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**ROTORCRAFT FLIGHT MANUAL SUPPLEMENT**

**FOR**

**HONEYWELL MARK XXII  
ENHANCED GROUND PROXIMITY WARNING SYSTEM  
(EGPWS)**

**ON**

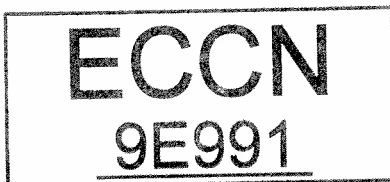
**Bell Helicopter Textron Model 412EP Helicopters**

REGISTRATION NO. \_\_\_\_\_

SERIAL NO. \_\_\_\_\_

This supplement must be attached to the FAA Approved Rotorcraft Flight Manual when the aircraft is modified by the installation of a Honeywell Enhanced Ground Proximity Warning System (EGPWS) in accordance with technical data approved by STC No. SR01474NY.

The information contained herein supplements or supersedes the information in the basic Rotorcraft Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Rotorcraft Flight Manual.



FAA Approved:

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Date:         JUN 28 2007        

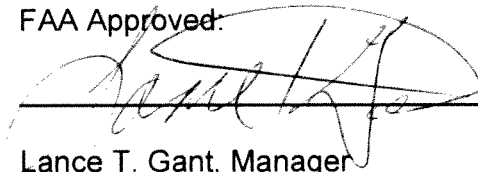
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**LOG OF REVISIONS**

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IR	03/12/02	Initial Release -Signed for: Mgr, NYACO, ANE 170, FAA, NY, NY	All
A	12/05/05	Reformatted Document Added PRIMUS 440/660/880 Digital Weather Radar System applicability Revised Introduction; Section C, Terrain (or Obstacle) Awareness Display (TAD) Revised Section 2, Normal Procedures; Section L, EGPWS Indicators and Controls Revised Section 2, Normal Procedures; Section M, KMD 550/850 Display "Pop-Up" and Auto-Ranging Features Added Section 5, Weight and Balance -Signed for: Mgr, RCO, ASW-170	All All 5,6 12 12 15
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D		Deleted Section 1.1, Type of Operations	13

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**INTRODUCTION**

**A General**

The Enhanced Ground Proximity Warning System (EGPWS) integrates two alerting functional areas into a single Line Replaceable Unit (LRU), the Enhanced Ground Proximity Warning Computer (EGPWC).

These functional areas are:

- (1) Ground Proximity Warning (including altitude callouts and bank angle alerting)
- (2) Terrain (or Obstacle) Awareness and Display (TAD)

The system operates by accepting a variety of aircraft parameters as inputs and applying alerting algorithms. In the event that the boundaries of any alerting envelope are exceeded, the EGPWS provides the flight crew with aural alert annunciations and visual displays.

The EGPWS comprises the following groups of components:

- (1) Aircraft sensors and other systems input signals
- (2) The Enhanced Ground Proximity Warning Computer (EGPWS)
- (3) Cockpit Audio System
- (4) Alert Lamps, Mode and Selector Switches and a Terrain Display

The EGPWS is designed to be fully compatible with normal aircraft operations. Unwanted alerts will be very rare if the pilot maintains situational awareness with respect to the terrain. The only pilot input is to initiate a preflight self-test.

This Flight Manual Supplement is applicable to EGPWS computer P/N 965-1590-010 with software version 010, and EGPWS computer P/N 965-1595-024 with software version 024.

**B Ground Proximity Warning**

GPWS Modes 1 through 6 employ the algorithms used in the MK XXII EGPWS.

<u>Mode</u>	<u>Function</u>	<u>Caution</u>	<u>Warning</u>
Mode 1	Excessive Descent Rate	"Sinkrate, Sinkrate"	"Pull Up"
Mode 2	Excessive Closure Rate	"Terrain, Terrain"	"Pull Up"
Mode 3	Altitude Loss After Takeoff	"Don't Sink"	
Mode 4	Unsafe Terrain Clearance	"Too Low Gear"	
		"Too Low Terrain"	
Mode 5	Excessive Glideslope Deviation	"Glideslope"	
Mode 6	Advisory Callouts	"Two Hundred, etc"	
Mode 6	Bank Angle Callouts	"Bank Angle"	
	Tail Strike Callouts	"Tail too low"	
	Be Alert Terrain INOP Advisory	"Be Alert Terrain INOP"	

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**C Terrain (or Obstacle) Awareness Display**

The “enhanced” functions of the EGPWS are the Terrain (or Obstacles) Awareness and Display (TAD). Obstacles of 100 feet or more have been included from a database provided by NOAA that covers the United States and parts of Canada and the Caribbean. These functions use geographic aircraft position, aircraft altitude and a terrain database to predict potential conflicts between the aircraft path and the terrain or cataloged man made obstacles. Additionally, it provides graphic displays of the conflicting terrain or obstacle.

<u>Mode</u>	<u>Function</u>	<u>Caution</u>	<u>Warning</u>
TA	Terrain Awareness	“Caution Terrain” “Caution Terrain”	“Warning Terrain”
TA	Obstacle Awareness	“Caution Obstacle” “Caution Obstacle”	“Warning Obstacle”

The Terrain (or Obstacle) Awareness Display (TAD) algorithms continuously compute terrain clearance envelopes ahead of the aircraft. If the boundaries of these envelopes conflict with terrain elevation data in the terrain database, alerts are issued. Two envelopes are computed, one corresponding to a Terrain Caution Alert level and the other to a Terrain Warning Alert level.

If the aircraft penetrates the Caution envelope boundary, the aural message “*Caution Terrain, Caution Terrain*” or “*Caution Obstacle, Caution Obstacle*” is generated, and the alert discrettes are provided for activation of a visual amber GPWS annunciator. Simultaneously, terrain areas of obstacles that conflict with the caution criteria are shown in solid yellow color on the display.

If the aircraft penetrates the Warning envelope boundary, the aural message “*Warning Terrain, Warning Terrain*” or “*Warning Obstacle, Warning Obstacle*” is generated, and the alert discrettes are provided for activation of a visual red GPWS annunciator. Simultaneously, terrain areas of obstacles that conflict with the warning criteria are shown in solid red color on the display.

Terrain picture data may be selected in place of the weather radar or traffic advisory display at any time by depressing the TERR key on the KMD 550/850 display or the TERR DISPLAY pushbutton associated with the PRIMUS 440/660/880.

When the conditions exist for either a Terrain Caution or Terrain Warning to be announced, both the KMD and PRIMUS displays will automatically change from a map, weather radar or traffic advisory picture to the terrain picture. The KMD 550/850 will automatically change to a 5NM range (or 2.5NM range in the Low Altitude mode). The PRIMUS 440/660/880 displays do not feature auto-ranging. Therefore, if LOW ALT mode is selected, the pilot must have the PRIMUS display range set at 3NM or less.

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Terrain that is sufficiently close to the aircraft, but does not satisfy the Caution or Warning criteria, is shown in varying density levels of red, yellow or green dot patterns with a black background. The density of the dot pattern is coarsely varied to depict terrain altitude with respect to the aircraft. All displayed terrain areas or obstacles are shown as rectilinear shapes which are designed to be easily distinguished from the display of weather radar images. Magenta (purple) dot patterns are used to indicate areas where terrain information is unavailable.

“Peaks” display mode provides additional terrain display features for enhanced situational awareness, independent of the aircraft’s altitude. This function is evidenced by the presence of three-digit elevation numbers indicating the highest and lowest terrain/obstacle elevation within the selected map range. These elevations are expressed in hundreds of feet above sea level (e.g. 125 is 12,500 feet MSL). In the event that there is no appreciable difference between the highest and lowest terrain/obstacle elevations (flat terrain), only the highest value is displayed. The colors of the elevation numbers match the color of the terrain that is represented. A distinct graphic representation of shore lines and sea level water (0 feet MSL) is supported by some displays.

Refer to the Honeywell EGPWS MK XXII Helicopter – Enhanced Ground Proximity Warning System Pilot’s Guide, 060-4314-200, dated July 2001, or later; Bendix / King KMD 550/850 Multi-Function Display Terrain Function (EGPWS) Pilot’s Guide Addendum 006-18236-0000 dated September 2001 or later; PRIMUS 440 Digital Weather Radar System Pilot’s Manual A28-1146-110; PRIMUS 660 Digital Weather Radar System Pilot’s Manual A28-1146-111; or PRIMUS 880 Digital Weather Radar System Pilot’s Manual A28-1146-102, as applicable, for additional information.

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**SYSTEM DESCRIPTION**

**A General**

All modes of the Enhanced GPWS are active if the GPWS INOP and TERR INOP annunciators are not illuminated, electrical power is on, and the following systems are operational.

- (1) Enhanced Ground Proximity Warning Computer (EGPWC)
- (2) Radio Altimeter
- (3) Air Data Computer
- (4) #1 Navigation/Glideslope Receiver
- (5) Roll Attitude System
- (6) Magnetic Heading System
- (7) Global Positioning System (either internal or external)
- (8) Audio System
- (9) Display System (KMD 550 / 850 or PRIMUS 440/660/880 Display).

**NOTE**

The **TERR DISPLAY ON** select switch must be set to ON to actuate PRIMUS 440/660/880 Display.

The **GPWS INOP** annunciator signifies a failure of the basic GPWS (Modes 1 through 6).

The **TERR INOP** annunciation signifies TAD is not available.

In the event the Radio Altimeter is not functioning, the basic GPWS modes will not be available. However, TAD will be available.

If the EGPWS TAD features become inoperative because of a system fault or inaccurate position information, the basic GPWS functions Modes 1 through 6 will be available.

**B EGPWS Circuit Protection**

The following circuit breakers are associated with the EGPWS:

<u>CB Nomenclature</u>	<u>Amps</u>	<u>Location</u>	<u>Bus</u>
EGPWS	5	Cockpit CB Panel	#2 28VDC Non Essential

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**C EGPWS Warnings/Cautions**

- (1) **EGPWS WARNING**: Any of the following conditions are regarded as an EGPWS warning:
  - a) Activation of the voice warning: “*WARNING TERRAIN*” or “*WARNING OBSTACLE*”
  - b) Activation of the red GPWS annunciator
- (2) **EGPWS CAUTION**: Any of the following conditions is regarded as an EGPWS cautionary alert:
  - a) Activation of the voice caution “*CAUTION TERRAIN*”, “*CAUTION OBSTACLE*”, “*TOO LOW TERRAIN*”, “*SINKRATE*”, “*DON’T SINK*”, or “*GLIDESLOPE*” voice alert.
  - b) Activation of the amber GPWS annunciator.

**D Response to EGPWS Warnings/Cautions**

- (1) If an EGPWS WARNING occurs, immediately initiate a maneuver which will provide maximum terrain or obstacle clearance until all alerts cease.

**E Response to Glideslope Deviation Alerts (Mode 5)**

**NOTE**

NAV 1 must be set to the appropriate ILS frequency for proper Mode 5 operation.

- (1) When an aural “*GLIDESLOPE*” alert occurs, initiate corrective action to fly the aircraft back to the Glideslope centerline.
- (2) To inhibit nuisance messages (e.g. on backcourse approaches), the *GLIDESLOPE CANCEL* switch can be pressed when the aircraft is below 2000 feet AGL.

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**F Advisory Altitude Callouts (Mode 6)**

The following advisory callouts are provided in this installation.

"BANK ANGLE, BANK ANGLE"	Occurs when roll attitude is excessive
"TWO HUNNDRED"	Occurs at 200 feet AGL
"ONE HUNDRED"	Occurs at 100 feet AGL
"FIFTY"	Occurs at 50 feet AGL
"FORTY"	Occurs at 40 feet AGL
"THIRTY"	Occurs at 30 feet AGL
"TWENTY"	Occurs at 20 feet AGL
"TEN"	Occurs at 10 feet AGL
"TAIL TOO LOW"	Impending tail strike
"BE ALERT TERRAIN INOP"	Terrain display not available

**G Minimums-Minimums Callout**

This callout is available for Decision Height settings when the Low Altitude mode is not selected. This callout will override an altitude callout set for the same height AGL.

**H Altitude Altitude Callout**

This callout is available for Decision Height settings when the Low Altitude mode is selected. This callout will override an altitude callout set for the same height AGL.

**I Smart 500 Foot Callout**

Provides a "FIVE HUNDRED" foot callout during non-precision approaches, or when one or more of the following conditions exist:

- (1) Flight path exceeds Glideslope beam by 2 dots.
- (2) Flight path exceeds Localizer beam by 2 dots.

**J Autorotation**

During autorotation only the "TWO HUNDRED" and "ONE HUNDRED" altitude callouts are provided.

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**K EGPWS Indicators and Controls**

The following indicators and controls are associated with the Enhanced GPWS:

Indicator/Control	Color	Location	Function
GPWS	RED	Pilot and Copilot Instrument Panel	GPWS Warning
GPWS	AMBER		GPWS Caution
GPWS NOP	AMBER	Pilot and Copilot Instrument Panel	Indicates basic GPWS functions are inoperative
TERR NOP	AMBER		Indicates that TAD is inoperative
GLIDE SLOPE CANCEL	GREEN	Pilot and Copilot Instrument Panel	Press to cancel Glideslope function
	AMBER		
LOW ALT ON	GREEN	Pilot and Copilot Instrument Panel	Press for flight operations below 500 feet AGL
	GREEN		
TERR INIB ON	GREEN	Pilot and Copilot Instrument Panel	Press to inhibit voice announcements and annunciations from the TAD function
	GREEN		
GPWS PTT	N/A	Pilot Instrument Panel	EGPWS press to self test
TERR	WHITE, BLUE or GREEN	On KMD 550 / 850	TERR Used to select terrain display on KMD 550/850
TERR DISPLAY ON	GREEN	Pilot and Copilot Instrument Panel	TERR DISPLAY Used to select terrain display when PRIMUS 440/660/880 installed

**L KMD 550/850 and PRIMUS 440/660/880 Display Features**

- (1) Pop-Up (Applicable to KMD and PRIMUS displays): In the event of a terrain alert, the display will automatically switch to display terrain. The display may then be manually selected to display weather radar or traffic advisory, if desired, when the terrain alert has ceased.
- (2) Auto-Ranging (Applicable only to KMD 550/850 display): In the event of a terrain alert, when the display automatically switches to display terrain, the display range automatically switches to 5NM (or 2.5NM if operating in the Low Altitude mode) range to provide the highest resolution image of the terrain.

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**M Use of Terrain (or Obstacle) Awareness Display**

The Terrain (or Obstacle) alerting may be shown on the display. A text field on the display may show the status of the Terrain (or Obstacle) Awareness Display.

The display may be used as one component of maintaining awareness of separation from terrain. The display is not intended for navigation purposes.

**CAUTION**

**The Terrain (or Obstacle) Awareness Display is intended to serve as a situational awareness tool only, and may not provide the accuracy and/or fidelity on which to solely base terrain avoidance maneuvering.**

**N Alert Priorities**

When any of the EGPWS alert lamps are illuminated, the TCAS, if installed, is placed in TA ONLY mode inhibiting all TCAS aural messages.

*The following lists the priority of the warning and cautions:*

Relative Priority	Warning Condition	Message	Lamp
HIGHEST	Mode 1 Pull up	Pull Up	GP WARN
	Mode 2 Pull Up Preface	Terrain Terrain	GP CAUTION
	Mode 2 Pull Up	Pull Up	GP WARN
	Terrain Awareness Preface	Warning Terrain	GP CAUTION
	Terrain Awareness Warning	Warning Terrain	GP WARN
	Obstacle Awareness Preface	Warning Obstacle	GP CAUTION
	Obstacle Awareness Warning	Warning Obstacle	GP WARN
	Mode 2 Terrain	Terrain	GP CAUTION
	Mode 6 Minimums	Pre-selected menu	No Lamp
	Terrain Awareness Caution	Caution Terrain – Caution Terrain	GP CAUTION
	Obstacle Awareness Caution	Caution Obstacle – Caution Obstacle	GP CAUTION
	Mode 4 Too Low Terrain	Too Low Terrain	GP CAUTION
	Mode 6 Altitude Callouts	Pre-selected menu	No Lamp
	Mode 4 Too Low Gear	Too Low Gear	GP CAUTION
	Mode 1 Sinkrate	Sinkrate – Sinkrate	GP CAUTION
	Mode 3 Don't Sink	Don't Sink – Don't Sink	GP CAUTION
	Mode 5 Glideslope	Glideslope	GP CAUTION
Mode 6 Bank Angle	Bank Angle	No Lamp	
Mode 6 Tail Strike	Tail Too Low	No Lamp	
LOWEST	TA & D Invalid Alert	Be Alert Terrain Inop	TERR INOP

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**O System Constraints**

If there is no terrain data in the database for a particular area, the affected display area is colored magenta. The terrain database, displays and alerting algorithms currently account for limited cataloged man-made obstructions within the United States and parts of Canada and the Caribbean. Obstacle alerting must be included in the Configuration Module (Cat 7) programming to be activated. If obstacle data is not in the database for a particular obstacle, Obstacle Awareness alerting is not available for that obstacle.

In standard EGPWS condition, the system may give no advance warning time for flight into precipitous terrain where there are few or no preceding obstructions. If the aircraft is flown toward obstructing terrain, the EGPWS will give no warnings if all the following conditions apply:

- (1) The aircraft is in a stabilized descent at a normal descent rate.
- (2) The aircraft ground speed is less than 60 knots.
- (3) There is no ILS Glideslope being received by the Enhanced Ground Proximity Warning System (i.e., there is no ILS available or the Glideslope receiver connected to the EGPWC is not tuned to the appropriate ILS frequency.)

Terrain clearances or descent rates during radar vectoring that are not compatible with those required by the minimum regulatory standards for Ground Proximity Warning equipment may cause unwanted warnings or alerts.

The GPWS uses an internal magnetic variation table to support the display of terrain data.

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**SECTION 1. OPERATING LIMITATIONS**

EGPWS computer P/N 965-1590-010 software shall be version 010.

EGPWS computer P/N 965-1590-024 software shall be version 024.

**1.1 Deleted**

**1.2 Limitations**

The EGPWS Pilot's guide 060-4314-200, dated July 2001, or later, must be immediately available to the flight crew when operating the Enhanced Ground Proximity Warning System.

- **Navigation must not be predicated upon the use of the Terrain (or Obstacle) Awareness Display.** The Terrain (or Obstacle) Awareness Display is intended to serve as a situational awareness tool only, and may not provide the accuracy and/or fidelity on which to solely base terrain avoidance maneuvering.
- Low Altitude mode may not be used in IFR conditions.
- Not all obstacles are in the database.
- Obstacles less than 100 feet AGL are not included in the database.
- New and non-charted obstacles are not in the database.
- Power lines are not included in the obstacle database.
- Terrain outside of the database will be displayed as magenta and the TERR INOP light will illuminate.
- PRIMUS 440/660/880 Series Displays: Auto-ranging is not installed. The pilot must select a range of 3NM or less on the display when activating LOW ALT mode.

**1.3 Placards**

The following placard will be located adjacent to the Terrain (or Obstacle) Awareness Display.

**NOT TO BE USED FOR NAVIGATION**

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**SECTION 2. NORMAL PROCEDURES**

**2.1 Level 1 Self-Test – Go/No Go**

**Perform a system self test on the ground prior to the first flight of every flight day.**

**NOTE**

This test must be performed in view of GPS satellites (i.e. outside the hangar) to ensure proper operation.

- (1) Ensure that the LOW ALT switch is NOT engaged.
- (2) Initiate the EGPWS Self Test.
- (3) Verify the following sequence:
  - a) The amber **GPWS INOP** and **TERR INOP** annunciators turn on momentarily.
  - b) The green LOW ALT **ON** annunciators turn on momentarily.
  - c) The amber **GPWS** annunciators turn on.
  - d) A “*GLIDESLOPE*” audible message is heard in the headsets.
  - e) The amber **GPWS** annunciators turn off.
  - f) The amber Glideslope **CANCEL** annunciators turn on momentarily.
  - g) The red **GPWS** annunciators turn on.
  - h) A “*PULL UP*” audible message is heard in the headsets.
  - i) The Terrain Display Self-test pattern is displayed.
  - j) A “*WARNING TERRAIN*” audible message is heard in the headsets.
  - k) The red **GPWS** annunciators turn off.
  - l) The Terrain Display Self-test pattern turns off after several sweeps of the terrain display.
- (4) Press either crewmember's **TERR INHIB** switch. The **ON** segment should turn on. Press either **TERR INHIB** switch again. The **ON** segment should turn off.

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**SECTION 3. EMERGENCY/MALFUNCTION PROCEDURES**

If an EGPWS WARNING occurs, immediately initiate a maneuver which will provide maximum terrain or obstacle clearance until all alerts cease.

**SECTION 4. PERFORMANCE**

No change from Basic Rotorcraft Flight Manual.

**SECTION 5. WEIGHT AND BALANCE**

No change from Basic Rotorcraft Flight Manual.

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