

SAFETY NOTICE

SUBJECT: **Guidance for Operators to Ensure Effectiveness of GPWS Equipment**

GENERAL: Safety Notices (SNs) are issued by the Civil Aviation Authority – Macao, China to convey advisory information to Macao aviation entities to enhance safety. SNs contain safety-related recommendations, guidance and/or industrial best practices to specific subjects which may or may not have been addressed by established requirements and regulations.

RELATED REGULATIONS: Fifth Schedule of the Air Navigation Regulation of Macao (ANRM)
AC/OPS/002 – Operations Manual Requirements

APPLICABILITY: This SN applies to all Macao operators who are required to operate aeroplanes equipped with Ground Proximity Warning System (GPWS).

CANCELLATION: This SN is the first SN issued on this subject.

REFERENCES: The following material was referred to for the development of this SN:

- ICAO Regional Aviation Safety Group – Asia and Pacific Regions (RASG-APAC) endorsed safety tools – Guidance for Operators to Ensure Effectiveness of GPWS Equipment
- Cooperative Development of Operational Safety & Continuing Airworthiness Programme – South East Asia (COSCAP-SEA) Advisory Circular CSEA 019

1. Introduction

1.1 Purpose

This Safety Notice is issued to provide information to operators on factors that can reduce the effectiveness of GPWS equipment. It is designed to raise crew awareness and lower the risk of Controlled Flight Into Terrain (CFIT) accidents by reducing the possibility that no warning will be given when a prompt warning is required; as well as reducing the possibility of navigation and position shift errors and the occurrence of false warnings.

2. Background

2.1 Several low-cost but crucial measures can be taken by stakeholders to reduce the likelihood of false GPWS warnings or, more seriously still, the system's failure to provide a valid warning. It is the responsibility of each individual operator to determine the applicability of the contents of this SN to

each aeroplane and GPWS equipment installed, and their operation. Operators should refer to their Aeroplane Flight Manual (AFM) and/or Flight Crew Operating Manual (FCOM) for information applicable to specific configurations. If there should be any conflict between the contents of this SN and those published in the other documents describe above, then information contained in the AFM or FCOM will take precedence over that contained in this SN.

- 2.2 The introduction of GPWS equipment in 1978 resulted in a significant reduction in CFIT accidents. However, CFIT accidents do still occur, not only to those aeroplanes that have no GPWS, but also to GPWS-equipped aeroplanes that encounter terrain rising too rapidly ahead of them or that descend below a safe approach path when in a landing configuration.
- 2.3 A further step was taken with the development of GPWS with a forward looking terrain avoidance function, generally referred to as enhanced GPWS and known in the United States as Terrain Awareness and Warning System (TAWS). With the advent of enhanced GPWS/TAWS in 1996, the number of CFIT accidents involving aircraft equipped with this technology was reduced drastically. However, not all aeroplanes have enhanced GPWS/TAWS equipment installed and there has been several CFIT accidents occurring every year. Accordingly to International Air Transport Association (IATA) Safety Report 2011, 90% of the CFIT accidents were related to aircraft not equipped with enhanced GPWS/TAWS.
- 2.4 In order to derive the greatest safety benefit from GPWS equipage, operators are encouraged to adopt necessary measures and practices as stipulated in this SN.

3. Scope

- 3.1 This SN contains measures that will ensure the effectiveness of GPWS equipment. This SN is designed to lower the risk of CFIT accidents by reducing the possibility that no warning will be given when a prompt warning is required; as well as reducing the possibility of navigation and position shift errors and the occurrence of false warnings.
- 3.2 Unless otherwise stated, the term “GPWS” in this SN refers to a Ground Proximity Warning System enhanced by a forward looking terrain avoidance function.

4. Software Update

- 4.1 Perhaps the most easily rectified shortcoming involves the software utilized by GPWS. Software updates are issued regularly, yet industry sources reveal these are not being implemented by all operators, or are not installed in a timely manner. Aside from the fact updates are often available free of charge from equipment manufacturers, there is ample reason to perform this task since the use of current information is clearly critical to safety.
- 4.2 Application of software updates improves the characteristics of the equipment. Such improvements are possible on the basis of operational experience, and enable warnings in situations that occur closer to the runway threshold where previously it was not possible to provide such warnings.

- 4.3 Without information provided by the latest version of software, operations of GPWS may be compromised in specific situations. The flight crew, who has no convenient means of knowing the software status of the equipment on which they ultimately rely, may have a false sense of confidence in its capability.

5. Database Update

- 5.1 Similarly, it is crucial to regularly update the obstacle, runway and terrain database provided by manufacturers for use with their equipment, since the proper functioning of the GPWS may otherwise be jeopardized. Again, updates are issued for these databases on a regular basis, free of charge by equipment manufacturers. GPWS operation can also be undermined by the lack of suitable navigational input. The equipment was designed to function with a position update system, but not all installations are linked to Global Navigation Satellite System (GNSS) receivers. While the required position data can be acquired by using an effective ground-based navaid network, the most reliable of which is provided by Distance Measuring Equipment (DME)/ Distance Measuring Equipment (DME), such support for area navigation systems is not available everywhere. Use of GNSS, accessible worldwide, eliminates the possibility of position shift, which is another source of false warnings (or worse, the failure to provide a genuine warning).
- 5.2 Collectively, these various shortcomings in the software, databases and procedures that support GPWS operation can degrade the value of the warning system, and clearly call for attention by national regulatory authorities, aircraft operators and manufacturers. To reduce the risk of CFIT as much as possible, countries around the world need to ensure that timely information of required quality on runway thresholds, as well as terrain and obstacle data, are provided for databases in accordance with the common reference systems.

6. Action by operators

- 6.1 In order to obtain the greatest safety benefit from GPWS, operators who are required to operate aeroplane equipped with GPWS should establish certain practices directly related to the equipment in use. This includes:
- (a) Update software to the latest available standard;
 - (b) Update database to the latest available standard;
 - (c) Ensure that the GNSS position is provided to GPWS;
 - (d) Enable the GPWS geometric altitude function (if available);
 - (e) Enable the GPWS peaks and obstacles function (if available); and
 - (f) Implement any applicable service bulletins issued by manufacturers.
- 6.2 It is essential that other measures be undertaken to ensure CFIT prevention through effective use of GPWS. These measures include, but are not limited to: crew training; use of standard operating procedures; crew reporting and operator investigation of spurious warnings; and implementation of a safety management system by the operator.

7. Recommended Actions

- 7.1 Operators are encouraged to note the information contained in this Safety Notice and review their policies, procedures and training to reflect the safety issues contained in this SN.

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