Honeywell

KTA870/ KMH880

Pilot's Guide

BENDIX/KING®

Traffic Advisory System/ Multi-Hazard Awareness System

Rev. 3

006-18265-0000

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Revision History

Manual KTA870/KMH880 Pilot's Guide

Revision 3, January 2005

Part Number 006-18265-0000

This revision clarifies the determination of when other aircraft are on the ground, and clarifies the GA-EGPWS Self-Test process.

The following pages were changed or added:

Front Cover, Copyright, 14, 53, 54, Back Cover

Revision History

Manual KTA870/KMH880 Pilot's Guide

Revision 2, January 2004

Part Number 006-18265-0000

This revision is to correct errors and to remove references to a specific type of database card.

The following pages were changed or added:

Front Cover, Copyright, 37, 41, 46, 59, 60, Back Cover

Revision History

Manual KTA870/KMH880 Pilot's Guide

Revision 1, March 2002

Part Number 006-18265-0000

This revision incorporates changes from the KGP 560.

Revision History

Manual	KTA870/KMH880 Pilot's Guide
Revision	0, March 2001
Part Number	006-18265-0000

This is the original version of this publication.

EGPWS (Optional)

SYSTEM COMPONENTS

TRAFFIC DISPLAYS:

KMD 850

Compatible Radar Indicators via GC 362A

Compatible EFIS

TA/VSI

TAS CONTROLS:

KMD 850

CP 66B TCAS I Controller

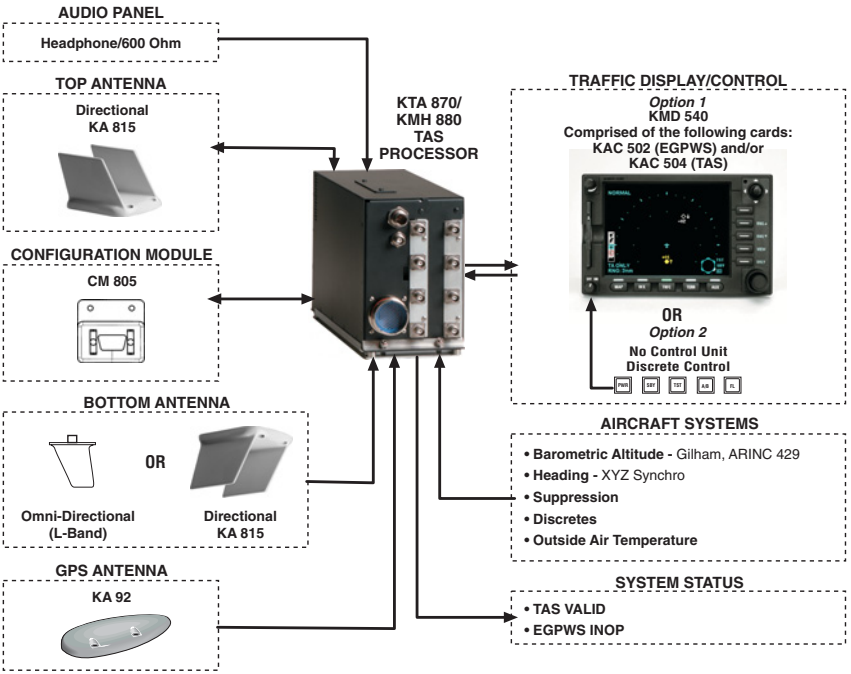
Discretes

OPTIONAL EGPWS CONTROLS & DISPLAYS:

KMD 850

Compatible Radar Indicators

Discretes



KTA 870/KMH 880 Block Diagram

INTRODUCTION

TAS (an acronym formed from the phrase Traffic Advisory System) is an airborne system used for detecting and tracking aircraft near your own aircraft. TAS includes a TAS processor, antennas, a traffic display and a means to control the system. The TAS processor and antennas detect and track other aircraft by interrogating their transponders. Aircraft detected, tracked, and displayed by TAS are referred to as Intruders. TAS analyzes the transponder replies to determine range, bearing and relative altitude, if the Intruder is reporting altitude. Should the TAS processor determine that a possible collision hazard exists, it issues visual and aural advisories to the crew. The visual advisory is shown by symbols on the traffic display. Complementing the traffic display, TAS provides appropriate synthesized voice announcements in the cockpit. A complete list of traffic symbols and announcements is given in the Theory of Operation and Symbology section of this Pilot's Guide.

TAS is unable to detect any Intruding aircraft without an operating transponder. TAS can detect and track aircraft with either an ATCRBS (operating in Mode A or C) or Mode S transponders.

The traffic display shows the Intruding aircraft's position. TAS identifies the relative threat of each Intruder by using various symbols and colors. The Intruder's altitude, relative to your own aircraft's altitude, is annunciated if the Intruder is reporting altitude. A trend arrow is used to indicate if the Intruder is climbing or descending more than 500 feet per minute. TAS traffic may be displayed on a weather radar indicator, on a dedicated TAS display, on a TAS compatible EFIS Display Unit or a TA/VSI (combination traffic display and vertical speed instrument).

TAS modes and functions are controlled by switches located on a TAS control panel or in combination with various other controls. A description of controls is given in the Controls and Displays section of this Pilot's Guide.

ATC procedures and the "see and avoid concept" will continue to be the primary means of ensuring aircraft separation. However, if communication is lost with ATC, TAS adds a significant backup for collision avoidance.

TAS:

- Is compatible with the ATC System
- Determines if a threat exists from ATCRBS or Mode S Transponder equipped aircraft
- Provides display and audio announcement to the crew

  - Position information displayed on a traffic display

  - Synthesized voice
- Incorporates sensor inputs and sophisticated algorithms to minimize nuisance visual and aural annunciations.

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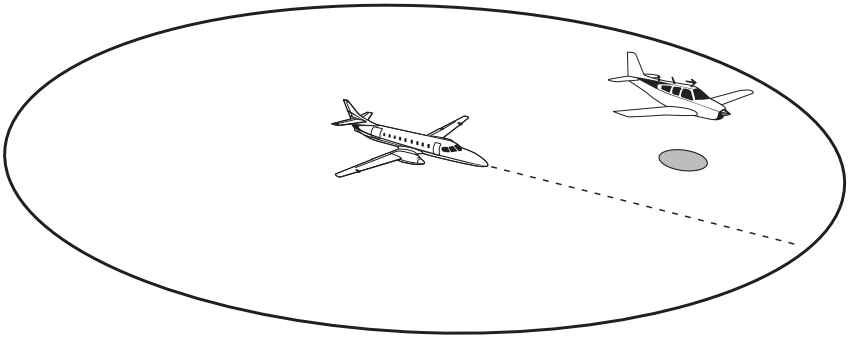
SECTION I : THEORY OF OPERATION AND SYMBOLOGY



Section I describes TAS Theory of operation and symbology.

TAS OPERATION

TAS monitors the airspace surrounding your aircraft by interrogating the transponder of the Intruding aircraft. The interrogation reply enables TAS to compute the following information about the Intruder:

1. Range between your aircraft and the Intruder.
2. Relative bearing to the Intruder.
3. Altitude and vertical speed of the Intruder, if the Intruder is reporting altitude.
4. Closing rate between the Intruder and your aircraft.

Using this data TAS predicts the time to, and the separation at, the Intruder's Closest Point of Approach (CPA). Should TAS predict that certain safe boundaries may be violated, it will issue a Traffic Advisory (TA) to alert the crew that closing traffic is nearby.

TAS SENSITIVITY LEVEL

TAS separates the surrounding airspace into two altitude layers. A different sensitivity threshold level for issuing TAs (traffic advisories) is applied to each altitude layer. Lower altitudes have less sensitive TA threshold levels to prevent unnecessary advisories in the higher traffic densities anticipated at lower flight levels, i.e., terminal areas.

TAS has two sensitivity levels (SL) which are described in Table 1, TAS Sensitivity Levels. SL A is invoked using the following order of precedence: (1) when the TAS aircraft is below 2,000 feet AGL (if equipped with radio altimeter) OR (2) when the landing gear is Extended (no radio altimeter installed). SL B occurs under all other flight conditions. Table 2, Typical Traffic Advisory Conditions for Sensitivity Levels describes what conditions will cause a TA to be issued. If aircraft is not equipped with either a radio altimeter or retractable landing gear, TAS will stay in SL B at all times.

Sensitivity Level	DESCRIPTION
SL A	In sensitivity level A, TAS performs surveillance and tracking functions and provides traffic advisories. The conditions for sensitivity level A are any one of the following: (1) Own aircraft is in-flight and is below 2,000 feet AGL, if a radio altimeter is installed. (2) Own aircraft is in-flight and the Landing Gear is extended, if a radio altimeter is NOT installed.

SL B	In sensitivity level B, TAS performs surveillance and tracking functions and provides traffic advisories. The conditions for sensitivity level B are based on own aircraft in-flight and: (1) If radio altitude source is installed and own aircraft altitude is above 2,000 feet AGL (radio altitude). (2) If radio altitude source is NOT installed and own aircraft has Landing Gear Retracted. (3) If the aircraft has a fixed landing gear and no radio altimeter is installed.

Table 1: TAS Sensitivity Levels

Sensitivity Level	CONDITIONS FOR TRAFFIC ADVISORIES (TAs)
SL A	The following conditions cause TAS to generate a TA in sensitivity level A: • TAS calculates that if current closing rate is maintained, separation of less than 600 feet in altitude between own and Intruder will occur in 20 seconds. • Separation between own and Intruder is less than 600 feet in altitude and less than 0.20 nautical mile range. • NAR (Non-Altitude Reporting) Intruder is within 15 seconds or 0.20 nautical mile range.
SL B	The following conditions cause TAS to generate a TA in sensitivity level B: • TAS calculates that if current closing rate is maintained, separation of less than 800 feet in altitude between own and Intruder will occur in 30 seconds. • Separation between own and Intruder is less than 800 feet in altitude and less than 0.55 nautical miles in range. • NAR (Non-Altitude Reporting) Intruder is within 20 seconds or 0.55 nautical mile range.
Standby or Fail Mode	• TAs are not generated.

Table 2: Typical Traffic Advisory Conditions for Sensitivity Levels

TAS SURVEILLANCE VOLUMES

Surveillance volume is that volume of airspace within which other aircraft with Mode S or ATCRBS transponders are tracked by own aircraft's TAS. The display volume is controlled by the operator and is not necessarily the same as the tracking volume.

(1) Range Tracking Volumes

The size of the range tracking volume is dependent on whether tracking is occurring on a directional or OMNI antenna and attenuation levels applied to the transmitted pulses from the TAS processor's transmitter. The typical range tracking volume is pictured as a circle.

The maximum range for TAS is 18 nm. However, there are instances when you may see intruders out to 36 nm. TAS reduces range tracking volumes in high density areas to reduce the number of receptions to be processed by TAS and for interference limiting. TAS can track as many as 45 aircraft and displays up to 30 of them.

(2) Altitude Tracking Volumes

TAS tracks other transponder equipped aircraft that are within a relative altitude of +/-10,000 feet.

TAS AURAL INHIBITS

TAS will inhibit the aural annunciation using the following order of precedence: (1) below 400 feet AGL (if equipped with radio altimeter) OR (2) when the landing gear is Extended (no radio altimeter installed). For installations aboard aircraft with fixed landing gear and no radio altimeter installed, the aural annunciation is not inhibited by the TAS processor, unless weight-on-wheels indicates on the ground. The aural annunciation is enabled above 600 feet AGL in aircraft equipped with a radio altimeter.

TAS TRAFFIC DISPLAY SYMBOLS

TAS will display three different traffic symbols on the traffic display. The type of symbol selected by TAS is based on the Intruder's location and closing rate. Relative bearing and distance to the Intruder are shown by the position of the Intruder symbol in relation to the own-aircraft symbol.

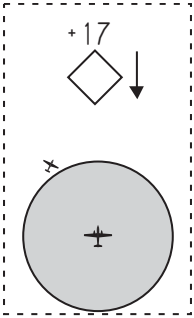
The symbols change shape and color as separation decreases between your aircraft and Intruders to represent increasing levels of urgency.

The traffic symbols may also have an associated altitude tag that shows relative altitude in hundreds of feet. A + sign and number above the symbol means the Intruder is above your altitude. A - sign and number beneath indicates the Intruder is below your altitude. A trend arrow appears when the Intruder's vertical rate is 500 feet per minute or greater.

No altitude number or trend arrow will appear beside any Intruder that is Non-Altitude Reporting (NAR).

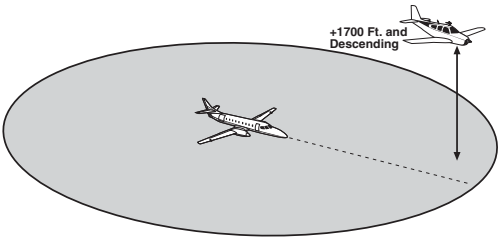
If TAS direction finding techniques fail to locate the azimuth of another aircraft, a NO BEARING message appears on the screen when the Intruder becomes a Traffic Advisory.

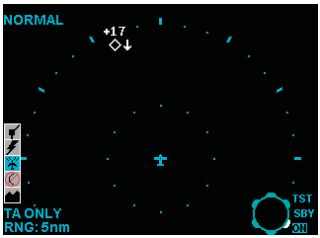
NON-THREAT TRAFFIC



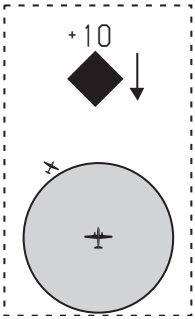
An open white diamond indicates that an Intruder's relative altitude is greater than ±1200 feet, or its distance is beyond 5 nm range. It is not yet considered a threat.

This traffic is 1700 feet above your own altitude, descending at 500 feet per minute or greater.



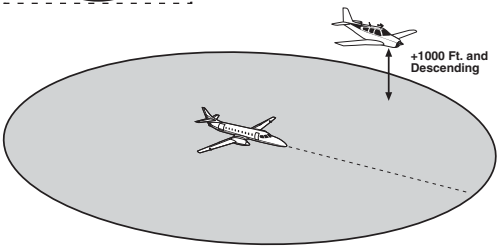


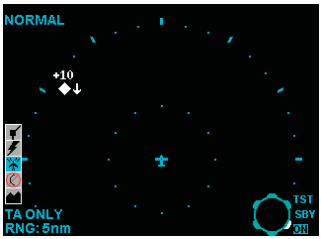
PROXIMITY INTRUDER TRAFFIC



A filled white diamond indicates that the Intruding aircraft is within ±1200 feet and within 5 nm range, but is still not considered a threat.

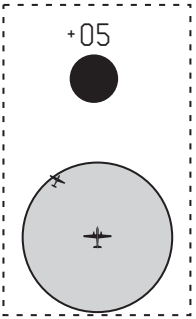
This Intruder is now 1000 feet above your aircraft and descending at 500 fpm or greater.





TRAFFIC ADVISORY (TA)

A symbol change to a filled yellow circle indicates that the Intruding aircraft is considered to be potentially hazardous. Depending upon TAS sensitivity level, TAS will display a TA when time to CPA (Closest Point of Approach) is 15 to 30 seconds.

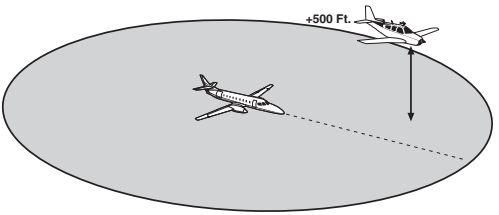


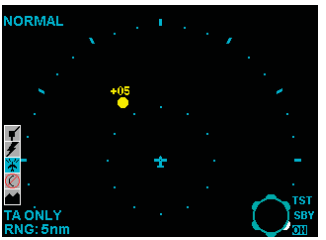
Here the Intruder is 500 feet above your aircraft. A voice is heard in the cockpit, advising:

"Traffic, Traffic"

The crew should attempt to gain visual contact with the Intruder and be prepared to maneuver upon visual acquisition.

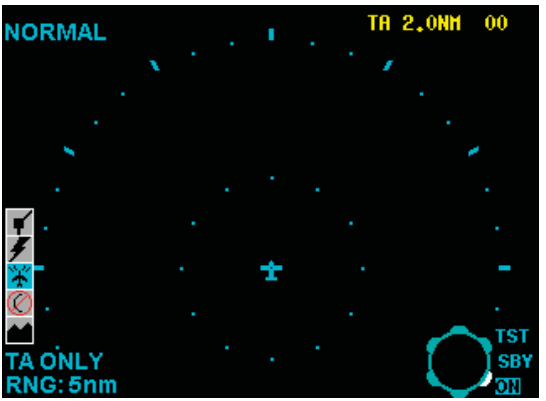
The crew should take no evasive action based solely on the TAS display.





NO BEARING TRAFFIC

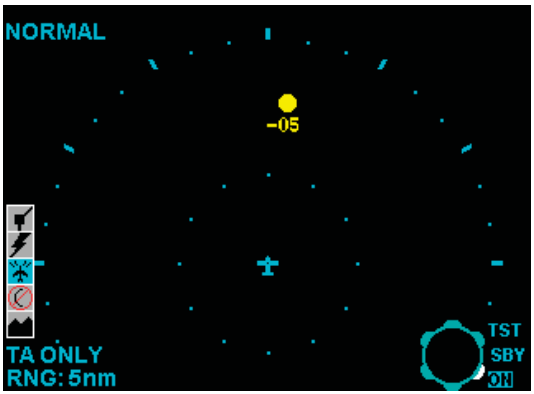
In installations with dual directional antennas with landing gear down, when omnidirectional antenna is installed on the bottom of the aircraft, or the intruder is located where the TAS cannot determine the azimuth of the intruder, a "No Bearing" TA will be annunciated. If traffic can only be seen by the bottom antenna as described above, a "No bearing" TA would be annunciated as shown. Here the intruder is two nautical miles away and co-altitude.



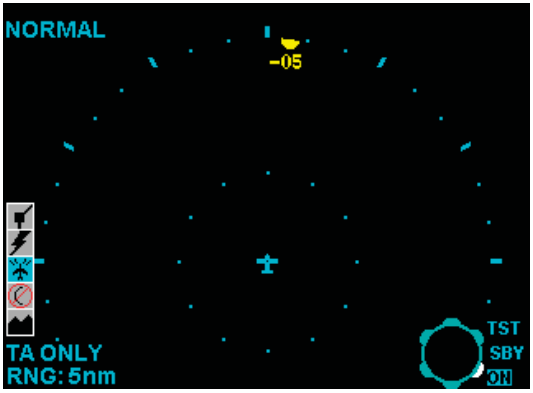
No Bearing TA

OFF SCALE TRAFFIC

Threat aircraft (TAs) that are beyond the selected display range are indicated by one half of the traffic symbol at the edge of the screen. The position of the half-symbol represents the bearing of the Intruder.



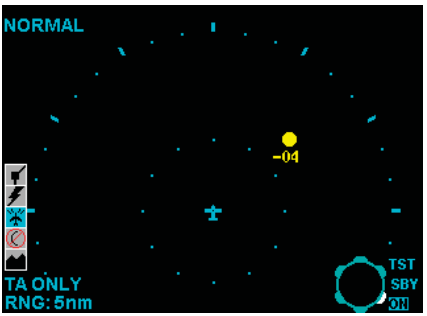
TA traffic on 5 mile range.



Same TA traffic; beyond selected range.

TAS INDICATIONS AND VOICE ANNOUNCEMENTS

"Traffic, Traffic"



Situation:

One Intruder is ahead near the 2:00 o'clock position, between 2 and 3 miles, 400 feet below your altitude and closing. TAS recognizes the threat and issues a TA.

TAS TRAFFIC ADVISORY ANNUNCIATION (TA):

Aural	Visual	Crew Response
"TRAFFIC, TRAFFIC"	A filled yellow circle on the Traffic Display	Conduct visual search for the Intruder. If successful, maintain visual acquisition to ensure safe operation.

IMPORTANT:

The pilot should NOT initiate evasive maneuvers using information on the Traffic Display only. Use the TA (Traffic Advisory) symbol to visually acquire the Intruder and be prepared to maneuver upon visual acquisition.

Audio Announcements:

Synthesized voice announcements are issued by TAS over the aircraft audio system. The following table lists all the audio messages, and advisories, in the TAS vocabulary.

Audio Messages

CONDITION	ADVISORY MESSAGE
Traffic Advisory	"TRAFFIC, TRAFFIC"
If Previous TA is Active	"TRAFFIC"
Self Test Passed	"TAS SYSTEM TEST OK"
Self Test Failed	"TAS SYSTEM TEST FAIL"

Intruders may be seen in surrounding airspace, but not on the TAS display. The situations in which this may happen are:

- Most small aircraft have one transponder antenna located on the bottom of the aircraft. When own aircraft is above one of these aircraft, the transponder antenna can be shaded from the TAS interrogations. When this occurs, the TAS interrogation may not reach the other aircraft's transponder, or the other aircraft transponder's reply may not reach TAS's antenna. A lack of replies prevents TAS from tracking intruders. Transponder shading also occurs when the other aircraft is maneuvering such that line of sight to its transponder antenna is blocked.
- The TAS directional antennas have a bearing "cone of confusion". TAS is able to determine bearings for intruders that are located within –10 degrees to +70 degrees elevation angle with respect to own aircraft's horizontal plane for the top directional antenna (+10 degrees to –70 degrees for a bottom directional antenna). Intruders that are located outside of those elevation angles will be tracked with no bearing.
- TAS is unable to determine bearings for intruder tracked on the bottom antenna when the own aircraft has a bottom monopole antenna or a bottom directional antenna but the landing gear is extended. In this case the intruder will be tracked, but not displayed, unless a Traffic Advisory is issued against it.
- The other aircraft may have a poor transponder. Ground stations have more gain and "hear" aircraft at farther distances than TAS.
- TAS is required to reduce transmitter power when in areas of high density so that it does not adversely affect (overwork) other aircraft transponders and prevent the ground ATC from tracking them. This is known as Interference Limiting (IL). IL can reduce the nominal TAS surveillance range to around 6 nmi. This means that TAS may not detect a poorly performing transponder until it is much closer.
- TAS has a one-second update rate. When in areas of high density, TAS may reduce its maximum surveillance range to either 10 nmi or to the range of the 30th intruder in track plus 1 nmi. This allows TAS to maintain its one-second update rate.
- TAS has an altitude surveillance volume of –10,000 feet to +10,000 feet relative to own aircraft's altitude. Any intruders outside this volume are not a threat to own aircraft and therefore are not tracked by TAS.

- The display may not be in the correct viewing mode to show the intruder. The relative altitude modes for the display (KMD 550/850) are:

  - Normal mode: -2700 feet to +2700 feet
  - Above mode : -2700 feet to +9000 feet
  - Below mode: -9000 feet to +2700 feet

  Other control head / display combinations may vary on the altitude bands.

- Some displays do not always allow the same range on the sides and aft as out the front. The selected range denotes the range out the front, and the sides and aft will be shown to a lesser range.

- TAS does not display other aircraft deemed to be on the ground. When own aircraft is below 1750 feet AGL, any aircraft within 400 feet of the ground is considered to be on the ground, and therefore not displayed (TAS must be connected to a radar altimeter for this feature).

SECTION II: CONTROLS AND DISPLAYS

TAS CONTROLS

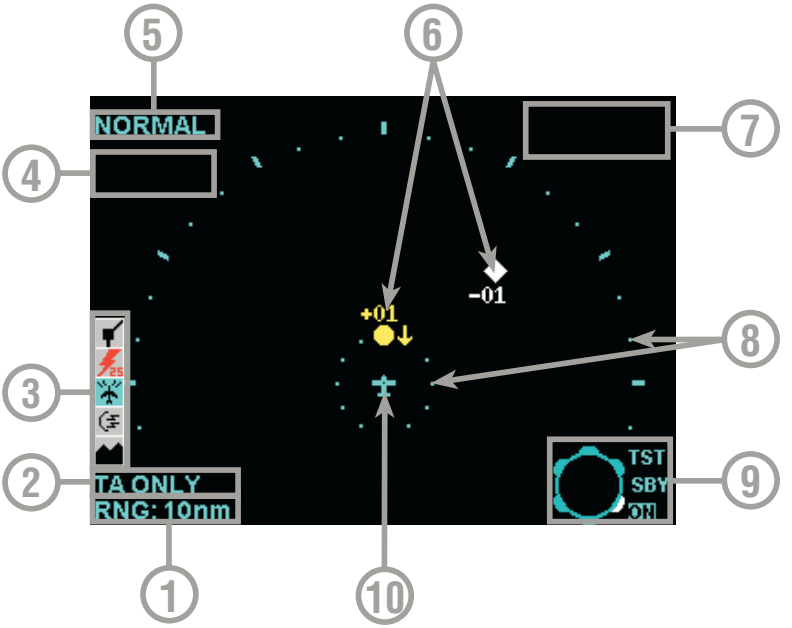
This section describes the control units for the TAS equipment. A couple of control units are described. The TAS functions can be controlled by various control panels or discrete switches. Not all the functions described are required in every installation.

TAS CONTROL & DISPLAY; KMD 550/850

KMD 550/850
TAS Control & Display

To display the traffic page press the TRFC function select key.

The following illustration defines the data that appears on the Traffic Display Page:



1 **Display Range** - **RNG:###nm**
2 **TAS Operating Mode** - **TAS TST**, **TAS SBY**, **TA Only**, or **TAS Fail**
3 **Icon Bar** - Displays icons representing data available (black) and displayed (color)
4 **Current Flight Level** - **FL:###**
5 **Altitude Volume** - **NORMAL**, **ABOVE** or **BELOW**
6 **Traffic Intruder Symbols** - Indicates type of traffic, altitude of traffic and vertical trend of traffic.
7 **"No Bearing" Intruder Dispay Area** - **AA X.XNM ±XX⇳**
8 **Range Rings** - Outer ring radius is selected range, inner ring radius is always two nautical miles
9 **Outer Knob Icon** - Shows current knob selection
10 **Aircraft Symbol** - Stylized airplane indicating aircraft position

KMD 550/850 TRAFFIC Page (TAS) OPERATIONAL CONTROLS

MODE - Toggles the altitude tag between relative or absolute altitude as shown in Figures 1 and 2. This key may be enabled or disabled in system configuration.

RNG▲/RNG▼ - Advances the indicator to the next range. The upper button increases range, the lower button decreases it. The selected range is displayed in the lower left corner of the display with the inner range ring always 2 nm.

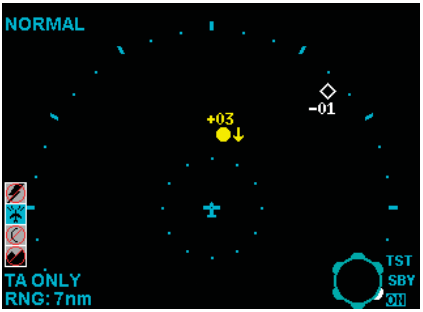


Figure 1

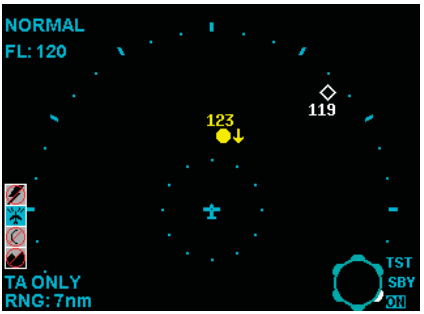
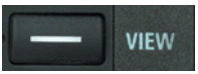


Figure 2

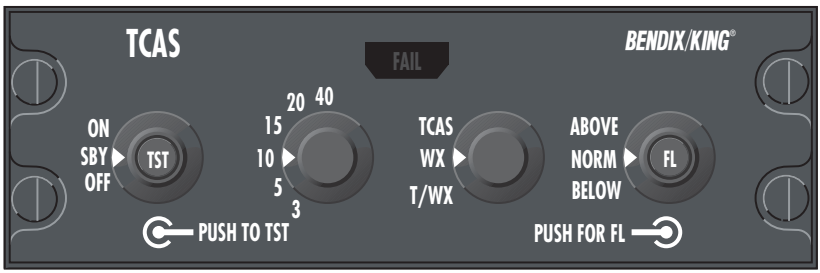


VIEW - Toggles between altitude volume views of NORMAL, ABOVE and BELOW. This key may be enabled or disabled in system configuration. NORMAL displays traffic that is between -2700 feet and +2700 feet relative to own aircraft. ABOVE displays traffic that is between -2700 feet and +9000 feet relative to own aircraft. BELOW displays traffic that is between -9000 feet and +2700 feet relative to own aircraft.

OVLY - Allows selection of flight plan for overlay on traffic data. The GPS flight plan data can be overlaid on the traffic display, if the desired data is available.

Outer Knob - Selects between Test (TST), Standby (SBY) and On mode of operation. This control may enabled or disabled in system configuration. If the KMD 550/850 is used with a TCAS II system, this control will not be available.

TAS CONTROL PANEL; CP 66B



CP 66B
TAS Control Panel

The CP 66B can have up to four separate knobs as shown above. Depending upon the system interface, the Range Knob and/or Display Selector may be removed.

The CP 66B amber Fail Annunciator will light during self test and in normal operation will flash if a system failure has been detected. If a failure has been detected, turning the Power Switch to **OFF** will turn off the flashing annunciator.

Power Switch:

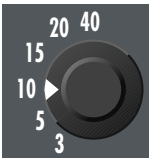
The **OFF** position deactivates selector switches and push buttons and extinguishes **FAIL** annunciation if on.

The **SBY** position places the TAS in Standby mode. In Standby mode, surveillance and tracking operations are disabled and the traffic display is blanked except for a "TAS STBY" ("TCAS STBY") mode annunciation.

The **ON** position enables the tracking and surveillance operations at the selected range, display and altitude limit.

Pressing the **TEST** button in the center of the knob initiates a comprehensive self test lasting approximately eight seconds. Refer to the Appendix for a description of the self test function.

Range Knob:



The TAS RANGE knob is used to select the range on the traffic display. The range selections are 3, 5, 10, 15, 20, and 40. All ranges are in nautical miles.

Note: *This feature may not be available in all installations or this feature may be superseded by a range control on the traffic display bezel.*

Display Select Switch:

The Display Select Switch is used in installations where the weather radar indicator is the traffic display. It selects between **T/Wx** (TAS w/Weather), **Wx** (Weather Only), and **TCAS** (Traffic Only) presentations on the radar screen. Details of the various modes are described later in this section under Weather Radar Indicators.

Altitude Limit Switch:

The Altitude Limit Select Switch selects altitude display limits. It has no effect on the TAS logic giving TAs. There are three selections available.

ABOVE - Traffic that is between 8700 feet above and 2700 feet below own aircraft will be displayed. Typically ABOVE is used during the climb phase of flight.

NORM - Traffic that is between 2700 feet above and 2700 feet below will be displayed. Typically NORM is used during the en route phase of flight.

BELOW - Traffic that is between 2700 feet above and 8700 feet below will be displayed. Typically BELOW is used during the descent phase of flight.

The **FL** (Flight Level) push button in the center of the Altitude Limit Select Switch replaces Intruder's relative altitude with absolute altitude for 15 seconds. During this period the altitude is displayed in flight level format. That is, 19,000 ft. is displayed as 190. After 15 seconds the absolute reading reverts to relative altitude.

The FL function is flagged below 18,000 feet MSL on most traffic displays unless barometric corrected altitude is available from an air data source. FL is not inhibited on the Radar indicator when used with GC 362A.

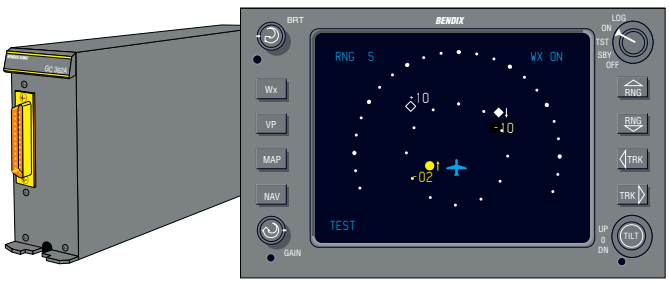
If FL is selected while inhibited, "FL - - -" will show in place of own flight level.

WEATHER RADAR INDICATORS

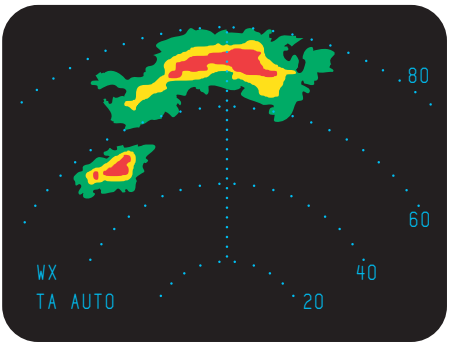
RDS 81, 82, 84 & 86, RDR 2000, RDR 2100 and Primus /Collins Color Indicators

The GC 362A TAS Graphic Processor allows TAS traffic to be displayed on a variety of Color Radar indicators. A T/Wx (TAS/Weather) select button is required to switch between Weather Only, Weather with TAS Traffic overlaid and TAS Only display modes. The T/Wx switch may be a separate momentary push button or included on another control panel.

Compatible Weather Radar Indicators	
Brand	**Mode**
Bendix/King	RDS-81,82,84,86 & RDR 2000/2100
Collins	WXR System with IND-270
Honeywell	200/300SL/400/870/P90/650/800

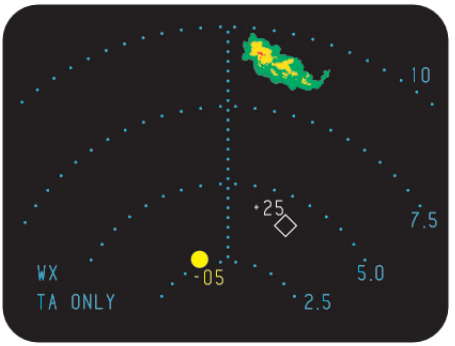


WEATHER ONLY MODE



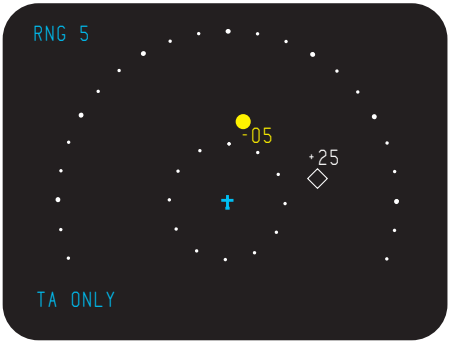
In this mode of operation, only weather radar information is displayed until a Traffic Advisory is issued by the TAS Processor. The range is controlled by the weather radar range control in this mode of operation. When a Traffic Advisory occurs, the display will revert to the default TAS display (either TAS Only or Weather/TAS Overlay) selected during installation by the pop-up default discrete. When TAS determines the Traffic Advisory is over, the display will revert to the weather radar picture. The TAS mode is annunciated by TA AUTO in the lower left hand corner of the screen.

WEATHER WITH TAS TRAFFIC MODE



A full time TAS display overlays the weather display in this mode. The display origin may be either at the bottom of the screen or the center of the screen, depending on the specific installation. Weather will be displayed in the upper 90° or 120° sector, depending on which radar is being used. Weather is blanked in the areas where TAS traffic is displayed. The range displayed in this mode is that which was selected for weather radar. If weather radar is in the standby mode or other non-radar mode, the display will be the same as that in the TAS Only mode. This mode is maintained unless another mode is manually selected. The TAS operational mode is annunciated along with the pilot selected weather radar mode in the lower left hand corner of the screen unless the radar is in standby, in which case the TAS mode is displayed in the upper right hand corner.

TAS ONLY MODE



In this mode the screen's origin point is 1/3 up from the bottom of the screen. Only TAS information is displayed. This mode is maintained unless another mode is manually selected. The range displayed is that selected on the TAS control panel. A 2 nm range ring is displayed on ranges 3, 5, 10, and 15 nm. The 2 nm range ring consists of discrete dots (cyan) at each of the 12 clock positions. The 2 nm range ring is not displayed on ranges 20 and 40 nm; instead, a half-range ring is displayed. The half-range ring consists of discrete dashes (cyan). The TAS operational mode is annunciated in the lower left hand corner of the screen.

Note: *On the "TAS ONLY" display "WX ON" will be annunciated in the upper right hand corner if the weather radar is transmitting. See Weather Radar operating guide.*

At power-up the screen initially displays the Radar with TAS Overlay mode. When the Test mode is selected on the TAS control panel the self test pattern is displayed unless TAS system failures are detected. If system failures are detected the screen is blanked and a list of faults is displayed.

WX & TAS MESSAGE FORMATS

TAS Mode Annunciations:

TEXT	Color	Description
TCAS STBY	(Blue)	TAS in Standby
TEST	(Blue)	TAS in TEST
TA ONLY	(Blue)	TA ONLY Mode
TA AUTO	(Blue)	TA ONLY Pop-Up

Note: *When the Radar is placed in Standby, the TAS mode annunciation is moved to the upper right hand corner and the display is in the WX only or TAS/WX modes.*

TAS Fault Annunciations:

Weather Only and Weather with TAS Mode.

In the event of a failure, all TAS information will be removed from the display. One of the following failure messages will be annunciated in the upper left corner of the screen.

TEXT	**Color**	**Description**
TCAS	(Yellow)	TAS System Failure.
GP FAIL	(Yellow)	GC362A Failure.

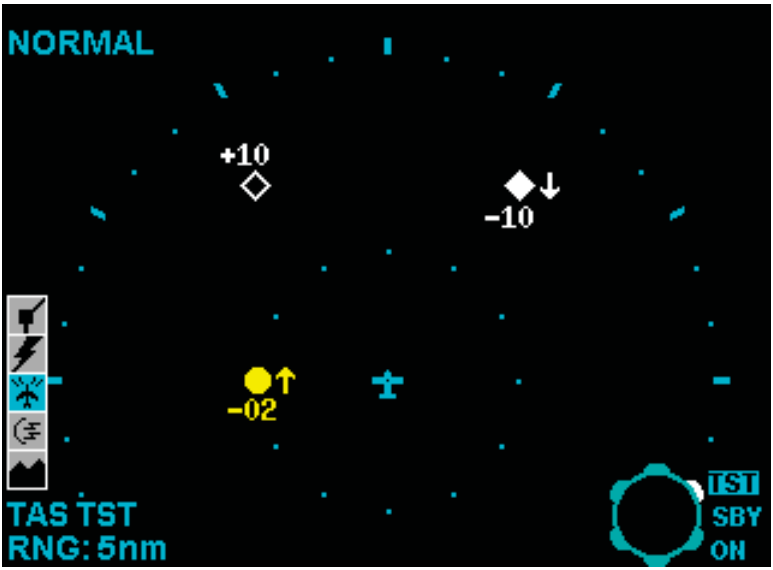
Additional failure information will be available in the TAS ONLY mode, if the failure will permit mode change.

TAS ONLY Mode

In the event of a failure, all TAS information will be removed from the display. If the failure will disallow mode change, the mode shall revert to the Weather Only mode and the fault shall be displayed as above. Otherwise, one or more of the following failure message will be annunciated in yellow text.

TCAS SYSTEM FAIL	TCAS PROCESSOR
UPPER ANTENNA	LOWER ANTENNA
RADIO ALT #1	RADIO ALT #2
ATTITUDE	HEADING
TRAFFIC DISPLAY #1	TRAFFIC DISPLAY #2
ALT DATA #1 & #2	GP RAM
NO RADAR 429 DATA	NO TCAS 429 DATA

SECTION III: OPERATIONAL PROCEDURES



TAS Traffic Display Test Page

SECTION III DESCRIBES OPERATION OF THE TRAFFIC ADVISORY SYSTEM

TAS OPERATING PROCEDURES

TAS warns the operator with an aural and visual Traffic Advisory whenever TAS detects another transponder equipped aircraft and predicts the Intruder to be a threat. The pilot should NOT initiate evasive maneuvers using information from the traffic display only or on a traffic advisory (TA) only, without visually sighting the traffic. These displays and advisories are intended only for assistance in visually locating the traffic and lack the resolution and coordination ability necessary for use in evasive maneuvering. The flight crew should attempt to visually acquire the intruder aircraft and maintain/attain a safe separation in accordance with the regulatory requirements and good operating practice. If the flight crew can not acquire the aircraft, air traffic control should be contacted to obtain any information that may assist concerning the intruder aircraft. Based on the above procedures minor adjustment to the vertical flight path consistent with air traffic requirements are not considered evasive maneuvers.

BEFORE TAKEOFF

TAS should be tested using the pilot initiated self test feature during cockpit preparation. After passing self test, TAS should remain in SBY before takeoff.

TAS Traffic on the Radar Display:

If the weather radar indicator is used as the TAS Traffic Display, select Radar to "STBY", "TST" or "ON". Note that the weather radar RT is radiating when in the radar is On. See the weather radar operator's guide for proper radar operation. Select the "T/WX" (TAS/Weather) Display Mode switch to display TAS, i. e., "TA AUTO" or "TA ONLY".

Before taking the active runway, TAS should be turned ON. Range, if available, may be selected to 10 nm or lower. Above/Norm/Below, if available, may be selected to ABOVE.

FLIGHT PROCEDURES

The TAS TA (traffic advisory) should alert the flight crew to use extra vigilance to identify the Intruding aircraft. Any time the traffic symbol becomes a yellow circle or "TRAFFIC, TRAFFIC" is announced in the cockpit, conduct a visual search for the Intruder. If successful, maintain visual acquisition to ensure safe separation.

Use of the TAS self-test function in-flight will inhibit TAS operation for up to eight seconds.

During initial departure, select the 10 nm TAS range or lower because the traffic density is the greatest near the airport.

During the climb phase of flight, select the 10 nm range or greater and continue to use the Above display volume mode, if available. If a TA occurs, select the 10 nm range or lower on the TAS traffic display.

During cruise, the longer TAS ranges may be used. The Above/Norm/Below selection should be NORM. A 10 NM (or greater) range may be selected for high altitude cruise.

During Descent and Approach, Below may be selected using the Above/Norm/Below switch. A TAS range of 10 nm or lower may be used.

1. If a stall warning occurs during a TA, immediately execute the stall recovery procedure. TAS will continue to provide TA alerts during a stall warning.

2. If a TA occurs while in the landing configuration, conduct a visual search for the Intruder. A TA does not mandate a missed approach.

3. If a TA is encountered during a high speed buffet, adjust pitch force as necessary to reduce buffet.

4. While it is extremely rare, EGPWS or Wind Shear may issue an alert while a TA (traffic advisory) is in progress. If this occurs, TAS will automatically inhibit the TAS audio alerts, but visual display of TAs will continue.

AFTER LANDING

After departing the active runway, TAS should be turned to Standby (SBY) or Off.

Post Flight

If a failure of the TAS system has occurred, give Maintenance as much specific information about the problem as possible. Avoid phrases such as "TAS Inop." Provide information in terms of fault lights lit, audio announcements, test pattern discrepancies and screen annunciations that indicate which unit was observed to have failed.

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SECTION IV: SYSTEM CONSIDERATIONS

Traffic Display

SECTION IV EXPLAINS CONSIDERATIONS OF THE TAS SYSTEM; WARNINGS AND LIMITATION, AND NOTES.

LIMITATIONS AND NOTES

LIMITATIONS

Refer to the Airplane Flight Manual.

NOTES

The capability of TAS is dependent upon the type of transponder in the Intruding aircraft:

The Intruding aircraft must be equipped with a properly operating transponder for normal TAS operation. TAS is unable to detect any aircraft without an operating transponder.

If the Intruder is Non-Altitude Reporting (NAR), TAS will display only the range and bearing. It can issue a TA (Traffic Advisory) based on distance and direction of flight. TAS assumes Non-Altitude Reporting (NAR) traffic is at the same altitude as your own aircraft.

Options for TAS also include the following:

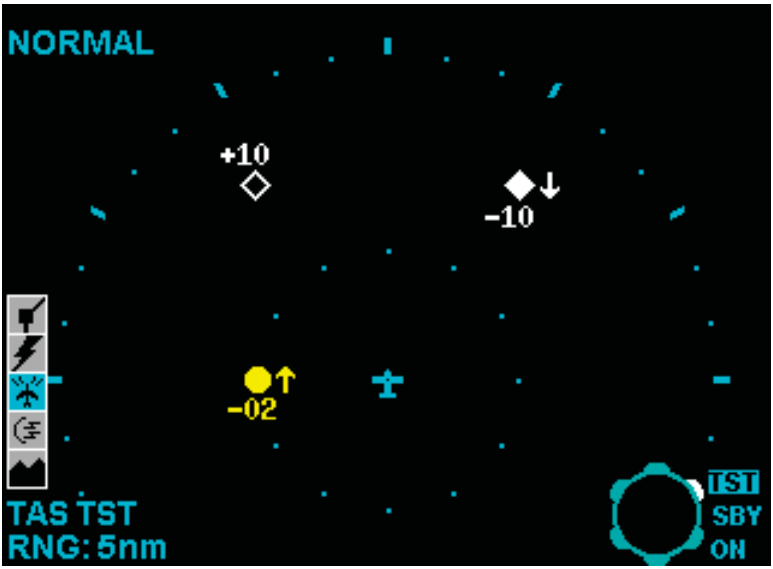
* The maximum number of targets displayed (3 - 30) can be selected via the configuration module.
* The TAS display may have pilot selectable range or may be a fixed range controlled by the aircraft wiring.
* The TAS system can be automatically placed in standby when the aircraft is on the ground.
* The manually initiated system self test can be inhibited in flight.
* TAS can be wired to give EGPWS and Wind Shear a higher aural warning priority.

If a radio altimeter is installed, the TAS aural warning (TRAFFIC, TRAFFIC) is inhibited below 400 feet AGL during descent and below 600 feet during ascent. If no radio altimeter is installed, then the aural warning is inhibited whenever the Landing Gear is EXTENDED.

It is possible to see an aircraft flying the same course and direction as your own aircraft, yet TAS may not consider it a threat. TAS calculates the closure rate of the Intruder, and derives the time to the Closest Point of Approach (CPA). If there is no closure rate, no advisory will be issued, unless the Intruder is very close (within approximately 0.2 mile). Conversely, traffic at the same altitude very far ahead (about 10 miles) may be shown as a TA by TAS because of a very rapid closure rate.

On a bottom monopole antenna installation, the TAS bearing and display of a Non-Altitude (NAR) aircraft may appear erratic when the intruding aircraft is close in range but distant vertically. This may make the NAR traffic symbol momentarily disappear or move around the TAS display. The range distance for the NAR will be accurate but the intruder may be well above or well below your aircraft. Use NORMAL visual scan techniques to scan for this and other intruding aircraft.

APPENDIX: TAS SELF TEST



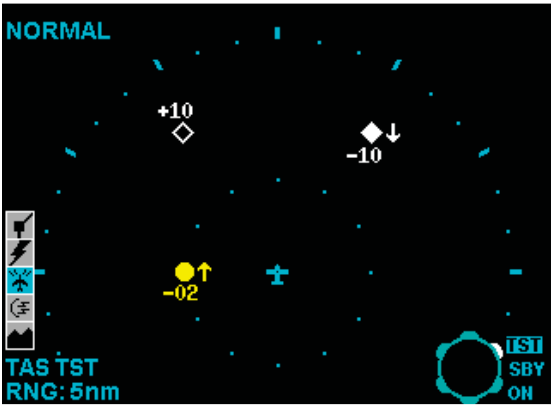
THE APPENDIX INCLUDES
A DESCRIPTION OF TAS SELF TEST.

TAS SELF TEST

The TAS self test determines the operational status of the entire TAS system. Select self test on the KMD 550/850. Once begun, self test continues automatically for approximately eight seconds. During self test, normal TAS operation is inhibited. For optimum display during self test, selection of the 5 nm range is recommended.

During the first few seconds of the test sequence, the traffic display allows verification of each type of Intruder symbol. The test generates the symbols arranged as shown. The traffic display annunciates the phrase "TAS TST".

Use of the TAS self test function in flight will inhibit normal TAS operation for up to 8 seconds. For this reason, the pilot should use caution when initiating the test in flight.



KMD 550/850 TAS Test Pattern; 5NM range

A Traffic Advisory (yellow circle) will appear at 9 o'clock, range of 2 miles, 200 feet below and climbing.

Proximity traffic (solid white diamond) will appear at 1 o'clock, range 3.6 miles, 1000 feet below, descending.

Non-Threat traffic (open white diamond) will appear at 11 o'clock, range of 3.6 miles, flying level 1000 feet above.

At the conclusion of a successful Self Test, a synthesized voice announces:

"TAS SYSTEM TEST OK"

FAILURE CONDITIONS:

Should a failure be detected during self test, the audio message says:

"TAS SYSTEM TEST FAIL"

A "TAS" flag will be annunciated on the traffic display. A self test failure may indicate that the auxiliary equipment required for TAS is not operational. Check the associated equipment.

Should a display failure be detected at any time, the Display Fail flag will appear on the KMD 550/850. A "Display Fail" flag is not caused by the TAS processor.

RADIO ALTIMETER

If RALT is installed and is inoperative, TAS will be Inoperative.

GLOSSARY OF TAS TERMS

ABBREVIATIONS AND DEFINITIONS

AFM or AFMS Airplane Flight Manual or Airplane Flight Manual Supplement.

AGL Above Ground Level. Height above the ground.

ATC Air Traffic Control. A federally operated ground based system that manages aircraft traffic flow.

ATCRBS ATC Radar Beacon System. A ground based secondary radar and airborne transponder system used to monitor traffic.

Absolute Altitude The altitude shown on a traffic display is described as Absolute whenever the FL mode has been selected. Otherwise, TAS displays the Relative Altitude between your own aircraft's pressure altitude and the encoded altitude of the Intruder aircraft.

Altitude Tag Data tag shown above or below threat symbol giving the relative altitude of the Intruder.

BITE Built-In Test Equipment. A feature of TAS that continuously monitors itself for operational errors.

CPA Closest Point of Approach. CPA refers to predicted point at which the Intruder will be closest to your own aircraft.

EGPWS Enhanced Ground Proximity Warning System.

FL Flight Level. This is a TAS mode that allows the annunciation of Absolute Altitude on the traffic display. The traffic display will indicate the altitude in hundreds of feet, I. E., 190 is 19,000 feet.

GA General Aviation.

Indicated Altitude Altitude shown on the altimeter with barometric correction setting set to local sea level pressure. Indicated altitude is used by the crew below 18,000 feet but not used for TAS processing.

Intruder Any aircraft that is in the surveillance range of TAS.

LRU Line Replaceable Unit. A self-contained avionics component that can be replaced in the field.

Mode A Transponder ATCRBS transponder that replies to ATC interrogations sending identification code but without giving altitude data.

Mode C Transponder ATCRBS transponder that replies to ATC interrogations giving identification code or encoded altitude data.

Mode S Transponder Transponder that replies to ATC interrogations giving an ATCRBS identification code, encoded altitude and other data fields including discrete aircraft address and airspeed capability.

NAR Non-Altitude Reporting traffic.

Non-Threat Intruder An aircraft that has entered the TAS surveillance volume at a distance greater than 5 miles or altitude greater than 1200 feet above or below your own aircraft.

Pressure Altitude Indicated altitude when barometric pressure is set to 29.92" Hg. (1013mb). Pressure altitude is used by TAS to determine the relative altitude of traffic.

Proximity Intruder An aircraft that is within 5 miles range and within 1200 feet above or below your own aircraft but does not meet the TAS definition of a threat.

Rad Alt or RALT Radio Altitude is the height above the ground as determined by a radio altimeter. RALT is used by TAS to inhibit TAs close to the surface. Radio altitude above terrain is absolute. As such, RALT height is sometimes referred to as absolute altitude in some systems. RALT systems typically function below 2,500 ft AGL.

Relative Altitude The difference in altitude between two aircraft. TAS calculates relative altitude as the difference between your own aircraft's pressure altitude and the encoded pressure altitude of the Intruder.

Self Test A functional test that determines equipment status. Self test differs from BITE performance monitoring because it is initiated by the crew and is not performed continually or automatically.

Sensitivity Level TAS has two sensitivity levels (SL). SL A shall be automatically invoked using the following order of precedence: (1) when the TAS aircraft is below 2,000 feet AGL (if equipped with radio altimeter) OR (2) when the landing gear is Extended (no radio altimeter installed). SL B occurs under all other flight conditions. If aircraft is not equipped with either a radio altimeter or retractable landing gear, TAS shall stay in SL B at all times.

Surveillance Volume The volume of airspace surrounding your aircraft that TAS scans for Intruding traffic. The TAS system scans approximately 20 NM around and 10000 feet above and below the aircraft. The volume will automatically begin to decrease when flying into a high density area.

TA Traffic Advisory. An audio and visual indication that another aircraft is a potential threat.

Threat An aircraft that has satisfied TAS threat detection logic and thus requiring a Traffic Advisory.

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INTRODUCTION

The Bendix/King General Aviation Enhanced Ground Proximity Warning System (GA-EGPWS) brings state-of-the-art technology in Terrain Display, Situational Awareness, Terrain Alerting and Warning, and Obstacle Alerting and Warning to the General Aviation pilot. The GA-EGPWS is an affordable, extremely lightweight, compact and rugged computer that is easily installed in single- and multi-engine piston aircraft as well as small turbo-props and other aircraft. The terrain function can be provided entirely by the KMH 880, or can be provided by a combination of a KTA 870 in combination with a KGP 560.

Based on 30 years experience in the development and advancement of Ground Proximity Warning Systems for Air Transport, Regional and Commuter Airlines, Military aircraft and Corporate aviation, Honeywell brings this vital safety technology to all segments of General Aviation. Using our proprietary world-wide terrain database, obstacle database, runway database, state-of-the-art GPS technology, and proven Terrain Display with Alerting and Warning functions, the system provides the General Aviation pilot with superior situational awareness with respect to terrain and known obstacles. In addition, the system contains the most advanced alerting and warning functionality to warn the pilot of danger with respect to terrain, man-made obstacles and other primary scenarios associated with the dangers of Controlled Flight Into Terrain (CFIT).

Use of a terrain display is optional, but recommended in order to enhance full situational awareness. If a terrain display is not installed in the system, all alerts and warnings are still present.

This Pilot's Guide outlines the basic requirements for system operation and recommended procedures for use of the GA-EGPWS by the General Aviation pilot. This Guide does NOT supersede FAA Approved Data or FAA Flight Manual Supplements, or FAA Required Procedures. Each pilot should be thoroughly familiar with his or her aircraft, its systems, and FAA and/or company requirements for that aircraft as equipped with the General Aviation Enhanced Ground Proximity Warning System.

WHAT IS THE GA-ENHANCED GROUND PROXIMITY WARNING SYSTEM?

The Bendix/King GA-EGPWS is a small lightweight computer that can be installed in most single- and multi-engine piston aircraft, small turboprop aircraft and other aircraft in which a Terrain Avoidance & Warning System is applicable.

The system uses information from an existing GPS (already in the aircraft) or internal GPS receiver contained in the GA-EGPWS computer. The only other required input is uncorrected barometric pressure from the aircraft's transponder or altitude reporting/encoding device. An additional input of Outside Air Temperature (OAT) is optional and recommended. See section on Aircraft Altitude.

The system can also accept inputs from various digital air data computers, when such equipment is available on an aircraft. The terrain database, obstacle database, runway database and alerting / warning functionality are contained in the GA-EGPWS computer, and require no pilot action for system operation.

Outputs generated by the system are:

* Terrain / Obstacle Display

* Voice alerts / Warnings / Callouts

* Visual alerts / Warnings

During normal flight operations, the system remains essentially silent, using GPS, altitude and temperature (optional) data in combination with its various database information to provide the pilot with a display of the aircraft position relative to surrounding terrain and known obstacles, thereby providing unprecedented situational awareness for the pilot. Pilot workload in interacting with the system during normal flight is minimal.

Should the aircraft fly into danger where a conflict with terrain or a known obstacle is imminent, the system will provide both visual and aural alerts and warnings to the pilot. The system also provides alerts and warnings for excessive rates of descent and inadvertent descents or altitude loss after take-off.

The system provides an aural altitude callout when 500 feet above runway elevation during a landing approach, and also monitors altimeter systems in the aircraft to provide alerts for possible altimeter malfunctions or errors.

Pilot reactions to alerts and warnings differ according to weather conditions, visibility, type of warning, phase of flight and aircraft performance considerations. Pilots should be thoroughly familiar with FAA, company, or other approved operational procedures as required by their aircraft and type of operation. Pilots should train to react properly to GA-EGPWS alerts and warnings just as one would train to react to an aircraft stall, engine failure or any other emergency situation.

REGULATORY STANDARDS

The GA-EGPWS satisfies the requirements for Terrain Avoidance & Warning Systems (TAWS) as defined by FAA TSO C151b, Class B and C, when installed in aircraft in accordance with approved procedures. (See System Installation Manual).

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GA-EGPWS FUNCTIONS AND FEATURES

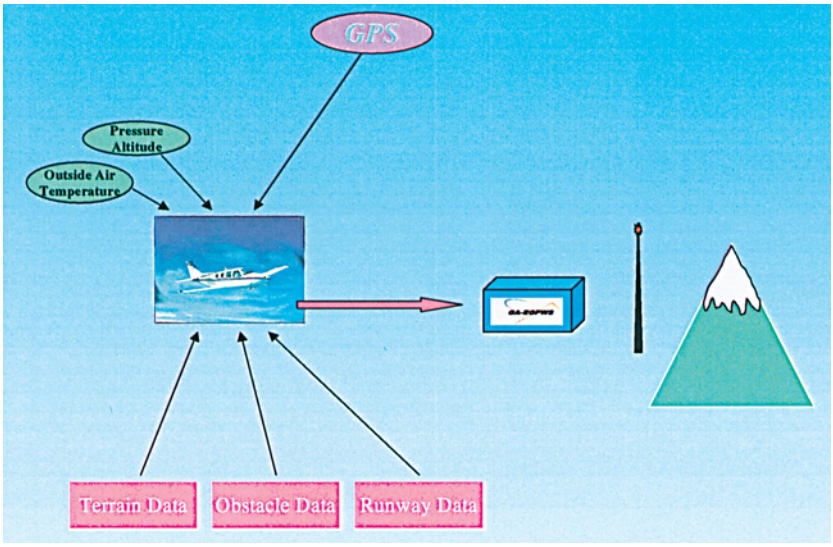
AIRCRAFT POSITION

The GA-EGPWS uses Global Positioning System (GPS) information from either an aircraft-installed GPS receiver, or an internal GPS receiver contained in the GA-EGPWS computer itself. It is good for the pilot to be aware of the actual position source being used by the system, as the internal GPS is not used for navigation of the aircraft.

GPS signals arrive at an antenna on the aircraft and are then processed by the GA-EGPWS computer to provide both horizontal (lateral) and vertical position (altitude) information. This position in space is then compared to the terrain, obstacle and runway database information contained in the GA-EGPWS computer to produce a "virtual" picture which can then be displayed to provide Situational Awareness for the pilot.

Other GPS information such as true track, groundspeed, vertical velocity, N/S and E/W velocity, and signal accuracy measurements are also processed by the GA-EGPWS computer to provide a complete picture of not only the aircraft position in three dimensions, but also an excellent picture of the aircraft's flight path.

This total package of information is then used to provide the Terrain Display for the pilot, and to provide alerting and warning functionality to protect the pilot and passengers from possible conflicts with terrain, known obstacles, and other scenarios associated with the dangers of Controlled Flight Into Terrain (CFIT).



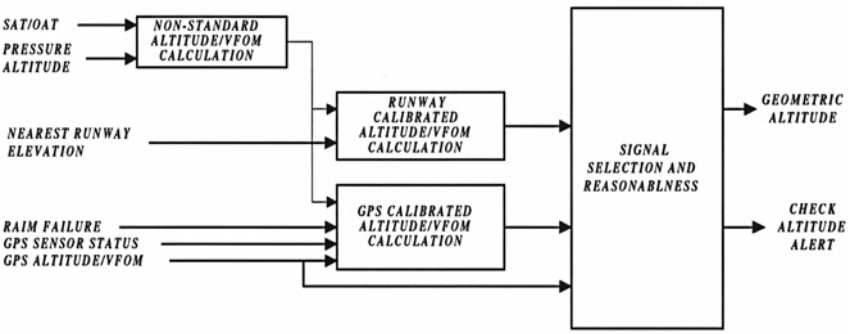
AIRCRAFT ALTITUDE

In addition to the altitude information provided by the GPS, the GA-EGPWS uses uncorrected barometric pressure altitude information from the aircraft's encoding altimeter, blind altitude encoder or transponder. This altitude information allows the system to do two main tasks.

First, by using a special "derived-altitude" developed by Honeywell called "Geometric Altitude", the GPS and uncorrected pressure altitude information is blended together by the system to provide accurate altitude information, which is using the same Mean Sea Level (MSL) reference as the terrain, obstacle and runway databases in the system. The blending functionality of "Geometric Altitude" means it is much less susceptible to errors or malfunctions in the use of normal altimeter systems. (The pilot is NOT required to enter an altimeter setting specifically for the GA-EGPWS system).

Where aircraft are routinely operated in extreme weather conditions (either hot or cold), Honeywell strongly recommends the optional temperature input be used with the GA-EGPWS. This additional factor in the blending formula of "Geometric Altitude" provides an even more accurate vertical position to the system, and prevents serious discrepancies between actual altitude and "Geometric Altitude" under extreme temperature conditions, especially during rapid climbing or descending flight profiles.

The second benefit of using "Geometric Altitude" in the system is that the pilot will now have an independent monitor of altitude. The system can detect an abnormal difference between "Geometric Altitude" and the uncorrected pressure altitude. Optionally, the system can provide a voice callout and display a message to the pilot should such an abnormal difference occur.



Geometric Altitude

On some terrain displays, an indication of MSL or GSL altitude will appear. This altitude is the reference altitude for the display and the terrain awareness algorithm. This reference altitude is based on internally calculated Geometric Altitude and NOT corrected barometric altitude that must be used when navigating within the National Airspace System. Geometric Altitude is the height above mean sea level (MSL) derived from the GPS receiver, filtered by the vertical figure of merits from the same GPS and complemented by short term variations in barometric altitude. It represents the aircraft's calculated true height above MSL and serves as the reference altitude for color-coding of the terrain display and the altitude input to the look-ahead algorithm. On some displays the Geometric Altitude number may be labeled 'MSL', 'GSL' (Geodetic Sea Level) or have no label. Exact location and display definition of this altitude is detailed in the Operating Guide and/or Flight Manual Supplements of the display system.

Because Geometric Altitude is primarily comprised of GPS altitude, this reference altitude will often differ from cockpit displayed corrected barometric altitude. **The geometric altitude is not to be used for navigation.** It is presented to provide the crew with additional situational awareness of true height above sea level upon which terrain alerting and display is based. GPS altitude is an altitude above mean-sea-level and it is the geodetic height above the WGS-84 ellipsoid corrected by the geoid height in the GPS receiver itself. With Selective Availability turned off as currently, the accuracy is usually better than 75 feet and with Selective Availability turned on, short term accuracy is in the order of 400 feet, but the geometric altitude should be within 100 feet.

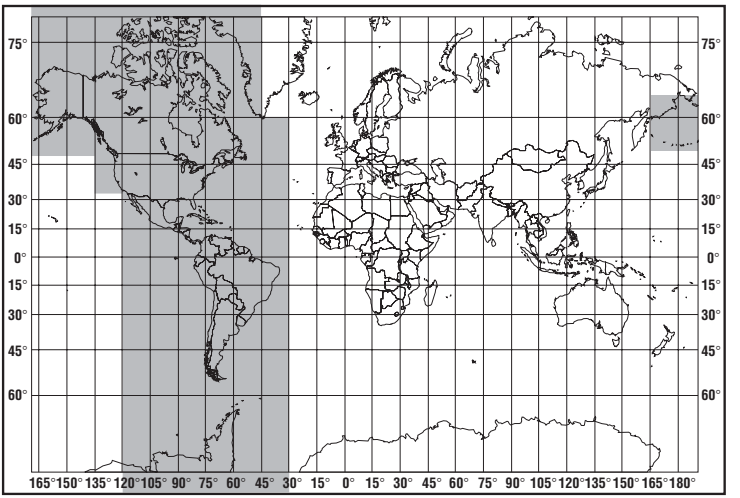
TERRAIN, OBSTACLES & RUNWAY DATABASE

The GA-EGPWS contains a removable database card, which is inserted into the unit through a slot in the top surface of the computer. This card contains all the terrain data, known obstacles data (where available), and runway data used by the system. This card must be installed in the computer for proper operation. Instructions for update procedures and installation of the database card are discussed later in this guide.

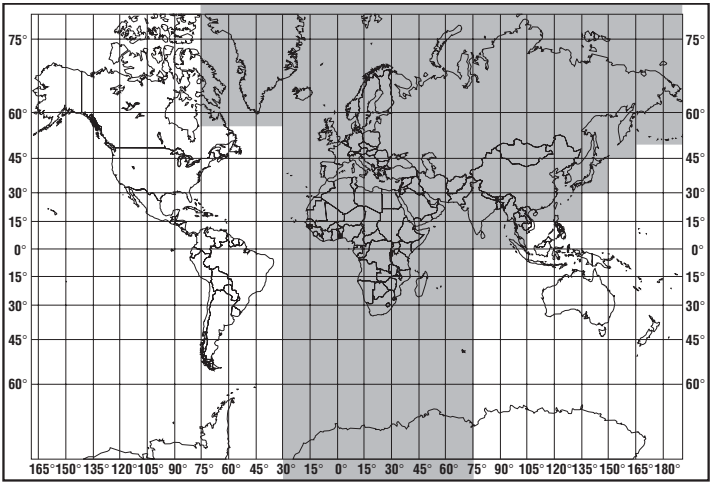
Terrain data is supplied from the same proprietary database used by other Honeywell EGPWS products, and is divided into three regions worldwide. (See pictures following). The terrain data is divided into grid patterns of various sizes, from areas about 1/4 nm square resolution to areas of about 5 nm square. This allows a large area of data to be stored in the unit, and allows high-resolution data near airports, with lower resolution data where terrain is not a factor and airports are sparse.

Data for known obstacles such as towers, buildings, antennas, etc. is contained on the same data card as the terrain and airport data. Presently, there are some 70,000-plus obstacles in the database, but they are all in the area of North America. As more reliable information becomes available, Honeywell will expand the capability to provide alerting and warning for obstacles in other areas of the world.

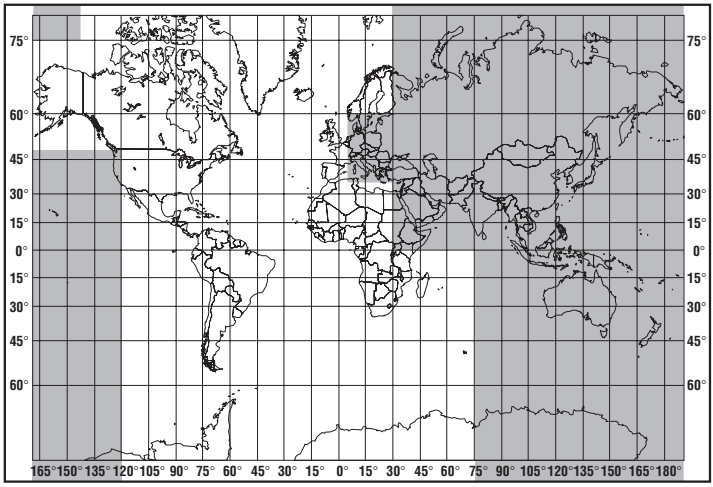
Obstacles in the database are those known obstacles more than 100 feet AGL, so obstacles of lower height will not produce GA-EGPWS "Obstacle" alerts or warnings. However, terrain elevations are "rounded" up to the next 100 feet, so alerting and warning protection is generally available for known obstacles that are less than 100 feet AGL.



Regional Database: Americas (shaded areas)



Regional Database: Atlantic (shaded areas)



Regional Database: Pacific (shaded areas)

Runway database information in the GA-EGPWS computer contains all known public runways that are 2000 feet in length or longer. This runway data is used to adjust the alerting and warning functions of the system so as to provide a dynamic system that is essentially free of nuisance or unwanted warnings. A list of runways in the database can be accessed at the Internet website: http:\\ www.egpws.com. A list of the most recent database versions available for the GA-EGPWS can also be found there.

TERRAIN INHIBIT SWITCH

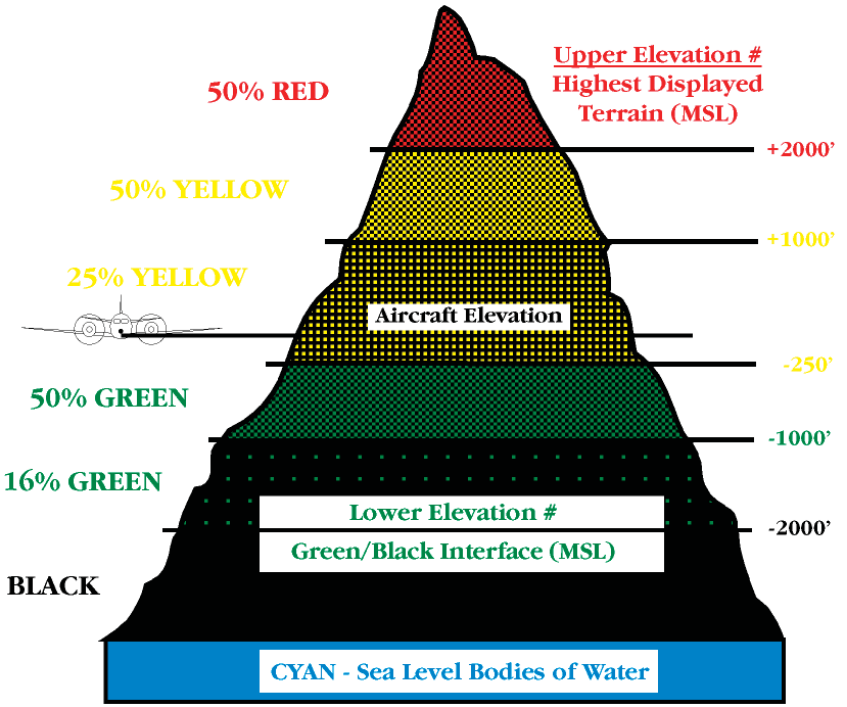
The GA-EGPWS requires the installation of a "Terrain Inhibit" switch as part of the system installation. When engaged by the pilot, this switch will inhibit all visual and aural alerts and warnings associated with the GA-EGPWS. Also, an external annunciator lamp is illuminated and a message will be displayed indicating "Warnings Inhibited". The terrain display, if installed, remains operational.

The purpose of the "Terrain Inhibit" switch is to allow aircraft to operate without nuisance or unwanted warnings at airports that are not in the system database. Examples might be private airports or those with runways shorter than 2000 feet. Additionally, there may be some "VFR-only" airports where unique terrain features are in close proximity to the runway, and the "Terrain Inhibit" may be used when operating in good VFR conditions. The "Terrain Inhibit" switch should be NOT engaged for normal operations.

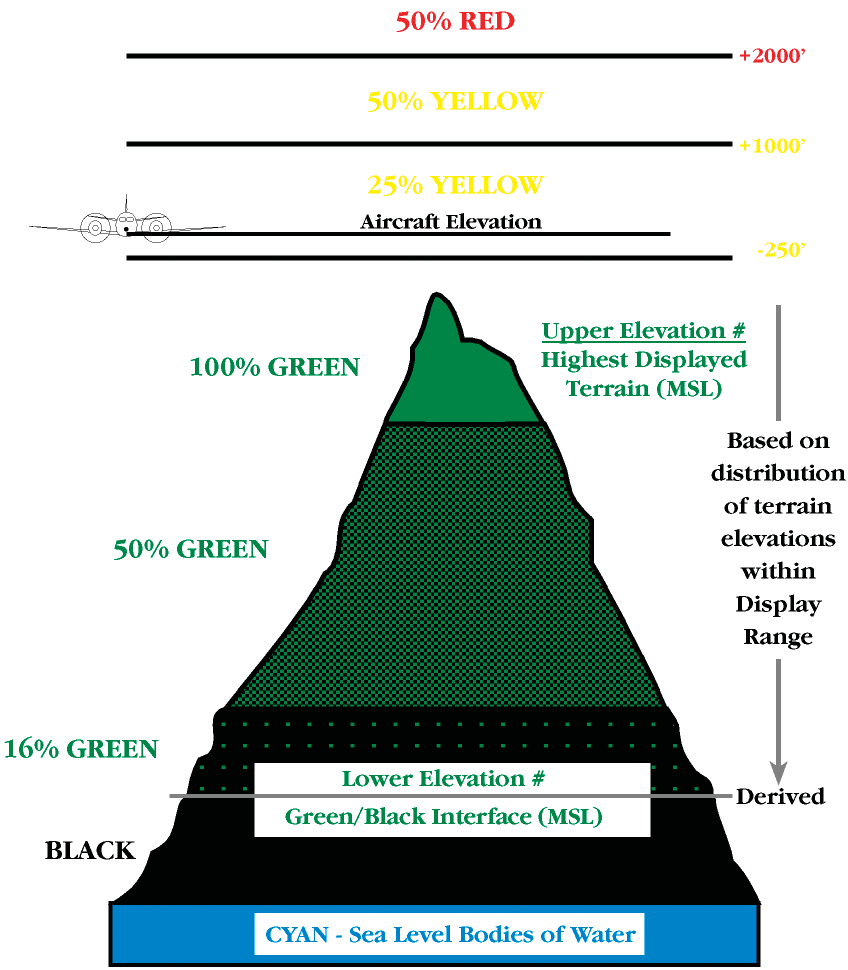
TERRAIN AWARENESS DISPLAY

The GA-EGPWS can be interfaced to numerous types of cockpit displays. Graphical display of GA-EGPWS terrain and obstacle data is the most important enhancement to Situational Awareness. This is especially true for lower performance aircraft. In addition to showing terrain ahead of the aircraft, (depending on configuration settings and display types) the system shows Geometric altitude (MSL/GSL), Magnetic Heading or Track. The color and intensity of the terrain displayed instantly alerts the pilot to areas of dangerous terrain and conversely to areas of less precipitous terrain. Range of the Terrain Display is selectable by the pilot from 1 nm to 320 nm, again depending upon the display type installed in the aircraft.

The following figure shows the Terrain Display color patterns when the aircraft is at lower altitudes, with terrain near or above the aircraft altitude for the display range selected by the pilot.



The following figure shows the Terrain Display color patterns when the aircraft is at higher altitudes, where terrain is a least 250 feet below the aircraft altitude for the display range selected by the pilot.



The system will adjust colors on the Terrain Display automatically as the aircraft altitude changes. The Terrain Display also transitions between the lower altitude "relative" display and the higher altitude "peaks" display automatically, so no pilot action is required for system operation.

Depending upon display type aircraft interface capabilities, the Terrain Display can show various presentations of the terrain around and in front of the aircraft, i.e. a "rose" or 360° compass view, a 1/3 - 2/3 360° view, 90° or 120° "arc" views with or without a vertical profile.

Installations without a heading input into the GA-EGPWS will either have a NORTH oriented or BLANK display when on the ground. Depending upon configuration the display will automatically transition to a TRACK UP (MAG XXX TRK) orientation upon reaching a configurable airspeed (typically 10 to 45 kts GPS ground speed). Once the display has transitioned to the TRACK UP display, the depiction of terrain is oriented to the current GPS track of the aircraft. The display will continue in this TRACK UP mode until transition below a configurable GPS speed when it will automatically transition back to either the NORTH UP or BLANK display. The BLANK display annunciates that the display is currently unavailable (DISPLAY UNAVAIL).

Installations with a heading input into the GA-EGPWS will present a terrain depiction oriented to the current heading of the aircraft (HEADING UP). These installations will not transition between different orientations of the display and will typically present the current heading as `MAG XXX HDG'.

The most important function of the system is to provide the pilot with easily interpreted information about terrain/obstacles relative to the aircraft, and thus increase the pilot's Situational Awareness. In brief, when using the Terrain Display during flight, the normal presentation of green, yellow and red colors indicate:

GREEN colors	Terrain/Obstacles are below the aircraft altitude. Safe terrain/obstacle clearance is indicated.
YELLOW colors	Terrain is very near or above the aircraft altitude. THE AIRCRAFT DOES NOT HAVE SAFE TERRAIN CLEARANCE.
RED color	Terrain is well above the aircraft altitude (*at least 2000 feet higher!*) THE AIRCRAFT DOES NOT HAVE SAFE TERRAIN CLEARANCE. THE AIRCRAFT MAY NOT BE ABLE TO ESCAPE THIS TERRAIN.

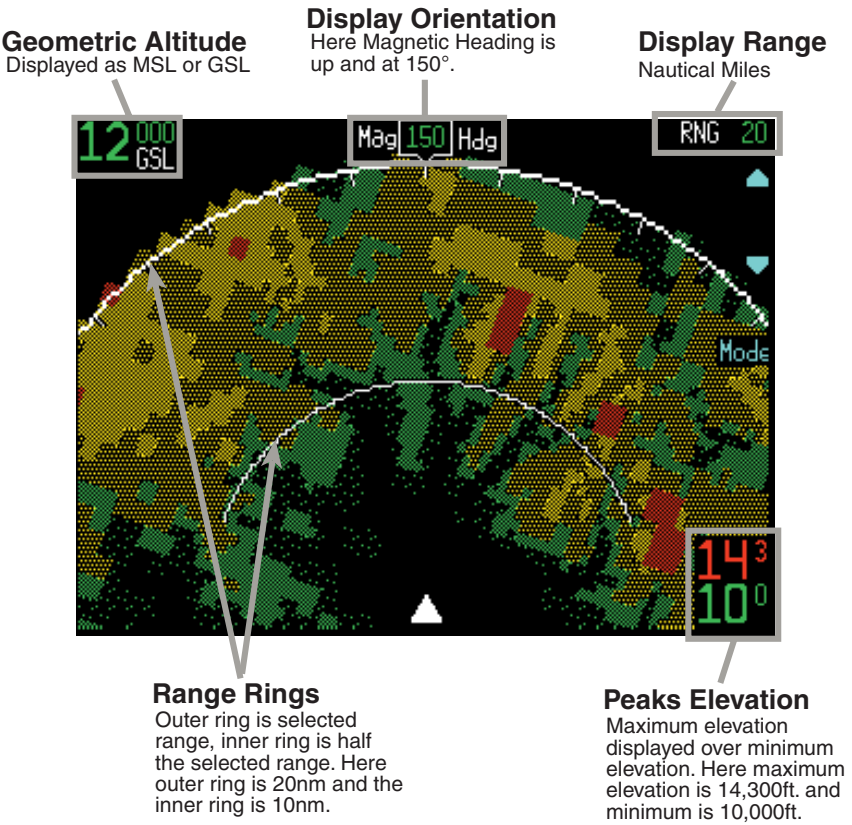
The following chart outlines all the various colors used by the GA-EGPWS Terrain Display and their functions in providing Situational Awareness to the pilot. Some display types may not support all colors

Color	Indication
Solid Red	Terrain/Obstacle Threat Area - Warning.
Solid Yellow	Terrain/Obstacle Threat Area - Caution.
50% Red Dots	Terrain/Obstacle that is more than 2000 feet above aircraft altitude.
50% Yellow Dots	Terrain/Obstacle that is between 1000 and 2000 feet above aircraft altitude.
25% Yellow Dots	Terrain/Obstacle that is 250 feet below to 1000 feet above aircraft altitude.
Solid Green (Peaks only)	Shown only when no Red or Yellow Terrain/Obstacle areas are within range on the display. Highest Terrain/Obstacle not within 250 feet of aircraft altitude.
50% Green Dots	Terrain/Obstacle that is 250 feet below to 1000 feet below aircraft altitude.
(Peaks only)	Terrain/Obstacle that is the middle elevation band when there are no Red or Yellow terrain areas within range on the display.
16% Green Dots	Terrain/Obstacle that is 1000 to 2000 feet below aircraft altitude.
(Peaks only)	Terrain/Obstacle that is the lower elevation band when there are no Red or Yellow terrain areas within range on the display.
Black	No significant Terrain/Obstacle.
16% Cyan (Peaks only)	Area having sea level elevation (0 feet MSL).
Magenta Dots	Unknown terrain. No terrain data in the database for the magenta shown.

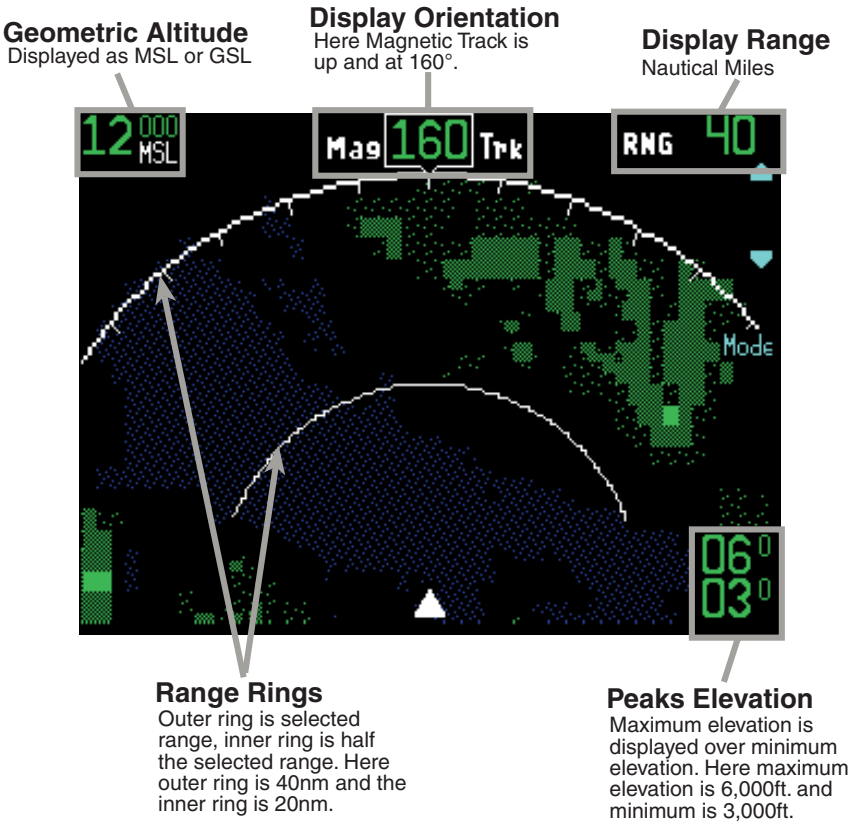
listed, or may display colors in slightly different densities than those listed, but the system is designed to present the most appropriate Terrain Display capable on the various display types which are usable by the system.

NOTE: Green colors indicating terrain/obstacles below the aircraft are NOT shown when the aircraft is on the ground, to reduce display clutter and to show only terrain that is significantly higher than the aircraft in the departure area. Green colors will appear when the aircraft has climbed approximately 500 to 800 feet above the elevation of the runway.

The following pictures show two examples of the Terrain Display.



GA-EGPWS Terrain Display at 12,000 feet approaching Aspen, CO



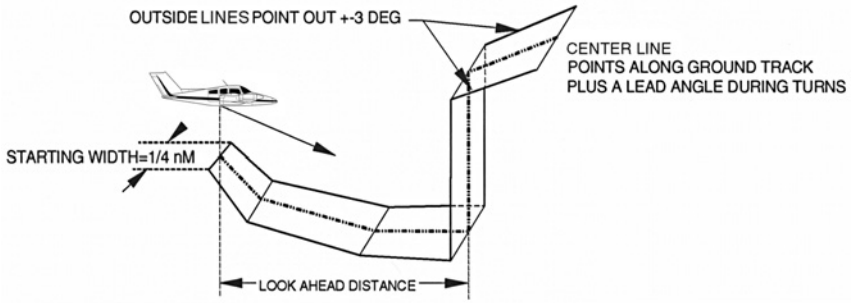
GA-EGPWS "Peaks" Terrain Display at 12,000 feet near Seattle, WA

"LOOK-AHEAD" ALERTING AND WARNING

Using aircraft position, altitude and flight path information, the system provides an envelope of protection for the aircraft that is independent from the Terrain Awareness Display. This "Look-Ahead" function compares the aircraft flight path to terrain and obstacle database information, and distance to known runways.

When the "Look-Ahead" function detects a terrain or obstacle threat approximately one minute ahead of the aircraft, the voice alert "Caution Terrain, Caution Terrain" (or "Caution Obstacle, Caution Obstacle") is given, and a bright, solid yellow "threat area" is shown on the Terrain Display. Should the aircraft flight path continue toward the threat area, the alert message will repeat approximately every 7 seconds.

The following illustration is a general representation of the "Look-Ahead" functionality.



If the aircraft flight path approaches to within approximately 30 seconds of a threat area, the voice message "Terrain Ahead" (or "Obstacle Ahead") or optionally "Terrain Terrain, Pull Up" (or "Obstacle-Obstacle, Pull Up") will be given continuously and the threat area on the Terrain Display will be shown in a bright, solid red color.

In either case, when the pilot reacts and changes the aircraft flight path to one that will safely avoid the detected threat area, the voice alerts will cease and the threat area(s) shown on the Terrain Display will be removed.

RUNWAY FIELD CLEARANCE FLOOR (RFCF)

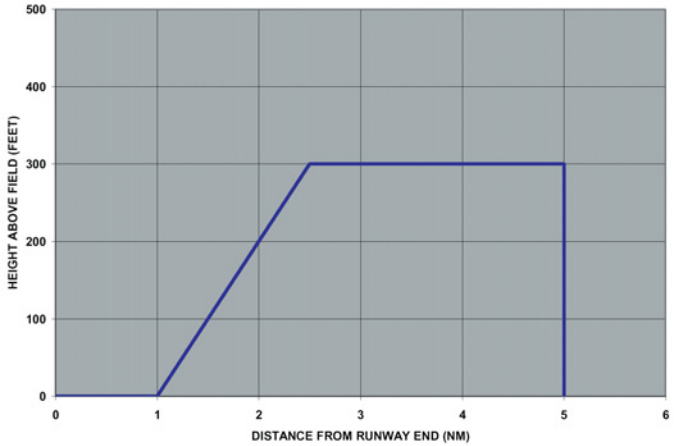
The GA-EGPWS provides additional alerting protection for situations where aircraft descend to an altitude that is too low considering the aircraft's distance from a known runway. This is called the Runway Field Clearance Floor (RFCF).

NOTE: This alert function is ONLY active when the aircraft is within 5 nm of a known runway in the system database.

Using the aircraft distance to a known runway and Geometric Altitude, the system establishes a "floor" of protection below the aircraft. Penetration of this floor will cause the yellow caution alert annunciator lamp to illuminate, and the voice alert "Too Low, Too Low" to be heard. If aircraft altitude continues to descend, the voice alert will be heard again, and at an increasing frequency.

When the pilot reacts to the alert and climbs back above the RFCF for the current distance from the known runway, the annunciator lamp will extinguish and the voice alerts will cease.

The following figure is a graphical representation of the Runway Field Clearance Floor.

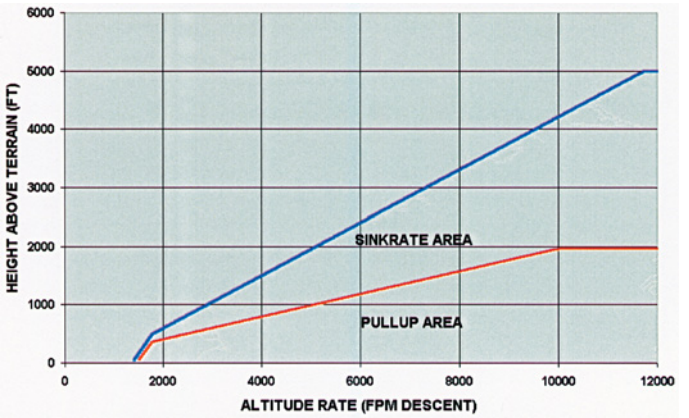


Runway Field Clearance Floor (RFCF)

EXCESSIVE RATE OF DESCENT ALERTING AND WARNING

The GA-EGPWS uses both GPS Vertical Velocity and pressure altitude to compute vertical velocity information when the aircraft does not provide specific air data for this purpose. In either case, when the aircraft is descending toward terrain at a high rate for its relative altitude above terrain, the system will provide alerting and warning to the pilot. This function is always active.

The following graph represents the envelope of protection provided for Excessive Rate of Descent scenarios:



Excessive Descent Rate

Initially, the voice alert "Sink Rate" will be heard, and the yellow caution alert annunciator lamp will illuminate. If the aircraft continues in the high rate of descent, the "Sink Rate-Sink Rate" voice alert will be repeated at an increasing frequency.

Should the aircraft penetrate the warning boundary, the voice alert "Pull Up" will be heard continuously and the red warning annunciator lamp will illuminate.

In both cases, as the pilot reacts to decrease the high rate of descent and the aircraft flight path exits the alerting/warning envelope, the annunciator lamp will extinguish and the voice alerts will cease.

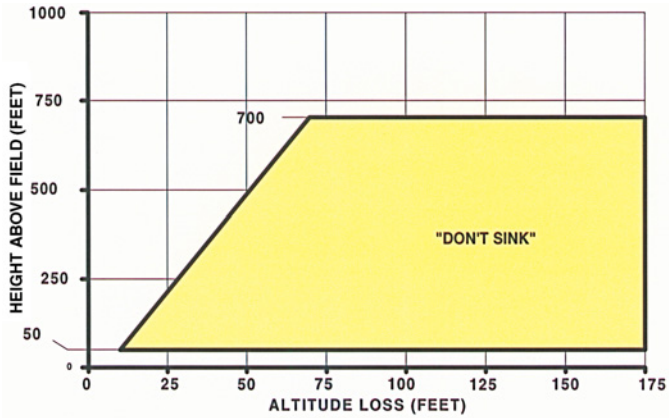
Sometimes, the alerting and warning functionality for excessive rate of descent may be overridden by the terrain "Look-Ahead" functionality. This is normal as the "Look-Ahead" function has a higher priority in the system alerting/warning logic. (See the Alerting/Warning Priority chart later in this guide.)

INADVERTENT DESCENT / LOSS OF ALTITUDE AFTER TAKE-OFF

The GA-EGPWS uses known runway position and elevation information to monitor altitude during take-off and initial climb. This function is active until the aircraft reaches an altitude of approximately 700 feet above the runway elevation used for take-off.

Should the aircraft experience an inadvertent descent or loss of altitude after take-off, the system will illuminate the yellow caution annunciator lamp and provide "Don't Sink-Don't Sink" voice alerts to the pilot. The voice alerts will be repeated with increasing frequency.

The following graph shows this alerting envelope:



Descent After Takeoff

As the pilot adjusts the flight path of the aircraft and a positive rate of climb is re-established, the voice alert "Don't Sink" will cease and the yellow caution annunciator lamp will extinguish.

NOTE: It is important for the pilot not to over-react to this situation. While it is important to react quickly and positively to re-establish a positive rate of climb, the pilot should remember that in the take-off / initial climb segment, the margin above stall speed for many aircraft is fairly small, and thus must be respected.

GA-EGPWS ALTITUDE MONITORING

The GA-EGPWS monitors the various altitude and temperature (if used) inputs that it receives during flight for the computation of Geometric Altitude. If there is an abnormal difference detected among these altitude values, the system can provide visual and voice alerts to the pilot.

Normal differences that are the result of non-ISA temperature conditions or are due to high or low-pressure systems will not normally activate the altitude monitor. Large errors due to faulty equipment or malfunctioning pitot-static systems will normally be detected by the monitor.

When an abnormal altitude discrepancy is detected by the system, there will be a single voice callout of "Check Altitude". There will also be the text message Chk Alt shown on the Terrain Display as long as the condition that triggered the alert persists.

The pilot should check all aircraft altimeters to ensure that the correct altimeter setting is set, that altimeter systems cross-check and that the pilot's altimeter is not stuck and indicating an erroneous altitude.

ALTITUDE CALLOUT

The GA-EGPWS provides an altitude callout for the pilot, to indicate a position approximately 500 feet above the elevation of the runway being approached. When the aircraft is within 5 nm of a known runway, the altitude callout function is active, and is then triggered when Geometric Altitude shows the aircraft 500 feet above the known runway elevation (from the system database). Example: "Five-Hundred".

This callout is not accompanied by any annunciator lamp indications and will occur only once per approach. The Altitude Callout is reset when the aircraft climbs more than 700 feet above the runway elevation.

NORMAL PROCEDURES

GA-EGPWS SYSTEM SELF-TEST

Prior to flight, the system should be tested for proper operation. Normally, this is done by the pilot during the BEFORE TAKE-OFF check. All aircraft power and systems should be up and running, and the GA-EGPWS "Not Available" annunciator lamp should be off.

NOTE: Because the system requires GPS information to operate, it may be several minutes after power-up before the aircraft GPS system supplies accurate information to the GA-EGPWS. If the internal GPS card is used to supply position information, it may take additional time for satellite acquisition depending upon the frequency of use of the system. The internal GPS card requires a current almanac to locate GPS satellite positions. This almanac can take several minutes to load. When an accurate GPS position is acquired and the rest of the GA-EGPWS system is available, the "NOT AVAILABLE" lamp will extinguish.

To perform a normal GA-EGPWS Self-Test:

- Press the Self-Test switch. When a Self-Test is initiated, the GA-EGPWS first checks for any configuration (installation or database) errors. If any are detected, it is audibly enunciated and the test is terminated. If none are detected, the test continues through a sequence resulting in turning on and off all system annunciators, enunciating specific audio messages, and if enabled, displaying a video test pattern on the terrain display. Any functions determined inoperative are also enunciated. The Self-Test terminates automatically at its conclusion.

  The following is a description of the expected results of a typical level 1 Self-Test. Actual annunciation nomenclature and sequence may differ depending on the installation.

- Observe that the amber "Not Available" and red "Warning" annunciator lamps associated with the system illuminate.
- Observe that the voice callout "EGPWS SYSTEM, OK" is heard.
- Observe that the red "Warning" annunciator lamp extinguishes, and the amber "Caution" annunciator lamp illuminates.
- Observe that the GA-EGPWS Terrain Display shows the Test Pattern.
- Observe that the Terrain Display Test Pattern is removed.
- Observe that the amber "Caution" and amber "Not Available" annunciator lamps associated with the system extinguish.

Pressing the Self-Test switch as the Level One Self-Test is completed will initiate Level Two of the internal test capability. Level Two provides information about any faults the system may be detecting. Normally, this will not be necessary. If a normal Self-Test is unsuccessful, a Level Two test is automatically initiated by the system.

Further Self-Test levels may be accessed after Level Two by following instructions to "Press to Continue" at the end of Level Two and so on. These further levels provide information about the installation configuration, part number, and software / database versions, etc. All levels of Self-Test may be performed on the ground, but only Self-Test Level One and Two are accessible during flight. If the "Not Available" annunciator lamp illuminates during flight, a Self-Test will indicate the reason.

GA-EGPWS Status Message	*GA-EGPWS Condition*
"EGPWS System OK"	EGPWS is operational and ready for flight.
"Terrain Inhibited"	Terrain Inhibit switch is engaged.
"EGPWS Computer Fault"	A fault in the EGPWS computer is detected. Level 2 Self-Test will follow automatically.
"EGPWS Not Available"	EGPWS is not operational for some reason. Level 2 Self-Test will follow automatically.

GA-EGPWS Self-Test: Level 1 Messages

GA-EGPWS Status Message	*GA-EGPWS Condition*
"Internal Faults. Internal GPS Failed"	The EGPWS internal GPS has failed.
"Internal Faults. Terrain Database Failed"	The EGPWS Terrain Database is not present, corrupted, or cannot be accessed.
"No Faults. EGPWS Computer OK. Internal GPS Not Navigating."	GPS inputs to the EGPWS are present, but are not yet satisfactory for normal operation.
"No Faults. EGPWS Computer OK. GPS Inputs Not Valid"	External GPS inputs to the EGPWS are not present, or are not valid for use.
"No Faults. EGPWS Computer OK. Outside Regional Terrain Database."	GPS position shows aircraft outside the area covered by the database installed in the EGPWS.
"EGPWS Computer OK. External Faults. Encoder Altitude Fault."	Pressure altitude source is not present, not valid for use or a wiring fault exists.
"EGPWS Computer OK. External Faults. GPS Bus Inactive."	There is no External GPS information available or a wiring fault exists.
"EGPWS Computer OK. External Faults. Display Configuration Fault. Internal GPS Not Navigating.	EGPWS Display is either not ON, is inoperative, or is not properly configured.
"EGPWS Computer OK. External Faults. Configuration Module Read Error."	EGPWS Configuration Module has a hardware fault. (i.e. wiring or connector problem)
"EGPWS Computer OK. External Faults. Air Data Bus Inactive."	External Air Data source inoperative or a wiring fault exists.
"EGPWS Computer OK. External Faults. Display Bus Inactive."	EGPWS Display is not ON, or a wiring fault exists.
"EGPWS Computer OK. External Faults. Static Air Temperature Wiring Fault."	Outside Air Temperature source wiring fault.
"Press to Continue"	Press the Self-Test switch to proceed to the next Self-Test Level.

GA-EGPWS Self-Test: Level 2 Messages

NOTE: This Level 2 list contains the most commonly heard messages. Other messages may be given, depending upon installation / equipment types. Messages may be heard in various combinations.

RECOMMENDED PROCEDURES FOR GA-EGPWS WARNINGS IN FLIGHT

"PULL UP"

If in Instrument conditions or at night where visual judgement of the situation is not assured:

1. Level wings and simultaneously pitch up at a rate of 2 to 3 degrees per second to the aircraft's BEST ANGLE of CLIMB attitude and speed. (RESPECT AIRCRAFT STALL CONDITION).
2. Apply Maximum Power.
3. Continue maximum climb until all visual and aural warnings cease.
4. Advise Air Traffic Control as necessary.

If in Visual conditions during the day:

1. Evaluate aircraft flight path with respect to terrain.
2. Take corrective action as necessary to recover safe terrain clearance.
3. Advise Air Traffic Control as necessary.

RECOMMENDED PROCEDURES FOR GA-EGPWS ALERTS IN FLIGHT

"Terrain Ahead" or "Obstacle Ahead"	Condition: Action:	Aircraft flight path is in conflict with terrain / obstacle. Take IMMEDIATE action to adjust flight path away from threat until alert/warning ceases.
"Caution Terrain" or "Caution Obstacle"	Condition: Action:	Aircraft flight path is in conflict with terrain / obstacle. Adjust flight path as required away from threat until alert ceases.
"Too Low" or "Too Low Terrain"	Condition: Action:	Insufficient terrain clearance for phase of flight. Adjust flight path to recover safe terrain clearance until alert ceases.
"Check Altitude"	Condition: Action:	Abnormal difference between GPS, Geometric and/or pressure altitude information in GA-EGPWS. Check all available aircraft altitude information. Ensure correct altimeter setting, altimeters cross-check and are not stuck.
"Don't Sink"	Condition: Action:	Aircraft is losing altitude during take-off / climb. Re-establish positive rate of climb.
"Sinkrate"	Condition: Action:	Rate of descent is EXCESSIVE for current height above terrain. REDUCE RATE OF DESCENT.
"500 Above" or "500"	Condition: Action:	Aircraft is approximately 500 feet above nearest known runway (within 5nm). Assure aircraft is in position for normal landing.

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ADDITIONAL INFORMATION

AUDIO MESSAGE PRIORITY

Only ONE message is produced at any one time.

The highest priority voice message takes precedence, and may IMMEDIATELY interrupt any lower priority message as shown in the table below. If the aircraft is in a situation that meets more than one condition for an alert or warning at the same time, the higher priority message will be heard until that condition is resolved. If the lower priority condition is still in effect at that time, the lower priority voice message will be heard.

The following tables show the voice output that is activated for each callout, alert and warning condition. The messages are arranged from highest priority at the top, to lowest priority at the bottom of the tables.

ALERT/WARNING CONDITION	AUDIO MENU	NOTES
PULL UP	PULL UP	1
TERRAIN AWARENESS PREFACE	TERRAIN AHEAD	1, 2
TERRAIN AWARENESS WARNING	TERRAIN AHEAD	1, 3
OBSTACLE AWARENESS PREFACE	OBSTACLE AHEAD	1, 2
OBSTACLE AWARENESS WARNING	OBSTACLE AHEAD	1, 3
TERRAIN AWARENESS CAUTION	CAUTION TERRAIN	4
OBSTACLE AWARENESS CAUTION	CAUTION OBSTACLE	4
RFCF TOO LOW TERRAIN	TOO LOW (PAUSE) TOO LOW	
ABOVE FIELD CALLOUT	500 ABOVE	
SINK RATE	SINK RATE Note: The basic warning is "SINK RATE (PAUSE) SINK RATE". However, if the Pull-up curve is violated only a single "SINK RATE" may occur prior to the pull up voice.	
DON'T SINK	DON'T SINK (PAUSE) DON'T SINK	
ALTITUDE MONITOR CALLOUT	CHECK ALTITUDE	5

Table 1: Standard Voice Callout Menu

Note 1: These are the only voices that can interrupt.

Note 2: The preface voices will always be given prior to the warning voice.

Note 3: Voice message is continuous.

Note 4: Voice message will repeat every 7 seconds.

Note 5: This callout is optional.

ALERT/WARNING CONDITION	AUDIO MENU	NOTES
PULL UP	PULL UP	1
TERRAIN AWARENESS PREFACE	TERRAIN TERRAIN	1, 2
TERRAIN AWARENESS WARNING	PULL UP	1, 3
OBSTACLE AWARENESS PREFACE	OBSTACLE OBSTACLE	1, 2
OBSTACLE AWARENESS WARNING	PULL UP	1, 3
TERRAIN AWARENESS CAUTION	CAUTION TERRAIN (PAUSE) CAUTION TERRAIN	4
OBSTACLE AWARENESS CAUTION	CAUTION OBSTACLE (PAUSE) CAUTION OBSTACLE	4
RFCF TOO LOW TERRAIN	TOO LOW TERRAIN	
ABOVE FIELD CALLOUT	500	
SINK RATE	SINK RATE Note: The basic warning is "SINK RATE (PAUSE) SINK RATE". However, if the Pull-up curve is violated only a single "SINK RATE" may occur prior to the pull up voice.	
DON'T SINK	DON'T SINK (PAUSE) DON'T SINK	
ALTITUDE MONITOR CALLOUT	CHECK ALTITUDE	5

Table 2: Alternate Voice Callout Menu

Note 1: These are the only voices that can interrupt.

Note 2: The preface voices will always be given prior to the warning voice.

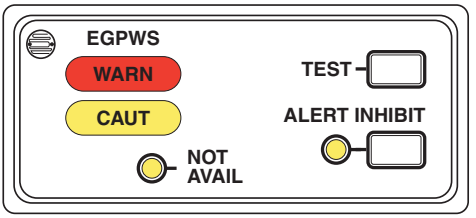
Note 3: Voice message is continuous.

Note 4: Voice message will repeat every 7 seconds.

Note 5: This callout is optional.

GA-EGPWS COCKPIT LAMPS & SWITCHES

A representative sample of a possible annunciator and switch installation is pictured below. Other configurations are at the discretion of the installer and operational requirements of the aircraft.



Typical Annunciator

GA-EGPWS SYSTEM LIMITATIONS

* The GA-EGPWS is a Situational Awareness tool, and an alerting and warning device. **It is not to be used for navigation of the aircraft.**

* The GA-EGPWS must have an operating source of GPS information, with enough satellites in view to provide GPS data within the accuracy requirements of the system.

* Without the optional Outside Air Temperature (OAT) input for correc-

tions, "Geometric Altitude" may have errors during rapid climbs or descents in non-ISA conditions. This may affect alerting/warning times and proper altitude reference on the Terrain Display.

* The Terrain, Obstacle and Runway database information is not all-inclusive.

* The GA-EGPWS "Look-Ahead" alerting and warning, and Runway Field Clearance Floor (RFCF) functions are gradually "de-sensitized" as an aircraft nears a known runway. Aircraft operating in close proximity to known runways may experience very short or no advance warnings with respect to terrain or obstacles in this area. (See sections on GA-EPWS "Look-Ahead" and RFCF).

GA-EGPWS CONTINUED AIRWORTHINESS AND DATABASE UPDATE PROCEDURES

Normal maintenance activities performed on the GA-EGPWS should follow standard industry maintenance practices. System maintenance practices may included updating the Terrain, Obstacle and Runway database. Other maintenance practices, such as re-programming the Configuration Module, are addressed in the System Installation Manual. Database load procedures and database update cards are exclusively supplied by Bendix/King Avionics.

The GA-EGPWS database is contained in a removable card installed in the top of each unit. It is up the GA-EGPWS customer to determine if a specific database is applicable to their operation. Honeywell estimates that the GA-EGPWS customer will update their database approximately once per year. Information regarding new releases and the content details of the database may be obtained via the internet at the following sites: www.bendixking.com and www.egpws.com.

Please see the following section, GA-EGPWS Product Support, for contact information to order database updates.

If possible, clearance to the top of the GA-EGPWS should be provided to facilitate removal and installation of the terrain database card. The terrain database card is removed and installed with power NOT APPLIED to the system. The GA-EGPWS computer may be removed from the aircraft to extract and install database cards if the mounting location does not provide enough clearance.

Updating the terrain database is accomplished by:

1. Moving the soft plastic cover over the database card out of the way.

2. Pressing the card ejector button located within the unit.

3. Removing the old database card.

4. Inserting the new database card and replacing the cover. Be sure to align the arrows on the database card and GA-EGPWS computer.

If possible, mount the GA-EGPWS such that the above can be accomplished without requiring disassembly of the aircraft or removal of the GA-EGPWS.

GA-EGPWS PRODUCT SUPPORT

Customer Support:

1-800-712-0400

To order database updates, contact Navigation Services at the following numbers:

1-800-247-0230 if calling from within the United States or Canada

(913) 712-3145 if calling from outside the United States or Canada

(913) 712-3904 FAX

e-mail: nav.database@honeywell.com

Database updates may also be ordered on-line by visiting www.gpsdatabase.com

NOTE: If ordering a database card for the GA-EGPWS, the serial number of the unit must be given at the time of ordering to ensure getting the proper type of card.

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006-18265-0000
Rev 3 1/05

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