



AIR NAVIGATION COMMISSION

ANC Task No. CNS-7901: Conflict resolution and collision avoidance systems

**PRELIMINARY REVIEW OF PROPOSED AMENDMENTS TO
ANNEX 6, PART II TO INCLUDE PROVISIONS CONCERNING
ACAS II EQUIPAGE AND PILOT TRAINING**

(Presented by the Director of the Air Navigation Bureau)

SUMMARY

This paper presents proposals for amendments to Annex 6, Part II, relating to the carriage of airborne collision avoidance system (ACAS II) equipment, and associated training requirements for pilots. The proposals concerning equipage arise from the need for alignment of the relevant provisions in Annex 6, Parts I and II, to enhance the effectiveness of airborne collision avoidance systems. The proposal concerning training of pilots of general aviation aeroplanes equipped with ACAS II is consequential to changes introduced by Amendment 12 to PANS-OPS, Volume I, to strengthen and clarify ACAS II operating procedures.

Action by the Air Navigation Commission is in paragraph 5.

COORDINATION

ATM, CNS, LEB, PEL/TRG, RAO

REFERENCES

- | | |
|------------------------------|--|
| *Annex 6, Parts I and II | Doc 7030, <i>Regional Supplementary Procedures</i> |
| Annex 10, Volume IV | |
| Doc 8168, PANS-OPS, Volume I | AN-CONF/11 Report (yellow cover) |
| Doc 4444, PANS-ATM | |

*Principal references

1. INTRODUCTION

1.1 Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes*, Appendix 2, paragraph 2.1.31 requires operations manuals to contain training requirements for the avoidance of collisions and the use of the airborne collision avoidance system (ACAS II). In contradistinction, neither Annex 6, Part II — *International General Aviation — Aeroplanes*, nor the *Regional Supplementary Procedures* (Doc 7030) specifies a requirement for pilot training in relation to ACAS II. This paper proposes amendment of Annex 6, Part II to include pilot training requirements in relation to ACAS II.

1.2 In light of a growing practice by manufacturers of large business aircraft to include ACAS II as standard equipment in their aeroplanes, and in view of the continuing role of ACAS II in present and future air traffic safety management systems, the paper also considers the question of equipage with ACAS II for international general aviation aeroplanes.

2. PILOT TRAINING IN THE OPERATION AND USE OF ACAS II

2.1 Modern turbine-engined general aviation aeroplanes designed for long range operations are increasingly manufactured with ACAS II as standard equipment, and routinely operate in the same airspace as international commercial air transport aeroplanes equipped with ACAS II. The ability of ACAS II to fulfil its role as a proven, independent safety net to prevent mid-air collisions is dependent upon the correct and timely execution of the necessary operational procedures by flight crews involved in an ACAS-ACAS encounter. Flight crews of general aviation aeroplanes used in international operations and equipped with ACAS II, therefore, must be appropriately trained in the operation and use of the equipment in accordance with the procedures specified in the *Procedures for Air Navigation Services — Aircraft Operations*, Volume I — *Flight Procedures* (Doc 8168, PANS-OPS) and the *Procedures for Air Navigation Services — Air Traffic Management* (Doc 4444, PANS-ATM).

2.2 In the context of the above, Recommendation 1/16 of the report of the Eleventh Air Navigation Conference (AN-CONF/11) proposed that ICAO should review current provisions and investigate the need to develop new provisions to enhance the effectiveness of ACAS, including provisions in Annex 6, Part II concerning training of general aviation pilots in the operation of ACAS.

2.3 The term “operator” as defined in Annex 6, Part I is also relevant to Part II of the Annex but the concept is not reflected in Part II, mainly because of difficulties caused by the fact that the operator of a general aviation aeroplane can be one of several different entities, depending on the nature of the flight. Consequently it has been impractical to specify a requirement in Annex 6, Part II for every operator of a general aviation aeroplane to:

- a) provide an operations manual;
- b) establish and maintain a ground and flight training programme, approved by the State of the Operator, which ensures that all flight crew members are adequately trained to perform their assigned duties; and

- c) conduct pilot proficiency checks, to ensure that piloting technique and the ability to execute emergency manoeuvres is checked in such a way as to demonstrate the pilot's competence.

2.4 Nevertheless, the responsibilities of the pilot-in-command of a general aviation aeroplane in relation to the qualifications and competence of the flight crew, as specified in Annex 6, Part II, Chapter 9, can be expanded to address pilot training requirements for ACAS II. The specification in paragraph 9.1 concerning the continued competence of flight crew members in regard to their licence privileges, can be broadened by the addition of a new specification requiring the pilot-in-command to ensure that each flight crew member of an aeroplane equipped with ACAS II has been appropriately trained to competency in the avoidance of collisions and the use of the airborne collision avoidance system. The proposed requirement is not intended to make the pilot-in-command responsible for the provision of such training, but is intended to ensure verification by the pilot-in-command, before flight, that each pilot has completed appropriate training and has demonstrated competency in the use of ACAS II. The regulation and oversight of pilot training for this purpose is a matter for States, taking into account the ACAS II training guidelines for pilots contained in PANS-OPS, Volume I, Part VIII, Attachment A.

2.5 It is proposed to amend the Standard in Annex 6, Part II, paragraph 9.1 by the addition of a new requirement for the pilot-in-command to ensure that each flight crew member of an aeroplane equipped with ACAS II has been appropriately trained to competency, as shown in the appendix to this paper.

3. EQUIPAGE WITH ACAS II

3.1 Annex 6, Part I, paragraph 6.18.1 requires equipage with ACAS II from 1 January 2003, for all turbine-engined aeroplanes of a maximum certificated take-off mass (MCTM) in excess of 15 000 kg or authorized to carry more than thirty passengers. From 1 January 2005, the ACAS II equipage requirement in Annex 6, Part I is extended to all turbine-engined aeroplanes in excess of 5 700 kg MCTM or authorized to carry more than nineteen passengers. In contrast, Annex 6, Part II contains no provision for carriage of ACAS II by aeroplanes used in international general aviation operations. From 1 January 2003, unless exempted by the appropriate authorities, these aeroplanes are required to be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provisions of Annex 10 — *Aeronautical Telecommunications*, Volume IV — *Surveillance Radar and Collision Avoidance Systems*. The purpose of the transponder requirement is to support the effectiveness of ACAS as well as to improve the effectiveness of air traffic services.

3.2 The effectiveness of ACAS II in preventing collisions is enhanced as the number of equipped aeroplanes increases, because in an ACAS-ACAS encounter, resolution advisories (RAs) complement each other in order to reduce the potential for collision. Where only one of the aeroplanes in an encounter is equipped with ACAS II, collision avoidance manoeuvring information generated by ACAS II is available only to the flight crew of the ACAS II-equipped aeroplane, while the flight crew of the other aeroplane may be entirely unaware of the situation. Collision avoidance may then depend solely on a correct and timely response by the flight crew of the ACAS II-equipped aeroplane.

3.3 ACAS II is specified in the *Regional Supplementary Procedures* (Doc 7030) for the AFI, EUR, and NAT Regions, and for a number of Flight Information Regions (FIRs) in the MID Region, as a requirement for all operations by turbine-engined aeroplanes in excess of 15 000 kg MCTM or with an approved passenger seating capacity of thirty or more. In each instance, no distinction is made between commercial and general aviation operations. On 1 January 2005, the requirement will be broadened in the

AFI, EUR and NAT Regions, and in the affected FIRs of the MID Region, to apply to all turbine-engined aeroplanes above 5 700 kg MCTM or authorized to carry more than nineteen passengers, for all operations. In contradistinction, States in the CAR, NAM, PAC and SAM Regions have not currently specified different equipage requirements from those in Annex 6, Part I. As explained in Doc 7030, Foreword, paragraph 2, requirements in Regional Supplementary Procedures must not conflict with provisions contained in the Annexes or PANS. To qualify as permissible additions to provisions in Annexes and PANS, requirements in Doc 7030 that are more demanding than those in Annexes or PANS must either specify detailed procedural regional options of those provisions, or promulgate a regional procedure of justifiable operational significance, additional to existing provisions in Annexes or PANS. Such provisions in Doc 7030 concerning the carriage of ACAS II therefore must be appropriately justified on operational safety grounds.

3.4 The preparedness of some States to require equipage ahead of the global applicability date for larger aeroplanes used in international commercial operations, and on a much broader scale than currently specified in Annex 6, Part I, indicates that implementation of ACAS II is viewed by those States as an essential independent component of the third layer of air traffic management (ATM) conflict management referred to in the AN-CONF/11 Report on Agenda Item 1 concerning future ATM systems. The more stringent ACAS II equipage requirements also indicate recognition by those States of the value of airborne collision avoidance equipment to safety. ACAS II has an important continuing role for the foreseeable future, in conjunction with developing concepts such as the airborne separation assistance system (ASAS) and the use of automatic dependent surveillance-broadcast (ADS-B).

3.5 A global standard in terms of ACAS II equipage for general aviation operations may be timely, and would assist in minimizing difficulties caused by the existence of vastly different equipage requirements in different regions. A global standard specifying the carriage of ACAS II for international operations in aeroplanes above 15 000 kg MCTM would undoubtedly enhance the level of operational safety for these aeroplanes at little or no additional cost to purchasers, and would also strengthen the provisions in the regional supplementary procedures.

3.6 A global standard requiring ACAS II for international operations in general aviation aeroplanes over 5 700 kg MCTM but not exceeding 15 000 kg would further enhance safety because of the number of aeroplanes in this group, which is estimated to comprise half of the world business jet fleet. ICAO does not possess information from States concerning the extent of international operations by these aeroplanes, but they are thought to contribute a large proportion of international operations in some regions. However, the cost of equipage would represent a greater proportion of the cost of aeroplanes between 5 700 kg and 15 000 kg MCTM, as compared with aircraft over 15 000 kg.

3.7 ACAS II is the only airborne collision avoidance system for which International Standards, Recommended Practices and guidance material are available. As indicated in Annex 10 — *Aeronautical Telecommunications, Volume IV — Surveillance Radar and Collision Avoidance Systems*, ACAS I is not intended for international implementation and standardization by ICAO. The Annex 10 specifications for ACAS I could be reviewed and amended as appropriate to provide for international standardization and implementation of ACAS I as an alternative to ACAS II. However, the safety benefit likely to be obtained from ACAS I equipage would fall far short of that obtained from ACAS II, because ACAS I cannot provide coordinated resolution advisories to assist in collision avoidance, and can only provide traffic advisories to assist alerted see and avoid collision avoidance.

3.8 The cost of retrofitting with ACAS II may represent a significant proportion of the value of the aeroplane; therefore it is considered that any new provisions concerning equipage should apply only to new aeroplanes in order to provide manufacturers with ample time to design their aeroplanes for standard equipage with ACAS II, if necessary, and ample time for operators to plan their fleet replacements.

3.9 A new Standard 6.15.1 is proposed for Annex 6, Part II, requiring equipage with ACAS II for all turbine-engined general aviation aeroplanes above 15 000 kg MCTM or authorized to carry more than thirty passengers, for which the individual airworthiness certificate is first issued after 1 January 2007. The proposal aligns Part II of the Annex with the corresponding ACAS II equipage requirement in Part I to the extent possible, and the proposed applicability date provides appropriate notification to the general aviation industry. The proposed new Standard is presented in the appendix.

3.10 A new Recommended Practice 6.15.2 is also proposed, specifying equipage with ACAS II for all turbine-engined general aviation aeroplanes above 5 700 kg MCTM but not exceeding 15 000 kg MCTM, or authorised to carry more than nineteen passengers, for which the individual airworthiness certificate is first issued after 1 January 2008. The proposal aligns Part II of the Annex with Part I to the extent possible, and applies the provision to new aeroplanes only, with an applicability date that provides appropriate advance notification for the general aviation industry. The proposed new Recommended Practice is presented in the appendix.

4. **APPLICABILITY DATE**

4.1 In view of its importance and relevance to safety, the common applicability date of 24 November 2005 is proposed for the amendment to Annex 6, Part II.

5. **ACTION BY THE AIR NAVIGATION COMMISSION**

5.1 The Air Navigation Commission is invited to:

- a) review the material in this paper and the proposals for the amendment of Annex 6, Part II, contained in the appendix;
- b) agree that the proposed amendments to Annex 6, Part II in the appendix, as may be modified by a) above, be circulated to States and appropriate international organizations for comments, with a proposed applicability date of 24 November 2005; and
- c) request the Secretary to present the results of the consultation in b) above for final review by the Commission in its 167th Session.
