



INTERNATIONAL CIVIL AVIATION ORGANIZATION
ORGANISATION DE L'AVIATION CIVILE INTERNATIONALE
ORGANIZACIÓN DE AVIACIÓN CIVIL INTERNACIONAL
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Subject: ICAO programme for the prevention of controlled flight into terrain (CFIT) — proposals for the revision of the requirements for the predictive terrain hazard warning function of the ground proximity warning system (GPWS) in Annex 6, Parts I and II

Action required: Comments to reach Montreal by 30 September 2001

Sir/Madam,

1. I have the honour to inform you that the Air Navigation Commission, at the third meeting of its 157th Session held on 24 April 2001, completed its preliminary review of proposed amendments to Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes* and Part II — *International General Aviation — Aeroplanes* with respect to the revision of the requirements for the predictive terrain hazard warning function of the ground proximity warning system (GPWS). The Air Navigation Commission authorized the transmittal of these proposals to Contracting States and interested international organizations. The proposed amendments to Annex 6, Parts I and II are in Attachments A and B, respectively.

2. It was noted by the Air Navigation Commission that the United States Federal Aviation Administration (FAA) had provided minimum performance standards (MPS) for terrain awareness and warning systems (TAWS), in Technical Standard Order (TSO), TSO-C151a, dated 29 November 1999. TAWS was a further development of the original GPWS. MPS were provided for two standards of TAWS equipment, Class A and Class B. Both TAWS Class A and Class B provide protection from conflict with terrain and a forward looking terrain avoidance function. The capabilities are based on position information from area navigation, flight path information and a terrain and airport database. The Class A MPS retains all the functions particular to the original GPWS, whereas the Class B MPS does not.

3. It should be noted that the existing ICAO Standards and Recommended Practices which refer to GPWS with or without a predictive terrain warning hazard function, in both Annex 6, Parts I and II, can be satisfied only by TAWS Class A equipment. A tabular presentation of the minimum functions of a GPWS

with forward looking terrain avoidance function, as prescribed by ICAO and as related to TAWS Class A and Class B, is provided in Attachment C.

4. Both the TAWS Class A and Class B MPS equipment eliminate the long standing problem of the original GPWS where, during non-precision instrument approach and landing operations, selection of the landing configuration inhibited the terrain alert and warning functions at normal rates of descent. Both classes of equipment use the aeroplane's current position and flight path information, determined from a suitable navigation source and an airport database, to determine if the aeroplane is hazardously below the normal approach path for the nearest runway.

5. The Class B MPS differs from the Class A MPS in that it does not require a feed from a radio altimeter nor from an air data computer. The Class B equipment is also less expensive, one manufacturer is known to list a price of U.S. \$10 000 for such equipment. Class B equipment can therefore be purchased and installed for considerably less cost than Class A equipment, particularly in aeroplanes where radio altimeters and air data computers are not provided.

6. After considerable investigation, the United States FAA concluded that Class B equipment provided adequate protection from the risk of controlled flight into terrain (CFIT), for some types of operation i.e. commercial passenger-carrying operations with small turbine-engined aeroplanes, with maximum certificated take-off mass (MCTM) 5 700 kg or less and six to nine passenger seats. In addition the FAA requires Class B equipment in all passenger-carrying operations, conducted under Part 91 of the Federal Aviation Regulations, where there were six or more passenger seats.

7. It is expected that the European Joint Aviation Authorities (JAA) will, in the near future, issue JTSO-C151a, Terrain Awareness and Warning System (TAWS), with MPS similar in all respects to the FAA's TSO-C151a.

8. The proposals for the amendment of Annex 6, Parts I and II are as follows:

- a) throughout Part I, 6.15 and Part II, 6.9, revision of the expression "predictive terrain hazard warning function" to read "forward looking terrain avoidance function", for harmonization with the terminology used by the FAA and the JAA (see Attachments A and B);
- b) Annex 6, Part I, 6.15 (see Attachment A):
 - 1) *turbine-engined aeroplanes with MCTM in excess of 5 700 kg or authorized to carry more than nine passengers.* Deletion of the existing Recommended Practice 6.15.7 and replacement with two new Standards, 6.15.4 and 6.15.5, with implementation dates of 1 January 2004 for new aeroplanes and 1 January 2005 for retrofit;
 - 2) *turbine-engined aeroplanes MCTM 5 700 kg or less and authorized to carry more than five but not more than nine passengers.* Introduction of a new Recommended Practice, 6.15.6;
 - 3) *piston-engined aeroplanes MCTM in excess of 5 700 kg or authorized to carry more than nine passengers.* Upgrade of the existing Recommended Practice, 6.15.2 to a new Standard, renumbered as 6.15.7, and amended to require GPWS to the TAWS Class B MPS. An implementation date of 1 January 2005 is proposed; and
 - 4) *GPWS system requirements.* Revision of the text of the existing 6.15.4, renumbered as 6.15.9, to allow the specification of only the GPWS functions related to TAWS Class B where this is necessary, as in the new paragraph 6.15.6 and the renumbered paragraph 6.15.7;

c) Annex 6, Part II, 6.9 (see Attachment B):

- 1) *turbine-engined aeroplanes MCTM in excess of 5 700 kg or authorized to carry more than nine passengers.* Replacement of the existing Standard 6.9.1 and Recommended Practice 6.9.5 by two new Standards, 6.9.1 and 6.9.2. Implementation dates of 1 January 2004 for new aeroplanes and 1 January 2005 for retrofit are proposed;
- 2) *turbine-engined aeroplanes MCTM 5 700 kg or less and authorized to carry more than five but not more than nine passengers.* Introduction of a new Recommended Practice, 6.9.3;
- 3) *piston-engined aeroplanes MCTM in excess of 5 700 kg or authorized to carry more than nine passengers.* The existing Recommended Practice, 6.9.2, is retained and amended. The paragraph is renumbered 6.9.4 with additional text, which provides for the use of GPWS to the TAWS Class B MPS; and
- 4) *GPWS system requirements.* Revision of the existing 6.9.4, renumbered as 6.9.6, to refer only to the GPWS functions related to TAWS Class B. Annex 6, Part II, 6.9, as proposed, refers only to GPWS equipment to the TAWS Class B MPS.

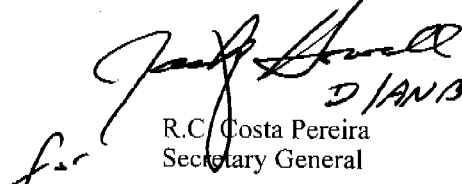
9. In examining the proposed amendments, you should not feel obliged to comment on editorial aspects as such matters will be addressed by the Air Navigation Commission during its final review of the draft amendment.

10. May I request that any comment you may wish to make on the proposed amendments be dispatched to reach me not later than 30 September 2001. The Air Navigation Commission has asked me to specifically indicate that comments received after the due date may not be considered by the Commission and the Council. In this connection, should you anticipate a delay in the receipt of your reply please let me know in advance of the due date.

11. For your information, the proposed amendments to Annex 6, Parts I and II are envisaged for applicability in November 2002. Any comments you may have thereon would be appreciated.

12. The subsequent work of the Air Navigation Commission and the Council would be greatly facilitated by specific statements on the acceptability or otherwise of the amendment proposals. Please note that, for the review of your comments by the Air Navigation Commission and the Council, replies are normally classified as "agreement with or without comments", "disagreement with or without comments" or "no indication of position". If in your reply the expressions "no objections" or "no comments" are used, they will be taken to mean "agreement without comment" and "no indication of position", respectively.

Accept, Sir/Madam, the assurances of my highest consideration.


D I A N B
R.C. Costa Pereira
Secretary General

Enclosures:

- Attachment A — Proposed amendment to Annex 6, Part I
- Attachment B — Proposed amendment to Annex 6, Part II
- Attachment C — Requirements for ICAO GPWS equipment

**NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT
TO ANNEX 6, PART I**

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1. ~~Text to be deleted is shown with a line through it:~~ text to be deleted
2. **New text to be inserted is highlighted with grey shading:** new text to be inserted
3. ~~Text to be deleted is shown with a line through it followed by the replacement text which is highlighted with grey shading.~~ new text to replace existing text

APPENDIX A

PROPOSED AMENDMENT

INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES

OPERATION OF AIRCRAFT

ANNEX 6
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

PART I
INTERNATIONAL COMMERCIAL AIR TRANSPORT — AEROPLANES

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CHAPTER 6. AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

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**6.15 Aeroplanes required to be equipped with
ground proximity warning systems (GPWS)**

6.15.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers shall be equipped with a ground proximity warning system.

(Editorial Note.— Existing paragraphs 6.15.2, 6.15.3 and 6.15.4 relocated as 6.15.7, 6.15.8 and 6.15.9 respectively.)

6.15.5² All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15 000 kg or authorized to carry more than 30 passengers, for which the individual certificate of airworthiness is first issued on or after 1 January 2001, shall be equipped with a ground proximity warning system which has a predictive terrain hazard warning forward looking terrain avoidance function.

6.15.6³ From 1 January 2003, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15 000 kg or authorized to carry more than 30 passengers shall be equipped with a ground proximity warning system which has a predictive terrain hazard warning forward looking terrain avoidance function.

6.15.4 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, for which the individual certificate of

airworthiness is first issued on or after 1 January 2004, shall be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.15.5 From 1 January 2005, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, shall be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.15.6 **Recommendation.** — *All turbine-engined aeroplanes of a maximum certificated take-off mass of 5 700 kg or less and authorized to carry more than five but not more than nine passengers should be equipped with a ground proximity warning system which provides the warnings of 6.15.9-1) and 3), warning of unsafe terrain clearance and a forward looking terrain avoidance function.*

6.15.27 **Recommendation.** — *From 1 January 2005 Aall piston-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers should shall be equipped with a ground proximity warning system which provides the warnings in 6.15.9-1) and 3), warning of unsafe terrain clearance and a forward looking terrain avoidance function.*

6.15.38 A ground proximity warning system shall provide automatically a timely and distinctive warning to the flight crew when the aeroplane is in potentially hazardous proximity to the earth's surface.

6.15.49 A ground proximity warning system shall provide, as a minimum unless otherwise specified herein, warnings of the following circumstances:

- 1) excessive descent rate;
- 2) excessive terrain closure rate;
- 3) excessive altitude loss after take-off or go-around;
- 4) unsafe terrain clearance while not in landing configuration;
 - a) gear not locked down
 - b) flaps not in a landing position; and
- 5) excessive descent below the instrument glide path.

6.15.7 **Recommendation.** — *All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers should be equipped with a ground proximity warning system which has a predictive terrain hazard warning function.*

**NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT
TO ANNEX 6, PART II**

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1. ~~Text to be deleted is shown with a line through it.~~ text to be deleted
2. ~~New text to be inserted is highlighted with grey shading.~~ new text to be inserted
3. ~~Text to be deleted is shown with a line through it followed by the replacement text which is highlighted with grey shading.~~ new text to replace existing text

PROPOSED AMENDMENT TO
INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES
OPERATION OF AIRCRAFT

ANNEX 6
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

PART II
INTERNATIONAL GENERAL AVIATION — AEROPLANES

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CHAPTER 6. AEROPLANE INSTRUMENTS AND EQUIPMENT

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6.9 Aeroplanes required to be equipped with
ground proximity warning systems (GPWS)

~~6.9.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers shall be equipped with a ground proximity warning system.~~

6.9.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, for which the individual certificate of airworthiness is first issued on or after 1 January 2004, shall be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.9.2 From 1 January 2005, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, shall be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.9.3 **Recommendation.**— *All turbine-engined aeroplanes of a maximum certificated take-off mass of 5 700 kg or less and authorized to carry more than five but not more than nine passengers should be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.*

6.9.24 **Recommendation.**— *All piston-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers should be equipped with a ground proximity warning system which provides a forward looking terrain avoidance function.*

6.9.35 A ground proximity warning system shall provide automatically a timely and distinctive warning to the flight crew when the aeroplane is in potentially hazardous proximity to the earth's surface.

6.9.46 A ground proximity warning system shall provide warnings of at least the following circumstances:

- 1) excessive descent rate;
- 2) ~~excessive terrain closure rate;~~
- 3) excessive altitude loss after take-off or go-around; ~~and~~
- 4) unsafe terrain clearance; ~~while not in landing configuration;~~
 - a) ~~gear not locked down;~~
 - b) ~~flaps not in a landing position; and~~
- 5) ~~excessive descent below the instrument glide path.~~

~~6.9.5 **Recommendation.** — All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, should be equipped with a ground proximity warning system which has a predictive terrain hazard warning function.~~

**REQUIREMENTS FOR ICAO GPWS EQUIPMENT RELATED TO THE FAA'S TSO-C151A
MINIMUM PERFORMANCE STANDARDS FOR TAWS CLASS A AND CLASS B**

TAWS Class A	TAWS Class B
<p>ICAO requirements for GPWS equivalent to the FAA's TAWS Class A specification Proposed Annex 6, Part I, 6.15.9</p>	<p>ICAO requirements for GPWS equivalent to the FAA's TAWS Class B specification. Proposed Annex 6, Part II, 6.9.6 and as specified in the proposed Annex 6, Part I, 6.15.6 and 6.15.7</p>
Excessive descent rate	Excessive descent rate
Excessive terrain closure rate	
Excessive altitude loss after take-off or go-around	Excessive altitude loss after take-off or go-around
<p>Unsafe terrain clearance while not in the landing configuration: a) gear not locked down b) flaps not in the landing position</p>	Unsafe terrain clearance
Excessive descent below the instrument glide path	
Forward looking terrain avoidance	Forward looking terrain avoidance

— END —