT
		Red obstacle is above or within 100 ft below current altitude.	Red obstacle is at or above current altitude.
		Yellow obstacle is between 100 ft and 1,000 ft below current altitude.	Yellow obstacle is within 250 ft below current altitude.
		White obstacle is more than 1,000 ft below current altitude.	White obstacle more than 250 ft below current altitude.

POWER LINE OBSTACLES

OBSTACLE	POWER LINE OBSTACLE LOCATION
	Red power line is above or within 100 ft below current altitude.
	Yellow power line is between 100 ft and 1,000 ft below current altitude.
	White power line is between 1,000 ft and 2,000 ft below current altitude.

OBSTACLE GROUPS

An asterisk indicates when the obstacle database contains only a single latitude and longitude for a group of obstacles. This occurrence is rare.

Alert Types

The behavior of an alerting function is determined at installation. Installer configurable settings allow:

- Alert suppression for specific runway types
- Gender selection for voice messages
- Volume level

TERRAIN ALERTING
• Imminent Impact • Reduced Clearance • Premature Descent
TAWS-A
• Imminent Impact • Reduced Clearance • Premature Descent • Excessive Descent Rate • Excessive Closure Rate • Negative Climb Rate • Flight Into Terrain • Excessive Below Glideslope/Glidepath Deviation
TAWS-B
• Imminent Impact • Reduced Clearance • Premature Descent • Excessive Descent Rate • Negative Climb Rate

Available alerting functions depend on the installed terrain system.

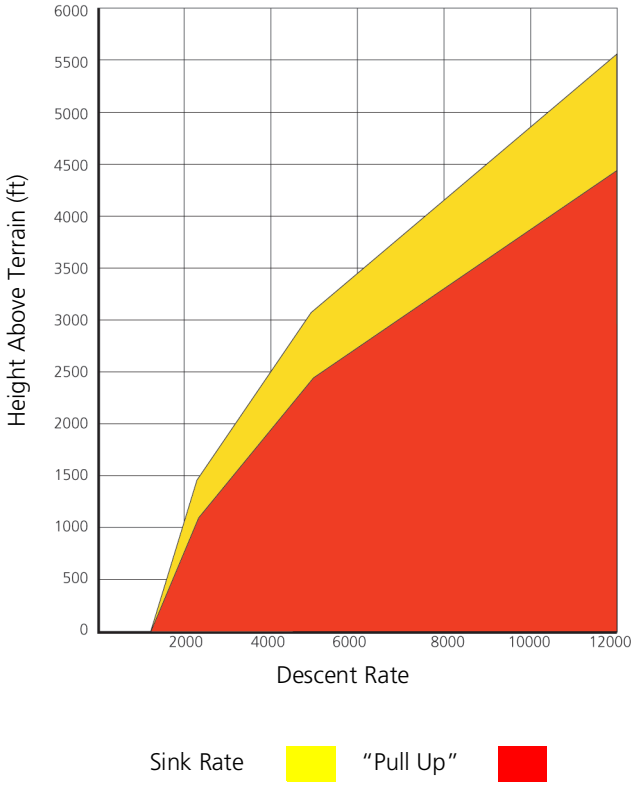
ALERT TYPE	CONDITION
Imminent Impact [1]	Aircraft reaches the minimum clearance altitude of any obstacle (IOI), terrain (ITI), or power line (ILI) in the projected flight path.
Reduced Clearance [1]	Aircraft's vertical flight path is projected to be within the minimum clearance altitude of an obstacle (ROC), terrain (RTC), or power line (RLC).
Premature Descent [2]	Aircraft is significantly below the normal approach path for the nearest runway. • Altitude is <700 ft above terrain • Distance from destination airport is 15 nm or less
Excessive Descent Rate	Aircraft descends toward terrain at an excessive rate.
Excessive Closure Rate [3]	Aircraft closes upon terrain at a rate excessive for gear and flaps in the landing configuration.
Negative Climb Rate	Aircraft loses altitude following takeoff. • Altitude is <700 ft above terrain • Distance from departure airport is 2 nm or less • Deviation from departure heading is <110°
Flight Into Terrain	Aircraft is too low with respect to terrain. Based on landing gear status, flap position, and ground speed.
Excessive Below Glideslope or Glidepath Deviation	Aircraft is significantly below the glidepath for the selected approach. Active only after departure and when the following conditions are met. • Altitude is <1,000 ft AGL • Gear is configured for landing • ILS, LPV, LNAV/VNAV, or LNAV+V approach is active and the unit is indicating vertical navigation

[1] Alerting inhibited <200 ft AGL within 0.5 nm of approach runway or <125 ft AGL within 1.0 nm of runway threshold.
[2] Alerting inhibited within 0.5 nm of approach runway or <125 ft AGL within 1.0 nm of runway threshold. Alerting thresholds for final descent are based on current position, speed, and flight path data.
[3] Alerting inhibited within 5 nm of nearest airport, except when FLTA is not available. In such cases, "TAWS N/A" or "TAWS FAIL" annunciates and ECR alerting remains active until landing.

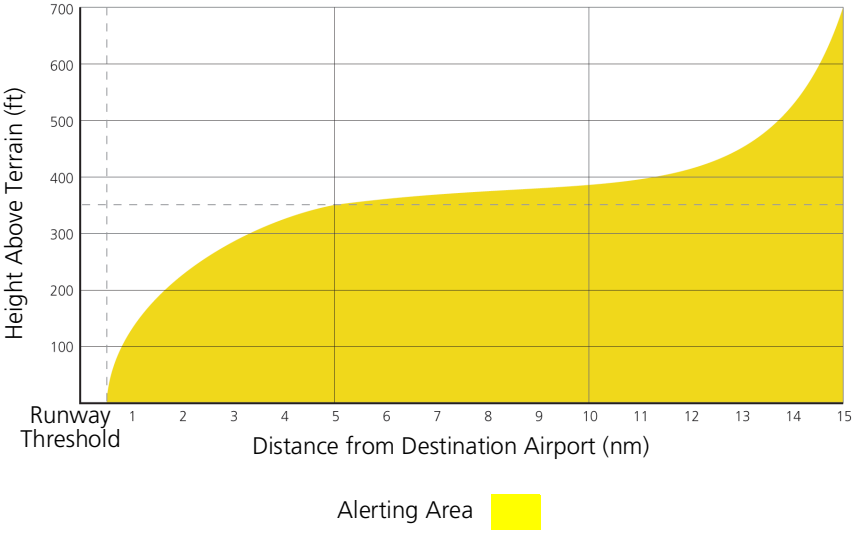
Alerting Thresholds

FLIGHT PHASE	MINIMUM CLEARANCE ALTITUDE	
	LEVEL FLIGHT	DESCENDING
En Route	700 ft	500 ft
Terminal	350 ft	300 ft
Approach	150 ft	100 ft
Departure	100 ft	100 ft

EDR THRESHOLDS

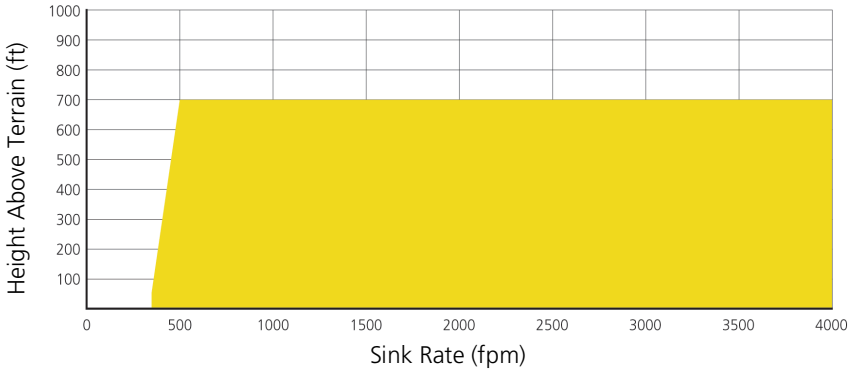


PDA THRESHOLD



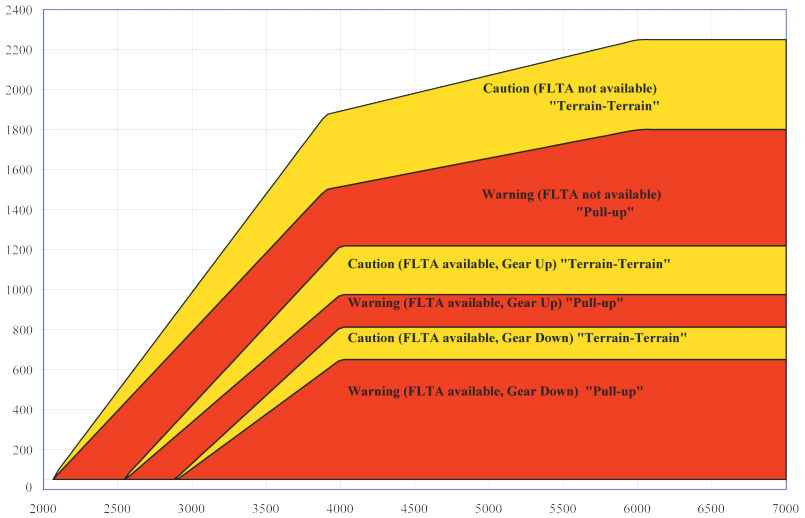
NCR THRESHOLDS

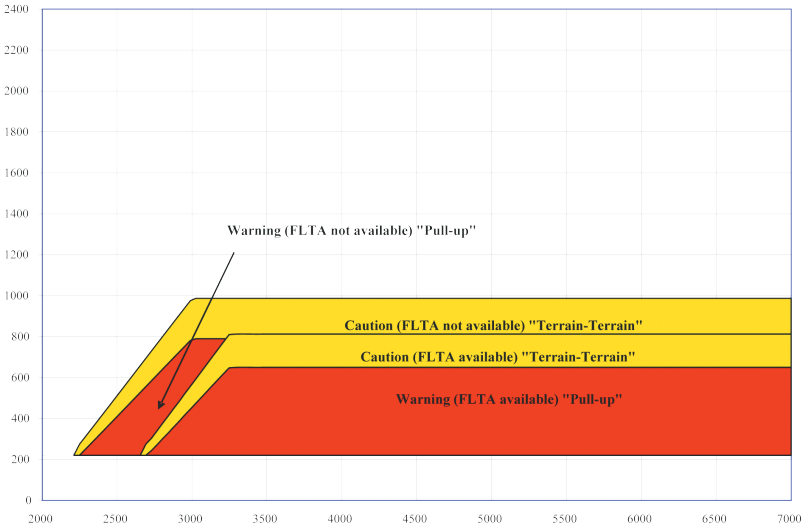
Alert triggers: altitude loss, sink rate



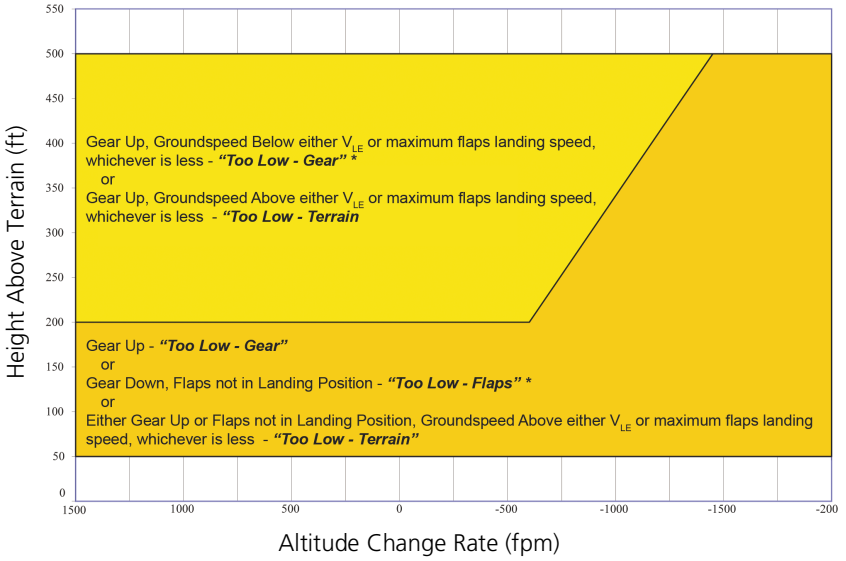
"Don't Sink"

EXCESSIVE CLOSURE RATE ALERT





FLIGHT INTO TERRAIN ALERT



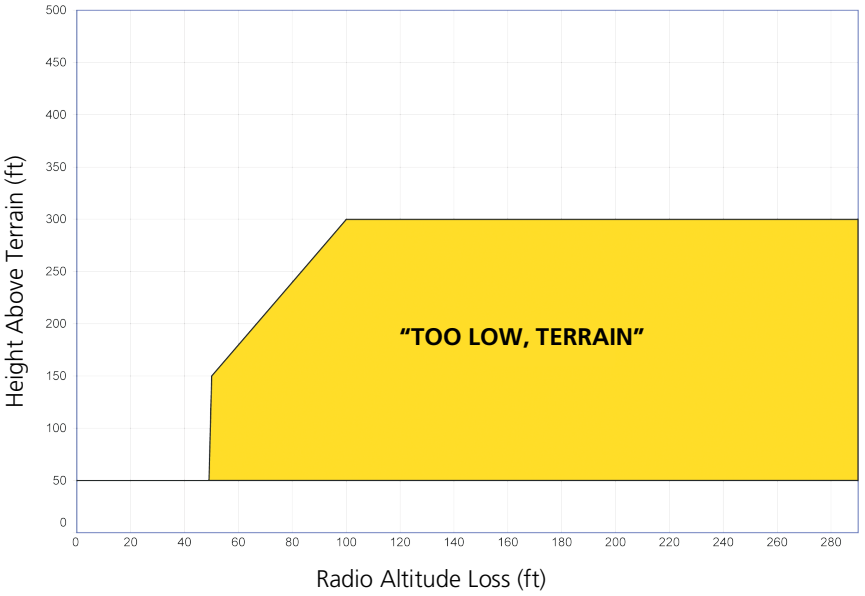
* Flap position will not trigger alert if Flap Override option is enabled. To enable, tap **Menu** > **Flap Override**.

OVERRIDING FLAPS-BASED FIT ALERTING

The FLAP O/R (Flap Override) should be activated when an approach without flaps is going to be performed.

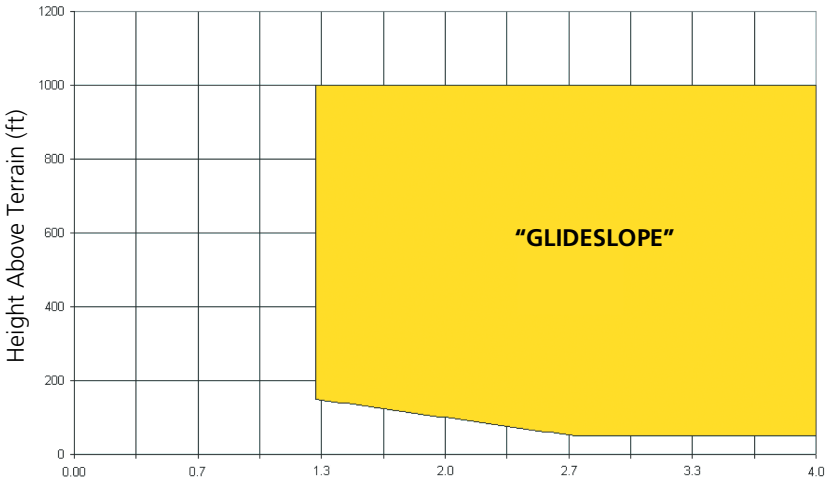
To reduce nuisance FIT alerts on approaches where flap extension is not desired (or is intentionally delayed), the pilot may override FIT alerting based on the flap position, while all other FIT alerting remains in effect.

FIT alerts also occur during takeoff or go-around if the aircraft's height above ground level (as determined by the radar altimeter) is too close to rising terrain. TAWS-A will issue the aural message "Too Low - Terrain" and visual annunciations when conditions enter the caution alert area.



EXCESSIVE BELOW GLIDESLOPE/GLIDEPATH DEVIATION ALERT

A Glideslope Deviation or Glidepath Deviation (GSD) caution alert is issued when the system detects that the aircraft is significantly below the glidepath for the selected approach.



Terrain Alerting

FEATURE REQUIREMENTS

- *Valid terrain/obstacle database*
- *Valid 3D GPS position solution*

Receive visual alerts for potential flight path conflicts involving terrain, obstacles, or power lines. Alerting behavior is determined at installation.

Terrain Alerting Features

- Non-TSO C151d certified terrain alerting system
- FLTA functions: RTC, RLC, ROC, ITI, ILI, and IOI
- Premature Descent alerts
- Terrain depictions and display overlays
- Cautions and warnings indicate alert severity and threat type
- Textual annunciations
- Pop-up alerts
- Threat location indication on Terrain page and Map
- Self-test and alert inhibit functionality

TERRAIN ALERTING	
ANNUNCIATION	**ALERT TYPE | CONDITION | AURAL MESSAGE**
PULL UP	**Alert Type:** Warning **Condition:** FLTA Terrain Warning (RTC-W, ITI-W) **Aural Messages:** • "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up" **or** • "Terrain, Terrain; Pull Up, Pull Up"
	Alert Type: Warning **Condition:** FLTA Obstacle Warning (ROC-W, IOI-W) **Aural Messages:** • "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up" **or** • "Obstacle, Obstacle; Pull Up, Pull Up"
	Alert Type: Warning **Condition:** FLTA Wire Warning (ILI-W, RLC-W) **Aural Messages:** • "Wire Ahead Pull Up, Wire Ahead Pull Up" **or** • "Wire Wire, Pull Up, Pull Up"
TERRAIN	**Alert Type:** Caution **Condition:** FLTA Terrain Caution (RTC-C, ITI-C) **Aural Messages:** • "Terrain Ahead; Terrain Ahead" **or** • "Caution, Terrain; Caution, Terrain"
OBSTACLE	**Alert Type:** Caution **Condition:** FLTA Obstacle Caution (ROC-C, IOI-C) **Aural Messages:** • "Obstacle Ahead; Obstacle Ahead" **or** • "Caution, Obstacle; Caution, Obstacle"

TERRAIN ALERTING	
ANNUNCIATION	**ALERT TYPE | CONDITION | AURAL MESSAGE**
WIRE	**Alert Type:** Caution **Condition:** FLTA Wire Caution (ILI-C, RLC-C) **Aural Messages:** • "Wire Ahead, Wire Ahead" **or** • "Caution Wire, Caution Wire"
TERRAIN	**Alert Type:** Caution **Condition:** Premature Descent Alert Caution (PDA) **Aural Messages:** "Too Low, Terrain"
None	**Alert Type:** Informational **Condition:** Voice Call Out (VCO-500) **Aural Messages:** "Five-Hundred"

TERRAIN SYSTEM STATUS

During power-up, the terrain system conducts a self-test of its aural and visual annunciations. This test can also be manually initiated. An aural alert is issued at test completion. Terrain system testing is disabled when ground speed exceeds 30 knots.

ANNUNCIATION	ALERT TYPE | CONDITION | AURAL MESSAGE
None	**Alert Type:** Informational **Condition:** Terrain Available **Aural Messages:** None
TER TEST	**Alert Type:** Informational **Condition:** Terrain System Test in Progress **Aural Messages:** None
None	**Alert Type:** Informational **Condition:** Terrain System Test Pass **Aural Messages:** "Terrain System Test OK"
TER N/A	**Alert Type:** Caution **Condition:** Terrain N/A **Aural Messages:** "Terrain Not Available"
TER INHB	**Alert Type:** Informational **Condition:** Terrain Alerting is Disabled **Aural Messages:** None
TER FAIL	**Alert Type:** Caution **Condition:** Terrain System Test Fail **Aural Messages:** "Terrain System Failure"

Alert Inhibit, TAWS & Terrain Alerting

The **Terrain Inhibit** control is accessible via the terrain pop-up alert or the Terrain page menu.

Always use discretion when inhibiting TAWS or Terrain Alerting alerts. Re-activate the alert function when appropriate.

TERRAIN INHIBIT FUNCTIONS	
INHIBIT	Manually inhibits TAWS or Terrain Alerting aural and visual alerts for low altitude approaches or rotorcraft operation.
AUTOMATIC INHIBIT	Automatically inhibits TAWS and Terrain Alerting alerts when the aircraft meets the following approach criteria. **TAWS:** • GPS/SBAS approach • Position inside FAF **TAWS & TERRAIN ALERTING:** • Altitude <200 ft above runway elevation • Position <0.5 nm of approach end or between each runway end

TAWS-A INHIBIT ANNUNCIATIONS

Terrain Page Annunciations

- TAWS-A alert inhibit annunciations appear at the bottom right of the display.
- "FLAP OVRD" does not annunciate if GPWS Inhibit is already active, as both functions inhibit FIT alerts.
- A plus sign indicates multiple alerts.

TAWS INHB+

TAWS-B

FEATURE REQUIREMENTS

- *Valid 3D GPS position*
- *TAWS-B feature enablement*

TAWS-B Features

- Optional TSO-C151d Class B terrain alerting system
- All Terrain alerting functions plus: premature descent, excessive descent rate, negative climb rate, and altitude voice callout (500 ft) alerts

TAWS-B Setup Selections

View	Selects 360° or Arc view on terrain page.
Layers	Selects to display flight plan and/or legend on the terrain page.
TAWS Inhibit	Prevents TAWS alerts.
Test	Tests the TAWS system. Available only when the aircraft is on the ground.

TAWS-B Alerts

TAWS-B ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
PULL UP	**Alert Type:** Warning **Condition:** Excessive Descent Rate Warning (EDR-W) **Aural Message:** "Pull Up"
	Alert Type: Warning **Condition:** FLTA Terrain Warning (RTC-W, ITI-W) **Aural Message:** • "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up" **or** • "Terrain, Terrain; Pull Up, Pull Up"
	Alert Type: Warning **Condition:** FLTA Obstacle Warning (ROC-W, IOI-W) **Aural Message:** • "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up" **or** • "Obstacle, Obstacle; Pull Up, Pull Up"
	Alert Type: Warning **Condition:** FLTA Wire Warning (ILI-W, RLC-W) **Aural Message:** • "Wire Ahead Pull Up, Wire Ahead Pull Up" **or** • "Wire, Wire, Pull Up, Pull Up"
TERRAIN	**Alert Type:** Caution **Condition:** FLTA Terrain Caution (RTC-C, ITI-C) **Aural Message:** • "Terrain Ahead; Terrain Ahead" **or** • "Caution, Terrain; Caution, Terrain"

TAWS-B ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
OBSTACLE	**Alert Type:** Caution **Condition:** FLTA Obstacle Caution (ROC-C, IOI-C) **Aural Message:** • "Obstacle Ahead; Obstacle Ahead" **or** • "Caution, Obstacle; Caution, Obstacle"
WIRE	**Alert Type:** Caution **Condition:** FLTA Wire Caution (ILI-C, RLC-C) **Aural Message:** • "Wire Ahead, Wire Ahead" **or** • "Caution Wire, Caution, Wire"
TERRAIN	**Alert Type:** Caution **Condition:** Premature Descent Alert Caution (PDA) **Aural Message:** "Too Low, Terrain"
	Alert Type: Caution **Condition:** Excessive Descent Rate Caution (EDR-C) **Aural Message:** "Sink Rate"
	Alert Type: Caution **Condition:** Negative Climb Rate Caution (NCR-C) **Aural Message:** • "Don't Sink" **or** • "Too Low, Terrain"
None	**Alert Type:** Informational **Condition:** Voice Call Out (VCO-500) **Aural Message:** "Five-Hundred"

Altitude VCO

TAWS-B provides aural advisory alerts as the aircraft descends, beginning at 500 feet above the terrain, as determined by the radar altimeter (if greater than 5 NM from the nearest airport) or 500 feet above the nearest runway threshold elevation (if less than 5 NM from the nearest airport). Upon descent to this altitude, TAWS-B issues the aural alert message "Five-hundred."

TAWS-B Not Available Alert

TAWS-B requires a 3D GPS position solution along with specific vertical accuracy minimums. Should the position 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. When the GPS signal is re-established and the aircraft is within the database coverage area, the aural message "TAWS Available" is generated (when the aircraft is airborne).

TAWS-B Failure Alert

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 a "TAWS FAIL" annunciation.

TAWS-B 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 alert is issued at test completion. TAWS System Testing is disabled when ground speed exceeds 30 knots.

ANNUNCIATION	ALERT TYPE	AURAL MESSAGE
None	TAWS Available	"TAWS Available"
TAWS TEST	TAWS System Test in Progress	None
None	TAWS System Test Pass	"TAWS System Test OK"
TAWS N/A	TAWS N/A	"TAWS Not Available"
TAWS INHB	TAWS Alerting is Disabled	None
TAWS FAIL	TAWS System Test Fail	"TAWS System Failure"

TAWS-A

FEATURE REQUIREMENTS

- *Valid terrain/obstacle/navigation database*
- *Valid 3D GPS position*
- *Valid flap and landing gear status inputs*
- *Valid radar altimeter*
- *Valid air data computer*

Class A TAWS incorporates radar altimeter input with the GSL altitude to provide a more accurate position reference when at lower altitudes for certain alert types, and to retain a level of ground proximity warning capability in the unlikely event of a navigation, terrain or obstacle database failure.

TAWS-A Features

- Optional TSO-C151d Class A terrain alerting system
- All Terrain-FLTA functions plus: premature descent, excessive descent and closure rate, negative climb rate, flight into terrain, excessive below glideslope/glidepath deviation
- Visual and aural annunciations when terrain and obstacles are within the given altitude threshold from the aircraft

TAWS-A Setup Selections

Tap **Menu** to access setup options. Selections are grouped by function: View, Layers, and TAWS.

INHIBIT	Manually inhibits FLTA or PDA visual alerts for low altitude approaches.
AUTOMATIC INHIBIT	Automatically inhibits FLTA alerts when the aircraft meets the following approach criteria. • Altitude <200 ft above runway elevation • Position <0.5 nm off approach end or between each runway end

TAWS-A Alerts

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
PULL UP	**Alert Type:** Warning **Condition:** Reduced Required Terrain Clearance (RTC) **Pop-up Alert:** • "Terrain - Pull Up" **or** • "Terrain Ahead - Pull Up" **Aural Message:** • "Terrain, Terrain; Pull Up, Pull Up" **or** • "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
	Alert Type: Warning **Condition:** Imminent Terrain Impact (ITI) **Pop-up Alert:** • "Terrain - Pull Up" **or** • "Terrain Ahead - Pull Up" **Aural Message:** • "Terrain, Terrain; Pull Up, Pull Up" **or** • "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
	Alert Type: Warning **Condition:** Reduced Required Obstacle Clearance (ROC) **Pop-up Alert:** • "Obstacle Pull Up" **or** • "Obstacle Ahead - Pull Up" **Aural Message:** • "Obstacle, Obstacle; Pull Up, Pull Up" **or** • "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
PULL UP	**Alert Type:** Warning **Condition:** Imminent Obstacle Impact (IOI) **Pop-up Alert:** • "Obstacle Pull Up" **or** • "Obstacle Ahead - Pull Up" **Aural Message:** • "Obstacle, Obstacle; Pull Up, Pull Up" **or** • "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
	Alert Type: Warning **Condition:** Excessive Descent Rate (EDR) **Pop-up Alert:** "Pull Up" **Aural Message:** "<whoop> <whoop> Pull Up"
	Alert Type: Warning **Condition:** Excessive Closure Rate (ECR) **Pop-up Alert:** "Pull Up" **Aural Message:** "<whoop> <whoop> Pull Up"
	Alert Type: Warning **Condition:** Imminent Line Impact (ILI) **Pop-up Alert:** "Wire Ahead - Pull Up" **Aural Message:** • "Wire Ahead, Pull Up; Wire Ahead, Pull Up" **or** • "Wire, Wire; Pull Up, Pull Up"
	Alert Type: Warning **Condition:** Reduced Line Clearance (RLC) **Pop-up Alert:** "Wire Ahead - Pull Up" **Aural Message:** • "Wire Ahead, Pull Up; Wire Ahead, Pull Up" **or** • "Wire, Wire; Pull Up, Pull Up"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
TERRAIN	**Alert Type:** Caution **Condition:** Reduced Required Terrain Clearance (RTC) **Pop-up Alert:** • "Caution - Terrain" **or** • "Terrain Ahead" **Aural Message:** • "Caution, Terrain; Caution, Terrain" **or** • "Terrain Ahead; Terrain Ahead"
	Alert Type: Caution **Condition:** Imminent Terrain Impact (ITI) **Pop-up Alert:** • "Caution - Terrain" **or** • "Terrain Ahead" **Aural Message:** • "Caution, Terrain; Caution, Terrain" **or** • "Terrain Ahead; Terrain Ahead"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
OBSTACLE	**Alert Type:** Caution **Condition:** Reduced Required Obstacle Clearance (ROC) **Pop-up Alert:** • "Caution - Obstacle" **or** • "Obstacle Ahead" **Aural Message:** • "Caution, Obstacle; Caution, Obstacle" **or** • "Obstacle Ahead; Obstacle Ahead"
	Alert Type: Caution **Condition:** Imminent Obstacle Impact (IOI) **Pop-up Alert:** • "Caution - Obstacle" **or** • "Obstacle Ahead" **Aural Message:** • "Obstacle Ahead; Obstacle Ahead" **or** • "Caution, Obstacle; Caution, Obstacle"
WIRE	**Alert Type:** Caution **Condition:** Imminent Line Impact (ILI) **Pop-up Alert:** "Wire Ahead" **Aural Message:** • "Wire Ahead; Wire Ahead" **or** • "Caution, Wire; Caution, Wire"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
WIRE	**Alert Type:** Caution **Condition:** Reduced Line Clearance (RLC) **Pop-up Alert:** "Wire Ahead" **Aural Message:** • "Wire Ahead; Wire Ahead" **or** • "Caution, Wire; Caution, Wire"
TERRAIN	**Alert Type:** Caution **Condition:** Premature Descent Alert (PDA) **Pop-up Alert:** "Don't Sink" **Aural Message:** "Too Low, Terrain"
	Alert Type: Caution **Condition:** Excessive Descent Rate (EDR) **Pop-up Alert:** "Sink Rate" **Aural Message:** "Sink Rate"
	Alert Type: Caution **Condition:** Excessive Closure Rate (ECR) **Pop-up Alert:** "Terrain" **Aural Message:** "Terrain, Terrain"
	Alert Type: Caution **Condition:** Negative Climb Rate (NCR) **Pop-up Alert:** • "Don't Sink" **or** • "Too Low - Terrain" **Aural Message:** • "Don't Sink" **or** • "Too Low, Terrain"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
TERRAIN	**Alert Type:** Caution **Condition:** Flight Into Terrain High Speed (FIT) **Pop-up Alert:** "Too Low, Terrain" **Aural Message:** "Too Low, Terrain"
	Alert Type: Caution **Condition:** Flight Into Terrain Gear (FIT) **Pop-up Alert:** "Too Low, Gear" **Aural Message:** "Too Low, Gear"
	Alert Type: Caution **Condition:** Flight Into Terrain Flaps (FIT) **Pop-up Alert:** "Too Low, Flaps" **Aural Message:** "Too Low, Flaps" **Alert Type:** Caution **Condition:** Flight Into Terrain Takeoff (FIT) **Pop-up Alert:** "Too Low, Terrain" **Aural Message**: "Too Low, Terrain"
GLIDESLOPE	**Alert Type:** Caution **Condition:** Glideslope Deviation (GSD) **Pop-up Alert:** "Glideslope" **Aural Message:** "Glideslope"
None	**Alert Type:** Informational **Condition:** Altitude Voice Call Out (VCO) **Pop-up Alert:** None **Aural Message:** "Five-Hundred"
	Alert Type: Informational **Condition:** TAWS Available **Pop-up Alert:** N/A **Aural Message:** "TAWS Available**"**

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
TAWS TEST	**Alert Type:** Informational **Condition:** TAWS system test in progress. **Pop-up Alert:** N/A **Aural Message:** None
None	**Alert Type:** Informational **Condition:** TAWS System Test Pass **Pop-up Alert:** N/A **Aural Message:** "TAWS System Test OK"
TAWS N/A	**Alert Type:** Caution **Condition:** TAWS N/A **Pop-up Alert:** N/A **Aural Message:** "TAWS Not Available"
TAWS INHB	**Alert Type:** Informational **Condition:** TAWS Alerting is disabled. **Pop-up Alert:** N/A **Aural Message:** None
TAWS FAIL	**Alert Type:** Caution **Condition:** TAWS system test has failed. **Pop-up Alert:** N/A **Aural Message:** "TAWS System Failure"
	Alert Type: Caution[1] **Condition:** • Incorrect TAWS configuration • Invalid/missing terrain, airport, or obstacle database • TAWS audio fault **Pop-up Alert:** N/A **Aural Message:** "TAWS System Failure"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
TAWS N/A	**Alert Type:** Caution **Condition:** No GPS position **Pop-up Alert:** N/A **Aural Message:** "TAWS Not Available"
	Alert Type: Caution **Condition:** GPS position unavailable/degraded. Outside of terrain database coverage. **Pop-up Alert:** N/A **Aural Message:** "TAWS Not Available"
None	**Alert Type:** Informational **Condition:** Sufficient GPS signal reception restored. **Pop-up Alert:** N/A **Aural Message:** "TAWS Available" (aural message only in flight)
GPWS FAIL	**Alert Type:** Caution **Condition:** • Incorrect TAWS configuration • Radar altimeter unavailable • GPS position unavailable/degraded • TAWS audio fault **Pop-up Alert:** N/A **Aural Message:** "GPWS System Failure"
GPWS INHB	**Alert Type:** Informational **Condition:** GPWS Inhibit **Pop-up Alert:** None **Aural Message:** "GPWS System Failure"

TAWS-A ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
GPWS N/A	**Alert Type:** Caution **Condition:** • GPWS Not Available • Incorrect TAWS configuration • Radar altimeter unavailable • GPS position unavailable/degraded • TAWS audio fault **Pop-up Alert:** N/A **Aural Message:** "GPWS System Failure"
G/S INHB	**Alert Type:** Informational **Condition:** Glideslope Inhibit **Pop-up Alert:** N/A **Aural Message:** None
FLAP OVRD	**Alert Type:** Informational **Condition:** FLAP Override **Pop-up Alert:** N/A **Aural Message:** None

[1] VCO alerts are not issued if both TAWS and GPWS systems have failed or are not available.

GSD alert is available if a valid ILS is being used for navigation, even when no valid GPS signal is being received.

ENABLE FLAP OVERRIDE

When the Flaps Override option is enabled, the annunciation "FLAP OVRD" is annunciated on the TAWS-A Page. If GPWS alerts are also inhibited (which include FIT), the "FLAP OVRD" annunciation is not shown.

1. Tap **Menu**.
2. Tap **Flap Override** to toggle the override state.

GSD alerting is only active after departure and the following conditions are met:

- An ILS, LPV, LNAV/VNAV, or LNAV+V approach is active and vertical navigation indications are being displayed.
- Aircraft is below 1000 feet AGL.
- Gear is configured for landing.

When a GSD caution alert occurs, the aural and visual annunciation "GLIDESLOPE" is issued. If a GSD caution alert occurs on an LPV, LNAV/VNAV, or LNAV+V approach, the aural and visual annunciation "GLIDESLOPE" is issued.

INHIBITING GLIDESLOPE DEVIATION (GSD) ALERTS

When G/S alerts are inhibited, they are only inhibited for a single approach. To inhibit G/S alerts on the next approach, the G/S Inhibit function must be activated again between the first and second approaches.

1. Tap **Menu**.
2. Tap **G/S Inhibit** to inhibit or enable glideslope or glidepath alerts.

The Glideslope (G/S) Inhibit function:

- Should be activated when flying a localizer backcourse approach to prevents nuisance GSD alerts
- GSD alerts are inhibited independent from all other FLTA, PDA, and GPWS alerts
- Will only be active for a single approach and will not remain active for subsequent approaches

INHIBITING GPWS ALERTS (EDR, ECR, FIT, AND NCR)

The "Inhibit GPWS" function only affects GPWS alerts (EDR, ECR, NCR, and FIT). Alerting for FLTA, PDA, and GSD is controlled independently from the GPWS alerts listed below.

EDR, ECR, FIT, and NCR aural and visual alerts can be manually inhibited as a group. Discretion should be used when inhibiting alerts and the GPWS system should be enabled when appropriate. When these alerts are inhibited, the alert annunciation "GPWS INH" is shown on the TAWS-A Page annunciation window.

1. Tap **Menu**.
2. Tap **GPWS Inhibit** to inhibit or enable GPWS alerts (choice dependent on current state).

GPWS Inhibit Annunciator

ALTITUDE VOICE CALL OUT (VCO)

TAWS-A provides aural advisory alerts as the aircraft descends, beginning at 500 feet above the terrain, as determined by the radar altimeter (if greater than 5 NM from the nearest airport) or 500 feet above the nearest runway threshold elevation (if less than 5 NM from the nearest airport). Upon descent to this altitude, TAWS-A issues the aural alert message "Five-hundred."

TAWS-A SYSTEM STATUS

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

TAWS-A ABNORMAL OPERATIONS

TAWS-A continually monitors several system-critical items such as database validity, flap and landing gear position, radar altimeter input, and GPS status.

If the GTN does not contain Terrain and Obstacle databases (or the databases are invalid), the aural message "TAWS System Failure" is generated along with the "TAWS FAIL" alert annunciation.

TAWS-A requires a 3D 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-A page, the aural message "TAWS Not Available" is generated if airborne, some TAWS-A terrain alerts will not be issued, and GPWS alerting (which are not dependent on GPS position) will continue to operate. When the GPS signal is re-established and the aircraft is within the database coverage area, the aural message "TAWS Available" is generated.

TAWS-A also requires radar altimeter input. Should the radar altimeter input fail or become degraded, the annunciation "GPWS FAIL" is generated in the annunciation window and on the TAWS-A Page. The aural message "GPWS System Failure" is also generated. The "GPWS FAIL" annunciation will also occur if both GPS altitude and barometric altitude are unavailable. If only the GPWS system has failed, GPWS-based alerts will not be available, while other TAWS-A alerting remains unaffected.

Multiple TAWS or GPWS annunciations cannot be displayed at the same time. When multiple annunciations exist, a plus-sign will be present next to the annunciation. The display of each annunciation will alternate with each being displayed for approximately five seconds.

HTAWS/(H)Terrain Alerting

NOTE

HTAWS-enabled units can be identified by going to the Terrain page and checking the lower right-corner for "HTAWS."

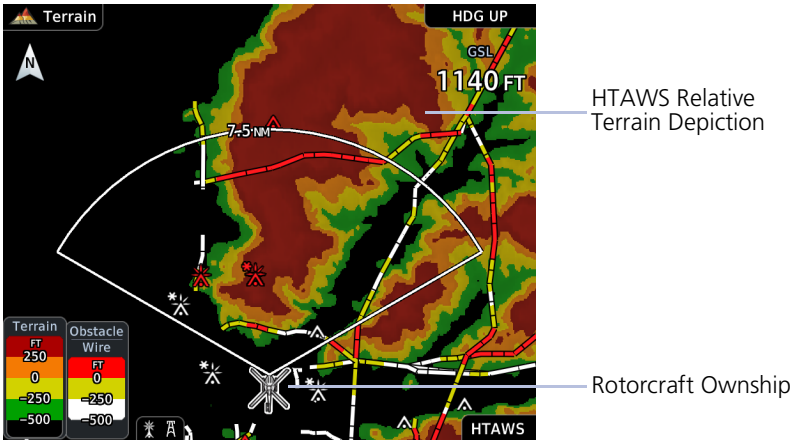
FEATURE REQUIREMENTS

- *Valid 3D GPS position*
- *Valid terrain/obstacle database*

Garmin's Helicopter Terrain Awareness Warning System (HTAWS) is an optional feature to increase situational awareness and aid in reducing controlled flight into terrain. Garmin HTAWS is TSO-C194 authorized. (H)Terrain Alerting is **not** TSO-C194 authorized.

HTAWS provides visual and aural annunciations when terrain and obstacles are a hazard to the aircraft.

HTAWS Terrain Display



POWER UP

During power-up of the unit, the terrain/obstacle database versions are displayed along with a disclaimer to the pilot. At the same time, HTAWS self-test begins. HTAWS gives the following aural messages upon test completion:

"HTAWS System Test, OK," if the system passes the test.

"HTAWS System Failure," if the system fails the test.

A test failure is also annunciated visually for HTAWS, as shown in the HTAWS Alert Summary table.

HTAWS Setup Selections

The HTAWS page menu provides options to acknowledge caution alerts, reduce protection, or inhibit alerting.

View	Selects 360° or Arc view on the Terrain page.
Layers	Selects to display flight plan and/or legend on the Terrain page.
RP Mode	• Reduces the alerting thresholds, and suppresses visual and aural annunciation of caution alerts • An external RP Mode switch and an external alert acknowledge switch can be used • "RP Mode" displays in the terrain annunciator field whenever protection is reduced
HTAWS Inhibit	When the ground speed is less than 30 knots HTAWS automatically displays "HTAWS INHB" and cannot be removed by menu option selection. Other features: • Inhibit mode deactivates aural and visual alerts (Use discretion when inhibiting the HTAWS system and remember to enable the system when appropriate) • VCOs are not inhibited in Inhibit mode • All FLTA aural and visual alerting suppressed • HTAWS should only be inhibited when in visual contact with terrain and obstacles • HTAWS configured units will always start up with HTAWS alerts uninhibited
Test HTAWS	Tests the HTAWS system. Available only when the rotorcraft is on the ground. An aural message communicates test results: "HTAWS System Test, OK" if the system passes the test. "HTAWS System Failure" if the system fails the test.

HTAWS Alerts

- HTAWS alerts employ either a CAUTION or WARNING alert severity level
- Visual annunciations display when alert is issued
- Aural alerts are simultaneously issued
- Annunciations appear in dedicated field in the lower left corner of the display
- HTAWS Caution Alerts display as constant black text on a yellow background
- HTAWS Warning Alerts display as constant white text on a red background

FORWARD LOOKING TERRAIN AVOIDANCE

Unit issues terrain alerts when the aircraft altitude is below the terrain elevation and when aircraft is projected to come within minimum clearance values of the terrain.

Any threat locations are depicted on the display. There are two levels of severity for FLTA alerts. They are cautionary (amber) and warning (red).

FLTA Caution:

- Estimated potential impact in approximately 30 seconds after a caution pop-up alert and annunciation
- Accompanied by the aural message "Caution Terrain; Caution Terrain"
- The time to an alert can vary with conditions, therefore there is no guarantee of a 30 second caution alert being issued

FLTA Warning:

- Warning pop-up alerts issued 15 seconds prior to estimated potential impact in normal mode and approximately 10 seconds in RP mode
- Accompanied by the aural message "Warning - Terrain, Terrain" or "Warning - Obstacle, Obstacle"
- The time to an alert can vary with conditions, therefore there is no guarantee of a 15/10 second warning alert being issued

HTAWS VOICE CALL OUT (VCO) AURAL ALERT

- VCO aural alert messages provide an advisory alert to the pilot the aircraft is between 500 feet and 100 feet above terrain in 100 foot increments
- When the aircraft descends within the selected distance from terrain, the aural message for the selected height above terrain is generated
- There are no display annunciations or pop-up alerts that accompany the aural message
- HTAWS allows an additional 50 foot VCO alert with radar altimeter input

HTAWS VCO SELECTION

If a radar altimeter is interfaced to GTN, alerts are available down to 50 feet and the height above terrain when the radar altimeter is used to generate the callouts.

To select VCO choices:

1. Tap **System** > **Audio** > **Voice Callouts**.
2. Tap **MAX Voice Callout** to select the Voice Call Outs.
3. The values above the selected value will be disabled (Off).

HTAWS NOT AVAILABLE ALERT

- Requires a 3D GPS navigation solution along with specific vertical accuracy minimums.
- "HTAWS N/A" displays if solution becomes degraded or aircraft is out of database coverage area.

HTAWS FAILURE ALERT

If the terrain/obstacle database is not available, the aural message "HTAWS System Failure" is issued along with the "HTAWS FAIL" annunciation.

HTAWS ALERT SUMMARY

HTAWS Caution Alerts appear as constant black text on a yellow background.

HTAWS Warning Alerts appear as constant white text on a red background.

PILOT ACTIONS

If an HTAWS warning and associated aural are received, the pilot should immediately maneuver the rotorcraft in response to the alert unless the terrain or obstacle is clearly identified visually and determined by the pilot not to be a factor to the safety of the operation.

A HTAWS caution alert indicates terrain or obstacle nearby. If possible visually locate the terrain or obstacle for avoidance. A HTAWS warning alert may follow a HTAWS caution unless the aircraft's path towards the terrain or obstacle is changed.

Display of terrain and obstacles on the display is supplemental data only. Maneuvering solely by reference to the terrain and obstacle data is not recommended or authorized.

HTAWS ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
TERRAIN	**Alert Type:** Warning **Condition:** FLTA Warning for Terrain **Pop-up Alert:** "Warning - Terrain" **Aural Message:** "Warning - Terrain, Terrain"
	Alert Type: Caution **Condition:** FLTA Caution for Terrain **Pop-up Alert:** "Caution - Terrain" **Aural Message:** "Caution -Terrain, Terrain"
OBSTACLE	**Alert Type:** Warning **Condition:** FLTA Warning for Obstacle **Pop-up Alert:** "Warning - Obstacle" **Aural Message:** "Warning - Obstacle, Obstacle"
	Alert Type: Caution **Condition:** FLTA Caution for Obstacle **Pop-up Alert:** "Caution - Obstacle" **Aural Message:** "Caution - Obstacle, Obstacle"
WIRE	**Alert Type:** Warning **Condition:** FLTA Warning for Power Lines **Pop-up Alert:** "Warning - Wire" **Aural Message:** "Wire Ahead Pull Up, Wire Ahead Pull Up"
	Alert Type: Caution **Condition:** FLTA Caution for Wire **Pop-up Alert:** "Caution - Wire" **Aural Message:** "Wire Ahead"
HTAWS FAIL	**Alert Type:** Caution **Condition:** HTAWS has failed. **Pop-up Alert:** None **Aural Message:** "HTAWS System Failure"

HTAWS ALERTS	
ANNUNCIATION	**ALERT TYPE | POP-UP | CONDITION**
HTAWS N/A	**Alert Type:** Caution **Condition:** HTAWS is not available. **Pop-up Alert:** None **Aural Message:** "HTAWS Not Available"
RP MODE	**Alert Type:** Informational **Condition:** Alerting thresholds are reduced. Visual and aural annunciation of caution alerts are suppressed. **Pop-up Alert:** None **Aural Message:** None
HTAWS INHB	**Alert Type:** Informational **Condition:** HTAWS has been inhibited by the crew, or the aircraft ground speed is below 30 knots (automatic inhibiting). **Pop-up Alert:** None **Aural Message:** None
None	**Alert Type:** N/A **Condition:** HTAWS provides optional 500 ft through 100 ft (in 100 ft increments) altitude call out alerts. An additional value of 50 ft is available if a radar altimeter is installed. **Pop-up Alert:** None **Aural Messages:** • "Five Hundred" • "Four Hundred" • "Three Hundred" • "Two Hundred" • "One Hundred" • "Fifty"

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