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DESCRIPTION

The Enhanced Ground Proximity Warning System (EGPWS) generates aural and visual warnings when one of the following conditions occurs between radio altitudes 30 feet and 2450 feet for modes 2, 4, 5 and between 10 feet and 2450 feet for modes 1 and 3.

- Mode 1 : excessive rate of descent
- Mode 2 : excessive terrain closure rate
- Mode 3 : altitude loss after takeoff or go around
- Mode 4 : unsafe terrain clearance when not in landing configuration
- Mode 5 : excessive deviation below glide slope.

In addition to the basic GPWS functions the GPWS has an enhanced function (EGPWS) which provides, based on a world wide terrain database :

- a Terrain Awareness Display (TAD), which predicts the terrain conflict, and displays the terrain on the ND.
- a Terrain Clearance Floor (TCF), which improves the low terrain warning during landing.

The cockpit loudspeakers broadcast, even if turned off, the aural warning or caution messages associated with each mode. The audio volume of these messages is not controlled by the loudspeaker volume knobs. (These knobs allow to adjust audio volume for radio communication only).

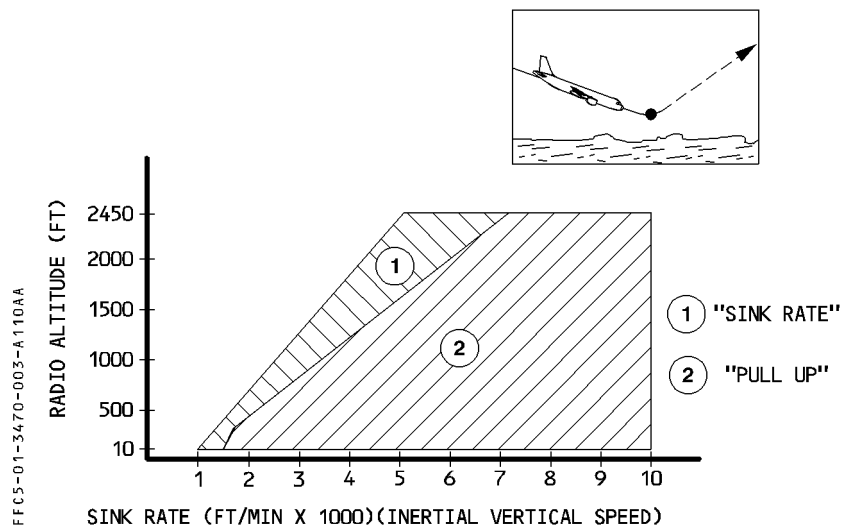
GPWS lights come on to give a visual warning for modes 1 to 4. For mode 5 the glide slope (G/S) lights come on on the captain and first officer instrument panel.

Note : A number of airports throughout the world have approaches or departures that are not entirely compatible with standard GPWS operation. These airports are identified in the database in such a way that when the GPWS recognizes such an airport, it modifies the profile to avoid nuisance warnings.

The EGPWS uses the baro altitude in QNH or QFE reference, depending on a pin program (QFE is an option).

If the QFE option is installed, the Enhanced GPWS uses the QFE barometric reference altitude independently of the selected barometric reference setting on the EFIS control panel.

MODE 1 : EXCESSIVE RATE OF DESCENT

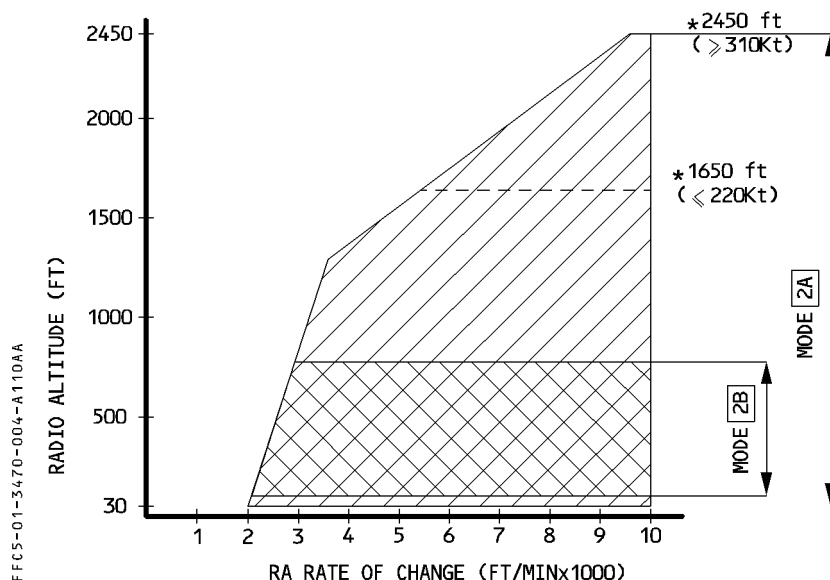
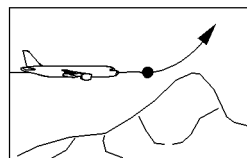


Mode 1 has two boundaries. Penetration of the first boundary generates the illumination of the GPWS lights and a repeated aural alert "SINK RATE". Penetration of the second boundary generates the repetitive "PULL UP".

The lower cut-off limit is 10 feet radio altitude.

The upper cut-off limit is 2450 feet radio altitude.

MODE 2 : EXCESSIVE TERRAIN CLOSURE RATE



2A — Flaps not in landing configuration and aircraft not on the glide slope beam.

Penetration of the boundary lights up the GPWS lights and sounds the repeated aural alert: "TERRAIN". After "TERRAIN" has sounded twice, the warning switches to "PULL UP", repeated continually until the aircraft leaves the warning envelope. After the aircraft leaves the boundary the GPWS lights stay on and the voice message "TERRAIN" persists. These alerts cease when the aircraft increases either the barometric or inertial altitude by 300 feet. If it enters another alert region during this altitude gain time, then the whole process begins again with a new reference altitude for the 300 feet altitude gain.

* Upper cut-off limit varies from 1650 feet to 2450 feet radio altitude depending on speed (between 220 kt to 310 kt).

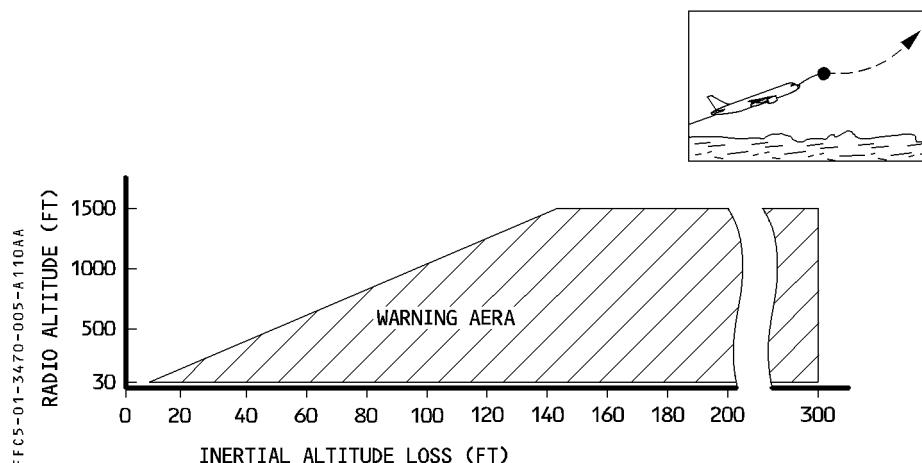
At certain airports, the upper boundary is limited to reduce the warning sensitivity and minimize the nuisance warnings.

2B — Flaps in landing configuration.

Lowering the flaps to the landing position automatically switches GPWS to Mode 2B. In this case lower boundary varies between 200 feet to 600 feet depending on radio altitude rate of change. During ILS approach (glide slope deviation $< \pm 2$ dots) the lower boundary is fixed at 30 feet.

When the aircraft enters the envelope, the alert is the same as for mode 2A. When gear and flaps are in the landing configuration, the voice message is "TERRAIN " and is not followed by "PULL UP" if the aircraft remains within the envelope.

MODE 3 : ALTITUDE LOSS AFTER TAKEOFF



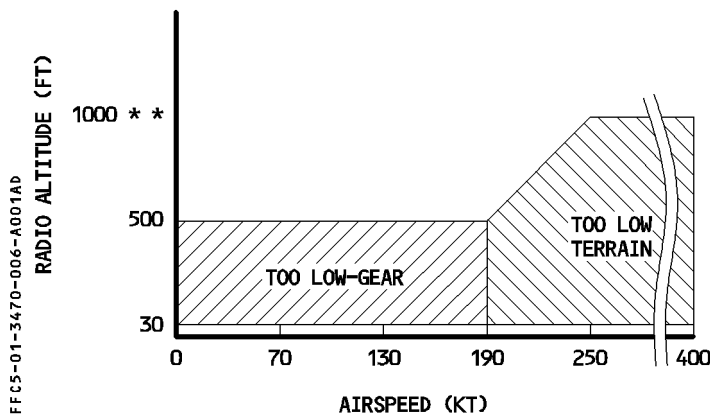
If the aircraft descends during the initial takeoff climb or during a go around, GPWS lights come on and the aural alert "DON'T SINK" sounds repeatedly.

The lower cut-off limit is 30 feet radio altitude.

Mode 3 is desensitized according to the time accumulated after departure and the radio altitude.

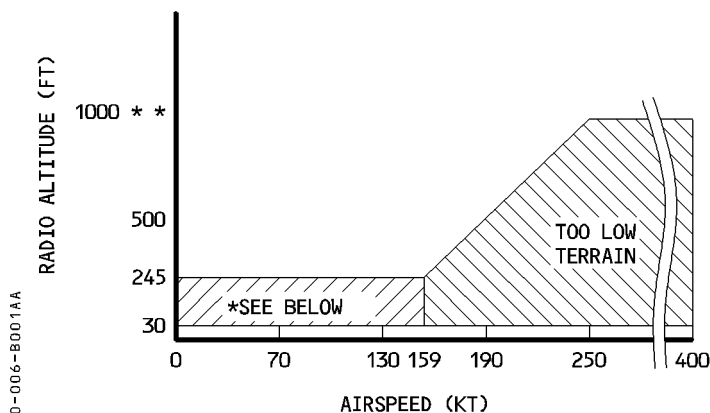
MODE 4 : UNSAFE TERRAIN CLEARANCE

4A - Landing gear up, and flaps not in landing configuration.



Two aural warnings may be triggered, depending on the area : "TOO LOW-GEAR" or "TOO LOW-TERRAIN".

4B - Landing gear, or flaps not in landing configuration.



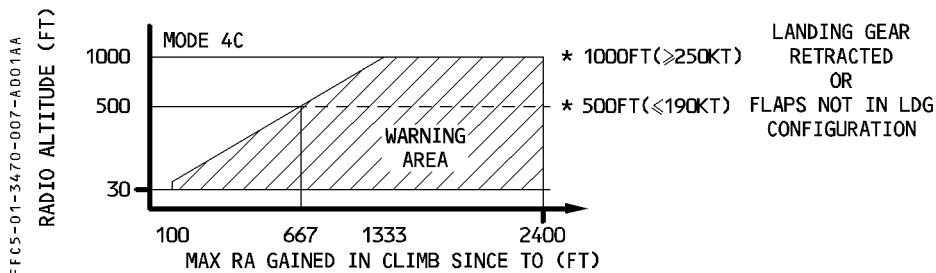
* "TOO LOW-FLAPS" IF FLAPS NOT IN LANDING CONFIGURATION.
 "TOO LOW-GEAR" IF LANDING GEAR RETRACTED.

** OTHER MAXIMUMS ARE USED AT CERTAIN AIRPORTS TO MINIMIZE NUISANCE WARNINGS.

Three aural warnings may be generated, depending on the area and the configuration :
 "TOO LOW-GEAR", "TOO LOW-FLAPS" or "TOO LOW-TERRAIN".

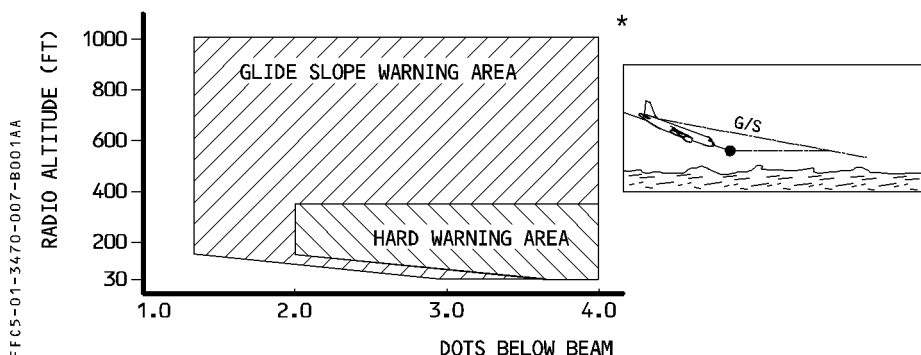
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4 C – Landing gear up of flaps not in landing configuration.



If the aircraft starts an inadvertent controlled flight into the ground during take-off and climb, and penetrates the boundary, then GPWS lights come on and the aural alert “TOO LOW TERRAIN” sounds repeatedly.

MODE 5 : DESCENT BELOW GLIDE SLOPE



Note : *

For certain airports the gear down logic requirement is deleted and other upper limits are used to increase warning envelope.

In both areas the alert is a repeated aural “GLIDE SLOPE” and lighting of both G / S lights. The loudness and the repetition rate of the aural message increase when the aircraft enters the hard warning area. The mode is armed when ILS1 receives a valid signal.

Pressing the GPWS-G/S pushbutton switch cancels the warning. This is temporary and the mode is automatically reactivated for a new envelope penetration. The upper cut-off limit is 1000 feet radio altitude.

The lower cut-off limit is 30 feet radio altitude.

EGPWS FUNCTIONS

TERRAIN AWARENESS AND DISPLAY

The Terrain Awareness and Display (TAD) function computes a caution and a warning envelope ahead the aircraft, according to the aircraft altitude, the nearest runway altitude, the range to the nearest runway threshold, the ground speed and the turn rate. When the boundary of these envelopes conflicts with the terrain memorized in the database, the system generates the relevant alert :

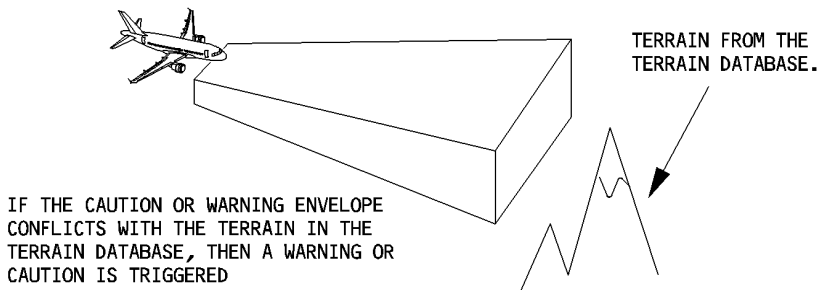
Alert Level	Aural Warning	ND (refer to 1.31.45)	Local Warning
Warning	TERRAIN AHEAD, PULLUP	– automatic terrain display * – Solid red areas – TERR AHEAD (red)	The pb light comes on on each pilot's instrument panel
Caution	TERRAIN AHEAD	– automatic terrain display * – Solid yellow areas – TERR AHEAD (Amber)	

* When the TERR ON ND switch is selected ON, the ND displays the terrain memorized in the database according to the aircraft position, when ARC or ROSE mode is selected. The terrain is displayed in green, yellow, red or magenta and with various density depending on the threat (see 1.31.45, INDICATIONS ON ND). When an alert is generated (either caution or warning) and the TERR ON ND is not selected, the terrain is automatically displayed to be selected and the ON light comes on on the TERR ON ND pushbutton switch.

Note : When TERR ON ND is selected, the weather radar display image is not displayed although the weather radar is ON.

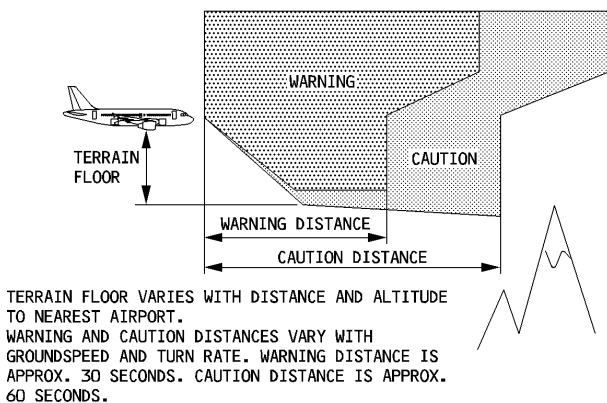
TERRAIN CAUTION AND WARNING ENVELOPE BOUNDARIES

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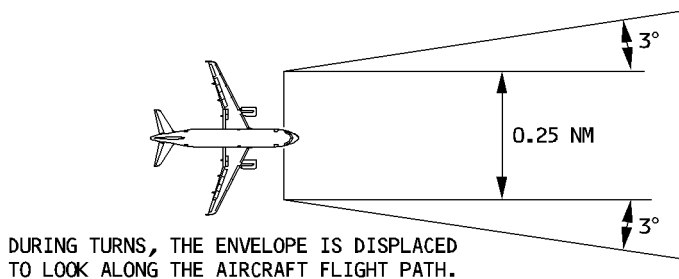
VERTICAL ENVELOPE

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HORIZONTAL ENVELOPE

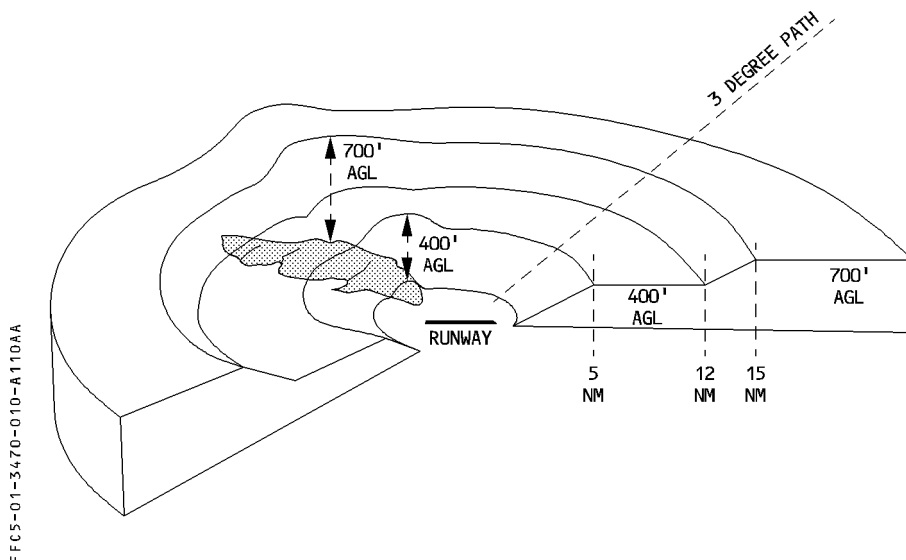
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TERRAIN CLEARANCE FLOOR

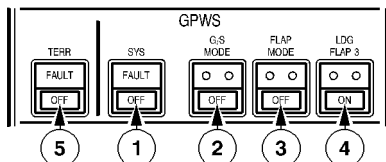
A terrain clearance floor envelope is stored in the database for each runway for which terrain data exist. The Terrain Clearance Floor (TCF) function warns a premature descent below this floor, regardless of aircraft configuration.



If the airplane descends below this floor, a TOO LOW TERRAIN aural warning is annouciated, and the pushbutton light comes on on glareshield.

CONTROLS AND INDICATORS

OVERHEAD PANEL



①SYS pb

- OFF : All basic GPWS alerts (Modes 1 to 5) are inhibited.
- FAULT It : This amber light comes on, along with an ECAM caution, if the basic GPWS Modes 1 to 5 malfunction.

Note : If ILS 1 fails, only Mode 5 is inhibited. Consequently, the FAULT light does not come on, and the GPWS FAULT warning is not triggered.

②G / S MODE pb

- OFF : Glideslope mode (Mode 5) is inhibited.

③FLAP MODE pb

- OFF : Flap mode ("TOO LOW FLAPS", Mode 4) is inhibited. (To avoid nuisance warnings in case of landing with reduced flaps setting).

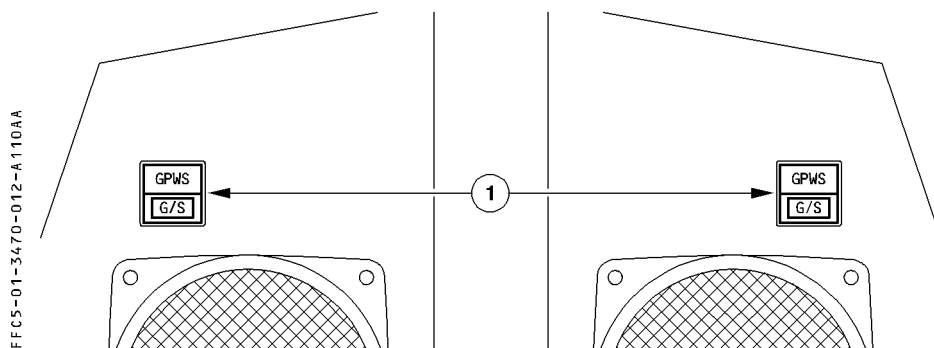
④LDG FLAP 3 pb

- ON : Flap mode is inhibited when FLAPS CONF 3 is selected. (To avoid nuisance warnings in case of landing in CONF 3).
In this case, the LDG MEMO displays FLAPS ... 3, instead of CONF ... FULL.

⑤TERR pb

- OFF : Inhibits the Terrain Awareness Display (TAD) and Terrain Clearance Floor (TCF) modes, and does not affect the basic GPWS Modes 1 to 5. If OFF is selected, the NAV GPWS TERR DET FAULT ECAM caution is displayed.
- FAULT It : This amber light comes on, along with an ECAM caution, if the TAD or TCF mode fails. The terrain is not shown on the ND. The basic GPWS Modes 1 to 5 are still operative, if the SYS pushbutton is OFF, or the FAULT lights are not on.

MAIN INSTRUMENTS PANEL



① GPWS – G/S pb

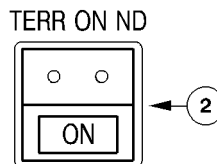
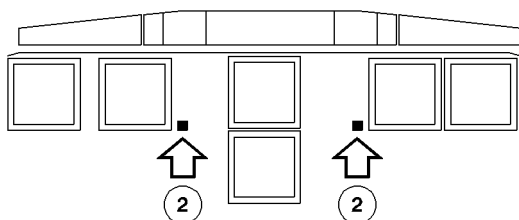
- GPWS : This red light comes on when any mode from 1 to 4 or TAD or TCF alert is activated. The corresponding aural warning sounds.
- G/S : This amber light comes on when mode 5 is activated. The “GLIDE SLOPE” aural warning sounds.

Note : 1. If the flight crew presses this button briefly when a glide slope warning is on, the G/S light goes out and the “GLIDE SLOPE” aural warning (soft or loud) stops.

2. The GPWS can be tested by pressing this pushbutton. If the pushbutton is pressed briefly, some of the aural warnings sound and pushbutton captions, related to the GPWS, come on. If the pushbutton is pressed continuously, then all the aural warnings sound.

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②TERR ON ND pb

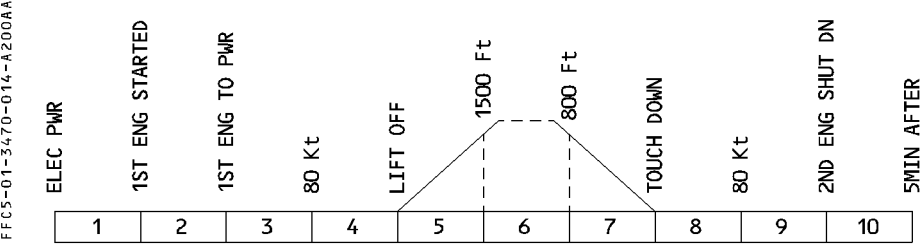
These pushbuttons are located on either side of the ECAM. Each pushbutton controls the inside terrain display.

- ON :
- The terrain is displayed on the ND if :
 - TERR pushbutton is selected ON, and
 - TERR FAULT light is not on.
 - The ON light comes on.
- OFF :
- The terrain data is not displayed on the ND.

Note : • If the Terrain Awareness Display (TAD) mode generates a caution or a warning while the TERR ON ND is not switched ON, the terrain is automatically displayed on the NDs (see EGPWS specific caution and warning due to TAD mode) and the ON light of the TERR ON ND pushbutton will come on.

- To differentiate between the terrain and the weather display, the terrain display sweeps from the center outward to both sides of the ND.

WARNINGS AND CAUTIONS



E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
GPWS FAULT	SINGLE CHIME	MASTER CAUT	NIL	GPWS SYS FAULT It	3, 4, 5, 8
GPWS TERRDETFAULT The enhanced terrain detection function is inoperative. The basic GPWS mode 1 to 5 are still operative.				GPWS TERR FAULT It	1, 3, 4, 5 8,10

MEMO DISPLAY

GPWS FLAP MODE OFF is displayed in green when GPWS FLAP MODE pushbutton switch is OFF. TERR STBY appears in green when the aircraft position accuracy (provided by the FMS) is not sufficient to allow the enhanced TCF and TAD modes to operate. These modes are not available until the TERR STBY memo disappears. If selected, the terrain data display on ND is automatically deselected when the TERR STBY memo is triggered."