

Docket No. SA-540

Exhibit No. 14 L

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Honeywell KGP 560/860 Pilot's Guide

(38 Pages)

Attachment 11

to the Human Performance Specialist's Factual Report

ANC17MA001

Honeywell KGP 560/860 Pilot's Guide

Honeywell

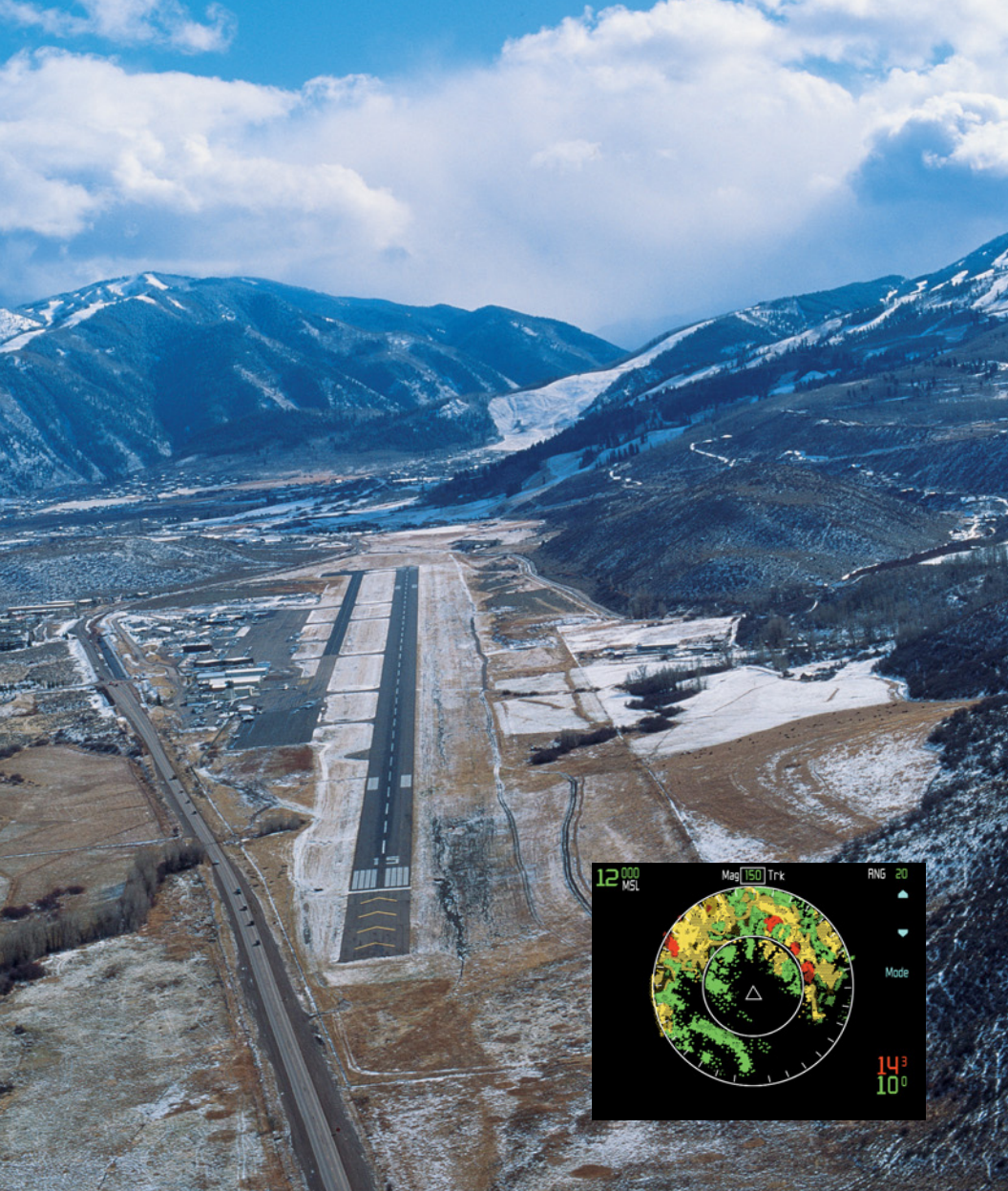
KGP 560 & KGP 860

General Aviation

Enhanced Ground Proximity Warning System

BENDIX/KING®

Pilot's Guide



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KGP 560 & KGP 860

Enhanced Ground Proximity Warning System

TABLE OF CONTENTS

| | |
|--|----|
| INTRODUCTION | 1 |
| What is the GA-Enhanced Ground Proximity Warning System? | 2 |
| Regulatory Standards | 3 |
| GA-EGPWS FUNCTIONS AND FEATURES | 5 |
| Aircraft Position | 5 |
| Aircraft Altitude | 6 |
| Terrain, Obstacles & Runway Database | 7 |
| Terrain Inhibit Switch | 9 |
| Terrain Awareness Display | 10 |
| “Look-Ahead” Alerting and Warning | 15 |
| Runway Field Clearance Floor (RFCF) | 16 |
| Excessive Rate of Descent Alerting and Warning | 17 |
| Inadvertent Descent / Loss of Altitude After Take-Off | 19 |
| GA-EGPWS Altitude Monitoring | 20 |
| Altitude Call-out | 20 |
| Aircraft Configuration Alerts (Gear & Flap Alerts - KGP 860 Only) | 20 |
| Bank Angle Alert (KGP 860 Only) | 21 |
| NORMAL PROCEDURES | 23 |
| GA-EGPWS System Self-Test | 23 |
| Recommended Procedures for GA-EGPWS Warnings In Flight | 25 |
| Recommended Procedures for GA-EGPWS Alerts In Flight | 26 |
| ADDITIONAL INFORMATION | 27 |
| Audio Message Priority | 27 |
| GA-EGPWS Cockpit Lamps & Switches | 29 |
| KGP 560/860 System Limitations | 29 |
| KGP 560/860 Continued Airworthiness and Database Update Procedures | 30 |
| KGP 560/860 Product Support | 31 |

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INTRODUCTION

The Bendix/King KGP 560 & KGP 860 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 KGP 560 & KGP 860 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.

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).



***The KGP 560 & KGP 860 GA-EGPWS Computer
(less than 1.5 pounds, KGP 560 shown, KGP 860 similar)***

Introduction

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 KGP 560/860 GA-EGPWS.

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 KGP 560/860 General Aviation Enhanced Ground Proximity Warning System.

WHAT IS THE GA-ENHANCED GROUND PROXIMITY WARNING SYSTEM?

The Bendix/King KGP 560/860 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. Additional interface capability with the KGP 860 allows the system to be installed in larger corporate and business aircraft.

The KGP 560/860 computer is compact and rugged, and can be mounted in any number of orientations to meet the requirements of the aircraft and space limitations. The computer weighs less than 1.5 pounds.

The system uses information from an existing GPS (already in the aircraft) or internal GPS receiver contained in the KGP 560/860 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. 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 KGP 560/860 computer, and require no pilot action for system operation.

Outputs generated by the system are:

- * Terrain / Obstacle Display
- * Voice alerts / Warnings / Call-outs
- * 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 call-out 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.

The KGP 860 also provides low gear and flap alerting as well as an excessive bank angle call-out, if configured

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 alerts and warnings just as one would train to react to an aircraft stall, engine failure or any other emergency situation.

REGULATORY STANDARDS

The KGP 560/860 GA-EGPWS containing Software Version -0005 or later satisfies the requirements for Terrain Avoidance & Warning Systems (TAWS) as defined by FAA TSO C151b, Class B & Class C, when installed in aircraft in accordance with approved procedures. (See KGP 560 or KGP 860 GA-EGPWS System Installation Manual, whichever is applicable). The KGP 560/860 GA-EGPWS containing software earlier than -0005 satisfies the requirements for Terrain Avoidance & Warning Systems (TAWS) as defined by FAA TSO C151a, Class B when installed in aircraft in accordance with approved procedures.

NOTE: All aircraft, which are required by Federal Aviation Regulations to have a Terrain Awareness and Warning System complying with TSO C151b Class B, must be configured with the Class B warning and audio configurations.

Introduction

The KGP 560/860 GA-EGPWS may also be installed in aircraft that do not require FAA approved TAWS systems, and may be utilized with an optional set of alerting and warning parameters that are designed especially for smaller piston aircraft and their normal flight characteristics. The FAA has now designated these operational TAWS requirements, under TSO C151b as the Class C curves. These “optional alerting and warning parameters”, now Class C operations, are set into the computer via the Configuration Module during installation, and require no pilot interaction.

GA-EGPWS FUNCTIONS AND FEATURES

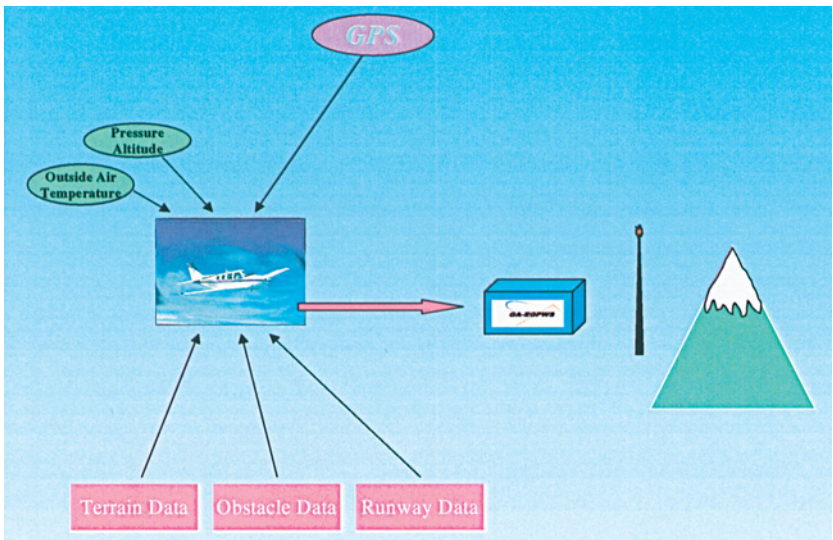
AIRCRAFT POSITION

The KGP 560/860 GA-EGPWS uses Global Positioning System (GPS) information from either an aircraft-installed GPS receiver, or an internal GPS receiver contained in the KGP 560/860 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 KGP 560/860 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 KGP 560/860 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 KGP 560/860 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).



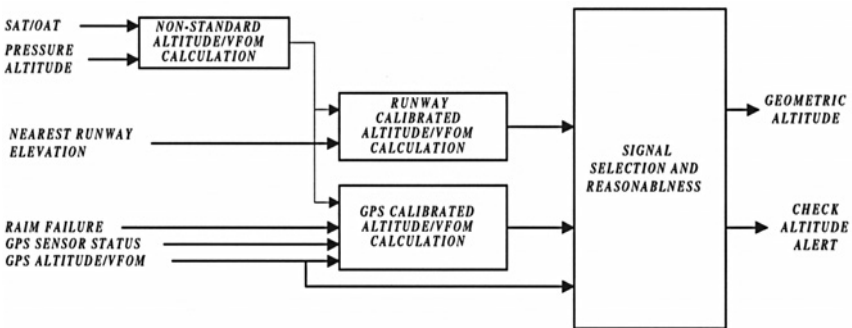
AIRCRAFT ALTITUDE

In addition to the altitude information provided by the GPS, the KGP 560/860 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 KGP 560/860 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 call-out and display a message to the pilot should such an abnormal difference occur.



Geometric Altitude

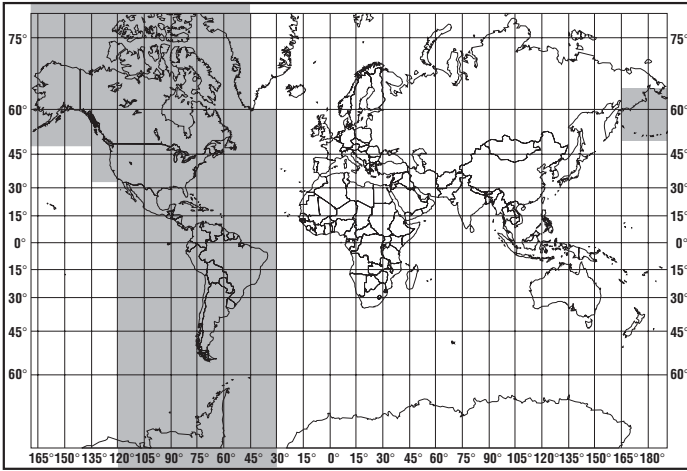
On some terrain displays, an indication of MSL or GSL altitude will appear. This altitude is the reference altitude for the display and the terrain awareness algorithm. This reference altitude is based on internally calculated Geometric Altitude and NOT corrected barometric altitude that must be used 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.

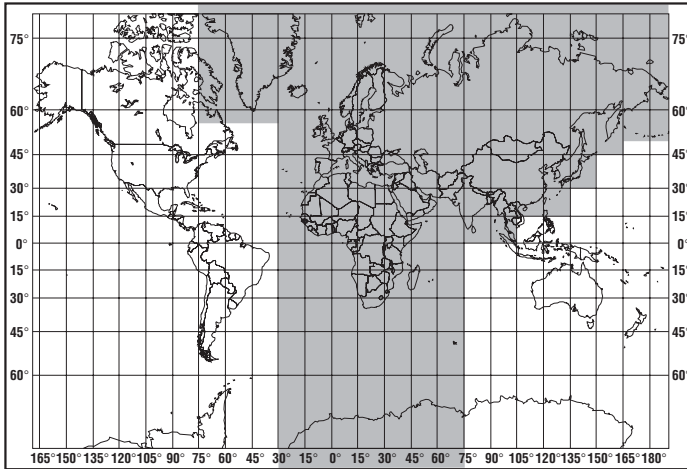
TERRAIN, OBSTACLES & RUNWAY DATABASE

The KGP 560/860 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.

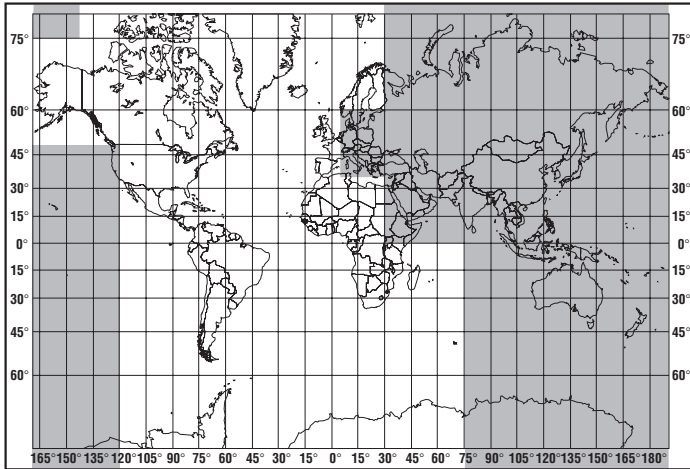
Terrain data is supplied from the same proprietary database used by other Honeywell EGPWS products, and is divided into three regions worldwide. (See the following pictures). The terrain data is divided into grid patterns of various sizes, from areas about 1/4 nm square resolution to areas of about 5 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.



Regional Database: Americas (shaded areas)



Regional Database: Atlantic (shaded areas)



Regional Database: Pacific (shaded areas)

Data for known obstacles such as towers, buildings, antennas, etc. is contained on the same database 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.

Runway database information in the KGP 560/860 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 KGP 560/860 GA-EGPWS can also be found there.

TERRAIN INHIBIT SWITCH

The KGP 560/860 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 illumi-

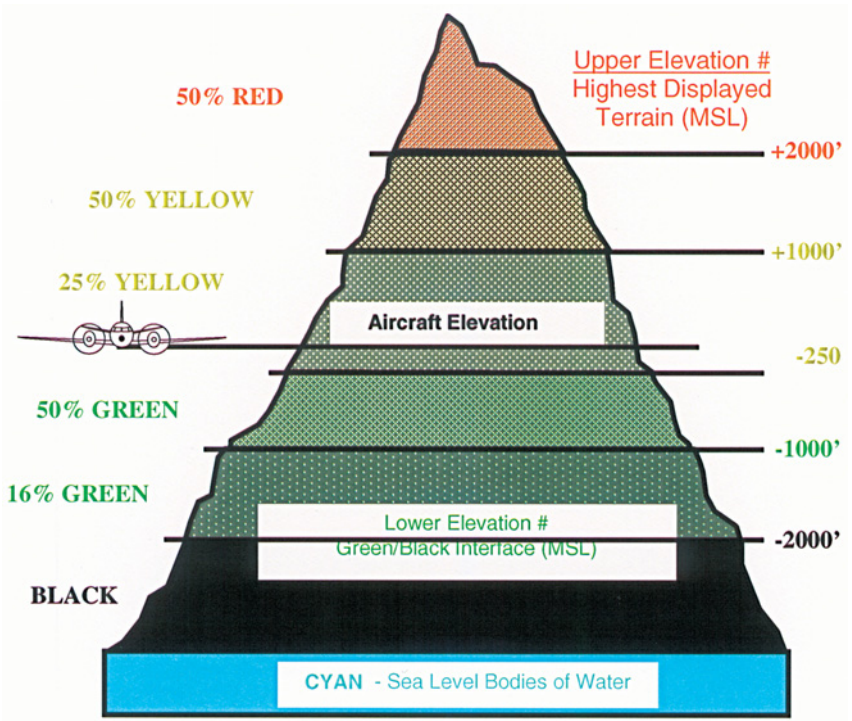
nated and a message will be displayed indicating "Warnings Inhibited". The terrain display, if installed, remains operational.

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

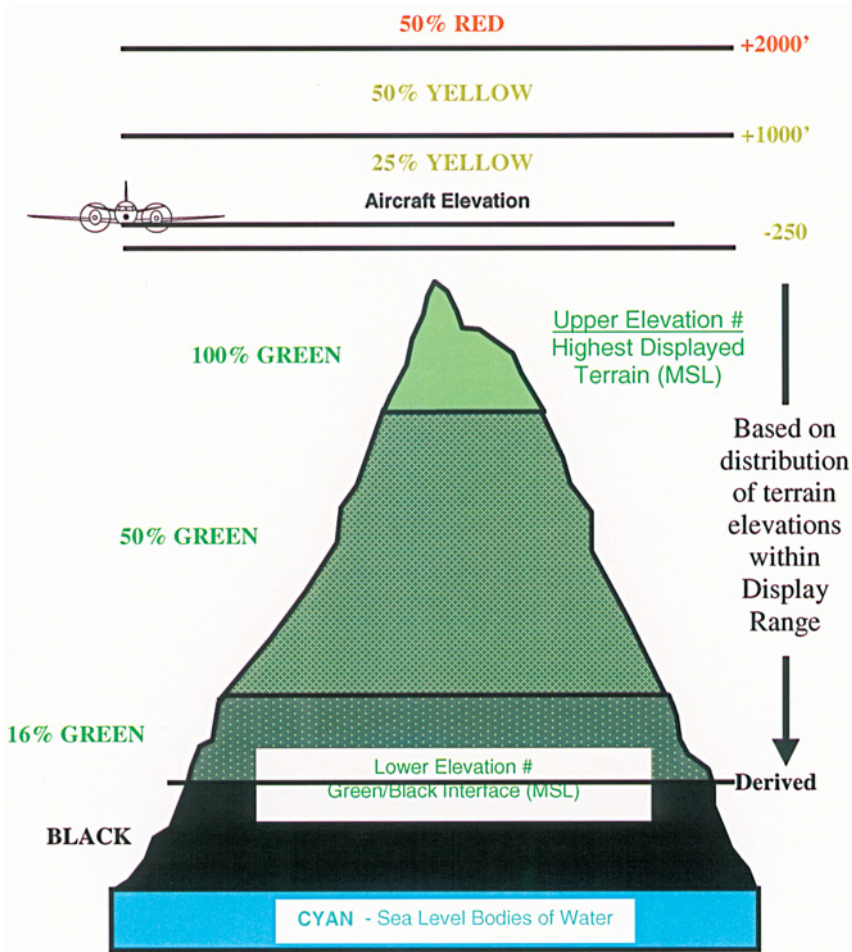
The KGP 560/860 GA-EGPWS can be interfaced to numerous types of cockpit displays. Graphical display of GA-EGPWS terrain and obstacle data is the most important enhancement to Situational Awareness. This is especially true for lower performance aircraft. In addition to showing terrain ahead of the aircraft, (depending on configuration settings and display types) the system can show 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.



Functions and Features

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 KGP 560/860 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 KGP 560/860 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 (<i>at least 2000 feet higher!</i>) THE AIRCRAFT DOES NOT HAVE SAFE TERRAIN CLEARANCE. THE AIRCRAFT MAY NOT BE ABLE TO ESCAPE THIS TERRAIN. |

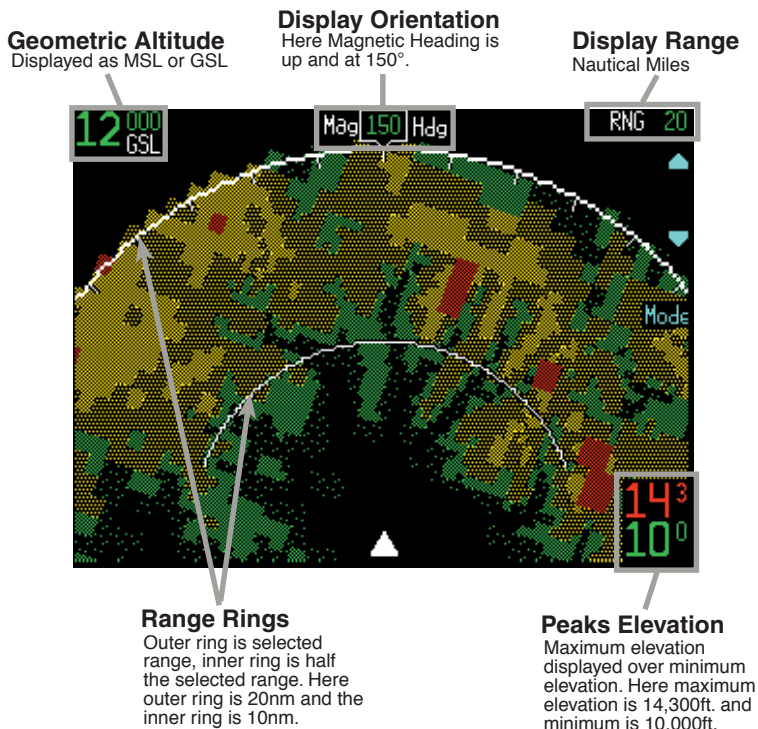
The following chart outlines all the various colors used by the KGP 560/860 Terrain Display and their functions in providing Situational Awareness to the pilot. Some display types may not support all colors listed, or may display colors in slightly different densities than those listed, but the system is designed to present the most appropriate Terrain Display capable on the various display types which are usable by the system.

Functions and Features

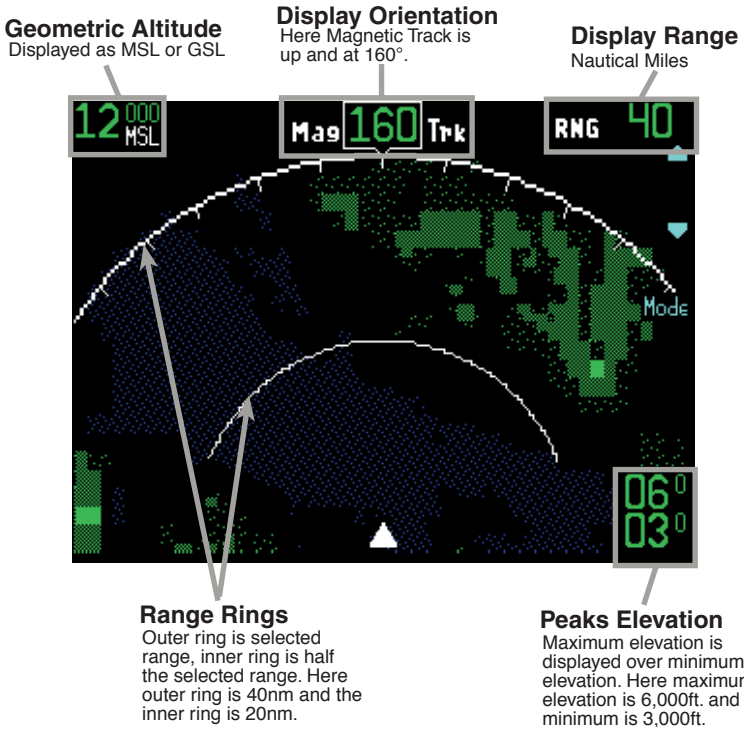
| Color | Indication |
|--------------------------|---|
| Solid Red | Terrain/Obstacle Threat Area – Warning. |
| Solid Yellow | Terrain/Obstacle Threat Area – Caution. |
| 50% Red Dots | Terrain/Obstacle that is more than 2000 feet above aircraft altitude. |
| 50% Yellow Dots | Terrain/Obstacle that 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 below aircraft altitude. |
| (Peaks only) | Terrain/Obstacle that is the middle elevation band when there is 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 is 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 area shown. |

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

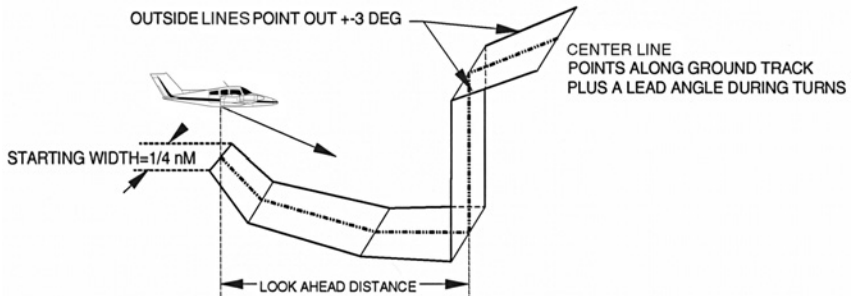


GA-EGPWS “Peaks” Terrain Display at 12,000 feet near Seattle, WA

“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.

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



Functions and Features

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.

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)

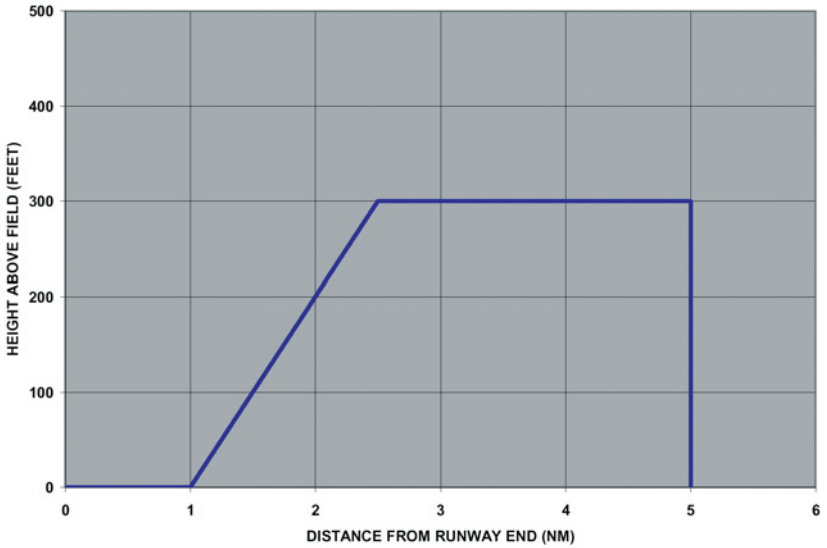
The KGP 560/860 GA-EGPWS provides additional alerting protection for situations where aircraft descend to an altitude that is too low considering the aircraft’s distance from a known runway. This is called the Runway Field Clearance Floor (RFCF).

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 in both the “TSO” and “optional alerting and warning parameters outside the TSO” configurations.



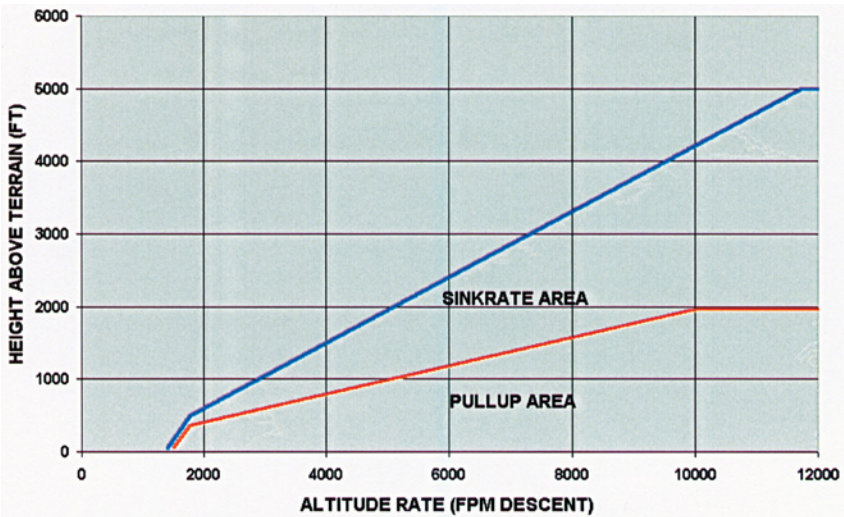
Runway Field Clearance Floor (RFCF)

EXCESSIVE RATE OF DESCENT ALERTING AND WARNING

The KGP 560/860 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.

Functions and Features

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.

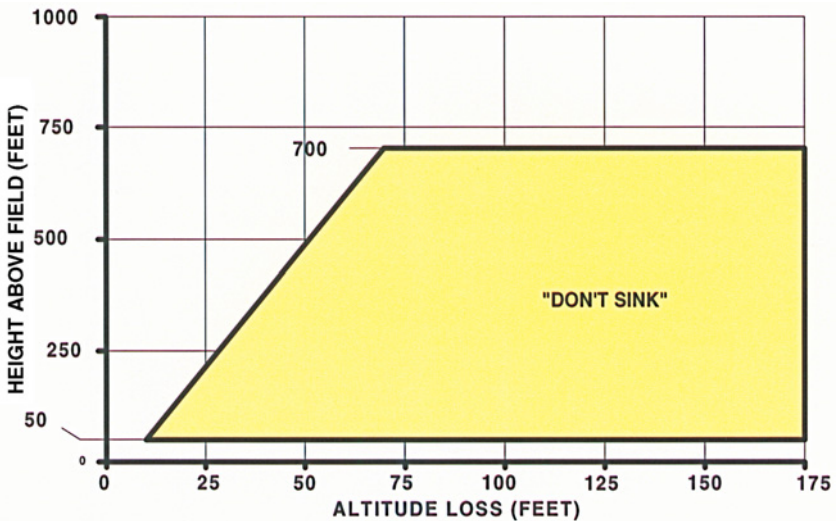
Sometimes, the alerting and warning functionality for excessive rate of descent may be overridden by the terrain “Look-Ahead” functionality. This is normal as the “Look-Ahead” function has a higher priority in the system alerting/warning logic. (See the Alerting/Warning Priority chart later in this guide.)

INADVERTENT DESCENT / LOSS OF ALTITUDE AFTER TAKE-OFF

The KGP 560/860 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 KGP 560/860 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 call-out 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 CALL-OUT

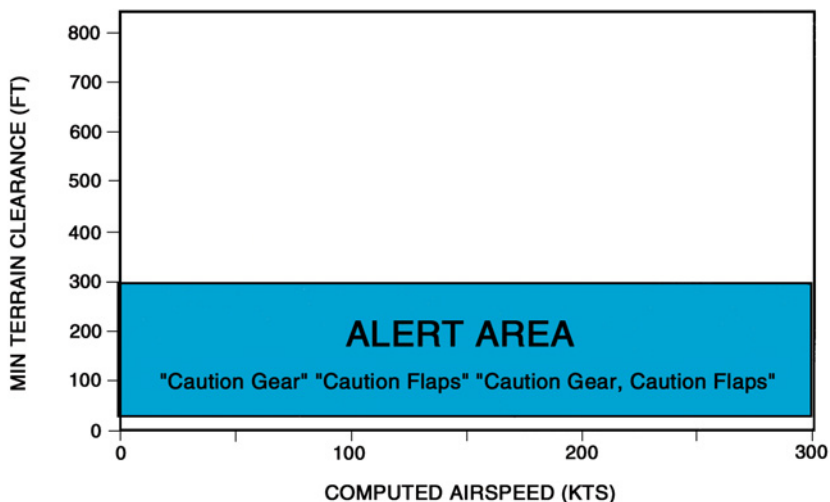
The KGP 560/860 GA-EGPWS provides an altitude call-out for the pilot, to indicate a position approximately 500 feet above the elevation of the runway being approached. When the aircraft is within 5 nm of a known runway, the altitude call-out function is active, and is then triggered when Geometric Altitude shows the aircraft 500 feet above the known runway elevation (from the system database). Example: “Five-Hundred Above” for installations using the optional alerting and warning parameters outside the TSO and “Five-Hundred” for TSO installations.

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

AIRCRAFT CONFIGURATION ALERTS (GEAR & FLAP ALERTS - KGP 860 ONLY)

The KGP 860 will provide aircraft configuration alerts to notify the pilot of Gear Up and Flaps Up conditions when close to the ground. These alerts are functions that may be selected during installation of the KGP 860. These functions add protection for the aircraft when either gear or

flaps are not in landing configuration. When the aircraft passes below 300 feet with flaps down, and the gear is up, a Gear Up aural “Caution Gear” is given. When the aircraft passes below 300 feet with the gear down, and the flaps are up, than an aural “Caution Flaps” is given. When both gear and flaps are in the up position when the aircraft passes below 300 feet, an aural “Caution Gear, Caution Flaps” will be given. The following illustrates the Alert Area.



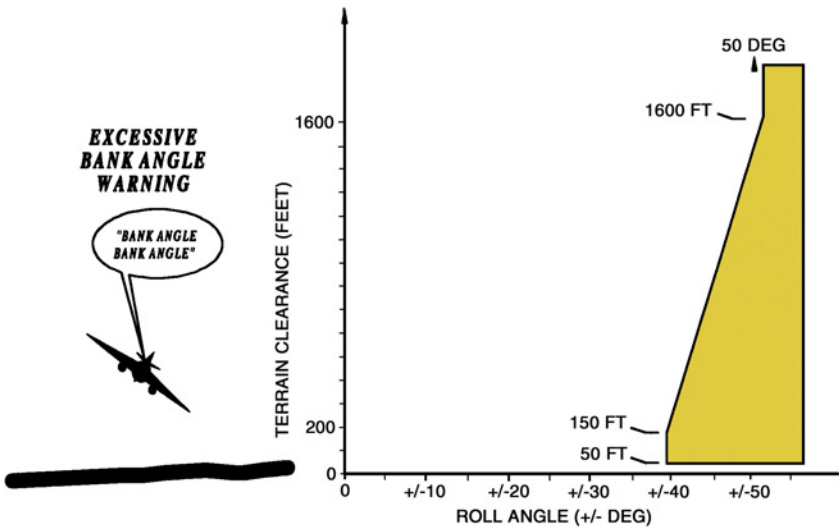
Gear and Flaps Alert Envelope

BANK ANGLE ALERT (KGP 860 ONLY)

The KGP 860 will provide excessive Bank Angle alerting (when configured during installation). The bank angle feature provides protection for over-banking during maneuvering on approach or climb-out and while at altitude. In addition, it protects against wing or engine strikes close to the runway.

The aural call-out “Bank Angle, Bank Angle” is given when the aircraft exceeds the roll angle as shown in the following illustration. Follow-on aural messages are given when the aircraft roll angle increases an additional 20% from the previous alert.

The bank angle call-out is based on the aircraft’s roll angle versus Computed Terrain Clearance. Bank Angle alerting for the KGP 860 is shown in the following figure. The Bank Angle alert is triggered when the aircraft banks greater than 40 degrees from 50 to 150 feet AGL. The alert value limit then varies linearly from 40 degrees at 150 feet AGL to where the roll angle limit is 50 degrees at 1600 feet AGL and above.



Excessive Bank Angle Alert Envelope

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 KGP 560/860. 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 KGP 560/860 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.

Normal Procedures

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. |

KGP 560/860 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. |

KGP 560/860 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

| | |
|--|---|
| <p>“Terrain Ahead” or “Obstacle Ahead”</p> | <p>Condition: Aircraft flight path is in conflict with terrain/obstacle. Action: Take IMMEDIATE action to adjust flight path away from threat until alert/warning ceases.</p> |
| <p>“Caution Terrain” or “Caution Obstacle”</p> | <p>Condition: Aircraft flight path is in conflict with terrain/obstacle. Action: Adjust flight path as required away from threat until alert/warning ceases.</p> |
| <p>“Too Low” or “Too Low Terrain”</p> | <p>Condition: Insufficient terrain clearance for phase of flight. Action: Adjust flight path to recover safe terrain clearance until alert ceases.</p> |
| <p>“Check Altitude”</p> | <p>Condition: Abnormal difference between GPS, Geometric and/or pressure altitude information in GA-EGPWS. Action: Check all available aircraft altitude information. Ensure correct altimeter setting, altimeters cross-check and are not stuck.</p> |
| <p>“Don’t Sink”</p> | <p>Condition: Aircraft is losing altitude during take-off climb. Action: Re-establish positive rate of climb.</p> |
| <p>“Sinkrate”</p> | <p>Condition: Rate of descent is excessive for current height above terrain. Action: Reduce rate of descent.</p> |
| <p>“500 Above” or “500”</p> | <p>Condition: Aircraft is approximately 500 feet above nearest known runway (within 5 nm). Action: Assure aircraft is in position for normal landing.</p> |
| <p>“Too Low Gear” or “Too Low Flaps”</p> | <p>Condition: Aircraft configuration of Gear or Flap position is not consistent with altitude above terrain. Action: Deploy Gear or Flaps consistent with approach to landing.</p> |
| <p>“Bank Angle”</p> | <p>Condition: Aircraft roll angle is greater than 40 degrees to 50 degrees depending upon altitude. Action: Ensure proper terrain clearance for excessive bank (roll) conditions.</p> |

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 call-out, 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 TERRAIN or TERRAIN AHEAD | 1, 2 |
| TERRAIN AWARENESS WARNING | PULL UP | 1, 3 |
| OBSTACLE AWARENESS PREFACE | OBSTACLE OBSTACLE or OBSTACLE AHEAD | 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 |
| TOO LOW GEAR & FLAPS | CAUTION GEAR CAUTION FLAPS | 6 |
| TOO LOW GEAR | CAUTION GEAR | 6 |
| TOO LOW FLAPS | CAUTION FLAPS | 6 |
| RFCF TOO LOW TERRAIN | TOO LOW TERRAIN | |
| ABOVE FIELD CALLOUT | 500 | |
| SINKRATE | SINKRATE Note: The basic warning is "SINKRATE (Pause) SINKRATE". However, if the Mode 1 Pullup curve is violated, only a single "SINKRATE" may occur prior to the pull up voice. | |
| DON'T SINK | DON'T SINK (Pause) DON'T SINK | |
| ALTITUDE MONITOR CALLOUT | CHECK ALTITUDE | 5 |
| BANK ANGLE | BANK ANGLE (Pause) BANK ANGLE BANK ANGLE BANK ANGLE (at low altitude) | 6 |

Basic & Alternate Class B & Class C - Voice Menu

Additional Information

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 10 seconds.

Note 5: Voice message may be disabled depending upon configuration.

Note 6: KGP 860 only, messages may be disabled depending upon configuration.

| 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 (Pause) CAUTION TERRAIN | 4 |
| OBSTACLE AWARENESS CAUTION | CAUTION OBSTACLE (Pause) CAUTION OBSTACLE | 4 |
| TOO LOW GEAR & FLAPS | CAUTION GEAR CAUTION FLAPS | 6 |
| TOO LOW GEAR | CAUTION GEAR | 6 |
| TOO LOW FLAPS | CAUTION FLAPS | 6 |
| RFCF TOO LOW TERRAIN | TOO LOW TERRAIN | |
| ABOVE FIELD CALLOUT | 500 ABOVE | |
| SINKRATE | SINKRATE Note: The basic warning is "SINKRATE (Pause) SINKRATE". However, if the Mode 1 Pullup curve is violated, only a single "SINKRATE" may occur prior to the pull up voice. | |
| DON'T SINK | DON'T SINK (Pause) DON'T SINK | |
| ALTITUDE MONITOR CALLOUT | CHECK ALTITUDE | 5 |
| BANK ANGLE | BANK ANGLE (Pause) BANK ANGLE BANK ANGLE BANK ANGLE (at low altitude) | 6 |

General Aviation - Voice 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.

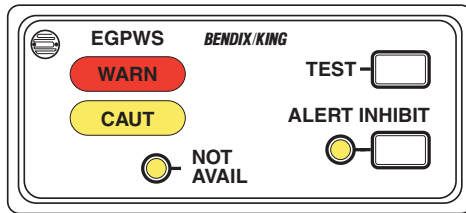
Note 4: Voice message will repeat every 10 seconds.

Note 5: Voice message may be disabled depending upon configuration.

Note 6: KGP 860 only, messages may be disabled depending upon configuration.

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

KGP 560/860 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 KGP 560/860 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 corrections, “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).

KGP 560/860 CONTINUED AIRWORTHINESS AND DATABASE UPDATE PROCEDURES

Normal maintenance activities performed on the KGP 560/860 should follow standard industry maintenance practices. System maintenance practices may include updating the Terrain, Obstacle and Runway database. Other maintenance practices, such as re-programming the Configuration Module, are addressed in the KGP 560/860 System Installation Manual. Database load procedures and database update cards are exclusively supplied by Bendix/King Avionics.

The KGP 560/860 database is contained in a removable card installed in the top of each unit. It is up to the KGP 560/860 customer to determine if a specific database is applicable to their operation. Honeywell estimates that the KGP 560/860 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, KGP 560/860 Product Support, for contact information to order database updates.

If possible, clearance to the top of the KGP 560/860 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 KGP 560/860 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 KGP 560/860 computer.

If possible, mount the KGP 560/860 computer such that the above can be accomplished without requiring disassembly of the aircraft or removal of the KGP 560/860 computer.

KGP 560/860 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 KGP 560, 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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006-18254-0001
Revision 6 Jan/2005

Honeywell