European Union Aviation Safety Agency

# Notice of Proposed Amendment 2023-04

**in accordance with**
**Article 6(1) of MB Decision No 01-2022**

# Implementation of the regulatory needs in support of the SESAR deployment

## Introduction of ACAS Xa for operations in the single European sky (SES) airspace & PBN specifications for oceanic operations

RMT.0682


**EXECUTIVE SUMMARY**

This Notice of Proposed Amendment (NPA) addresses two different subject matters in support of operations in the single European sky (SES): the use of airborne collision avoidance system (ACAS) Xa and the harmonised use of performance-based navigation (PBN) navigation specifications for oceanic operations.

ACAS Xa is one of the Single European Sky ATM Research (SESAR) solutions that has been standardised and adopted as an International Civil Aviation Organization (ICAO) standard that aims to increase the already high level of safety in air traffic management (ATM).

In addition to proposing a regulatory change to enable the use of ACAS Xa in the SES airspace, this NPA includes regulatory changes proposing the introduction of the ACAS X technical specification order and the installation requirements for ACAS II and ACAS Xa. Air operations guidance material is also proposed to be amended to reflect the ACAS X operations and to ensure consistency with other regulatory provisions. The proposed amendments on ACAS X are expected to increase safety, transpose related ICAO Standards and Recommended Practices (SARPs) and improve harmonisation.

To ensure an effective transition to a PBN operational environment in the SES airspace, this NPA also proposes amendments to the airspace usage requirements in Regulation (EU) 2018/1048 to transpose additional ICAO PBN specifications in support of oceanic and remote continental operations, in particular the RNP 4 and RNAV 10 specifications. The guidance material to the Regulation is also proposed to be amended to be consistent with the regulatory requirements.


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|---|---|---|---|
| **Domain:** | New technologies and concepts | | |
| **Related rules:** | Regulation (EU) No 1332/2011 (ACAS), Regulation (EU) 1048/2018 (PBN), Regulation (EU) 2017/373 (ATM/ANS), Regulation (EU) No 965/2012 (Air OPS), the related AMC & GM, CS-ACNS, CS-ETSO, AMC 20-15 | | |
| **Affected stakeholders:** | Providers of ATM/ANS (ANSPs); air operators; aircraft and system/equipment manufacturers; national competent authorities (NCAs)/national supervisory authorities (NSAs), EASA | | |
| **Driver:** | Safety | **Rulemaking group:** | No |
| **Impact assessment:** | Yes | | |

**EASA rulemaking procedure milestones**

| **Start**<br>Terms of Reference | **Public consultation**<br>NPA 2023-04 | **Proposal to the Commission**<br>EASA Opinion | Adoption by the Commission<br>Implementing act | **Decision**<br>Certification Specifications, Acceptable Means of Compliance, Guidance Material |
|---|---|---|---|---|
| 10.12.2019 | 26.5.2023 | 2023 | 2024 | 2024 |





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# 1. About this NPA

## 1.1. How this NPA was developed

The European Union Aviation Safety Agency (EASA) developed this NPA in line with Regulation (EU) 2018/1139[1] (the 'Basic Regulation') and the Rulemaking Procedure[2]. This Rulemaking Task (RMT).0682 is included in Volume II of the European Plan for Aviation Safety (EPAS) for 2023-2025[3] for which the scope and overall timescales are defined in the related Terms of Reference (ToR)[4].

The regulatory proposal related to the introduction of new technologies for airborne collision avoidance have been developed in coordination with the Federal Aviation Administration (FAA) and with the assistance of Eurocontrol subject matter experts.

The PBN-related regulatory proposal has been developed by EASA, with relevant data provided by ENAIRE[5] and the Network Manager to develop the contents of Appendix 1.

The major milestones of this RMT are presented on the cover page.

## 1.2. How to comment on this NPA

The NPA is hereby submitted to all interested parties for consultation in accordance with Article 115 of the Basic Regulation, and Article 6(1) of the Rulemaking Procedure.

Please submit your comments using the automated **Comment-Response Tool (CRT)** available at **http://hub.easa.europa.eu/crt/**[6].

The deadline for the submission of comments is **28 August 2023**.

## 1.3. The next steps

Following the NPA public consultation, EASA will assess all the comments received and, if necessary, further review the subject regulatory proposal. As a result of this process, EASA may issue an Opinion including a proposal for amendment to Commission Regulation (EU) 2017/373[7], Commission

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1 Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91 (OJ L 212, 22.8.2018, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1535612134845&uri=CELEX:32018R1139).

2 EASA is bound to follow a structured rulemaking process as required by Article 115(1) of Regulation (EU) 2018/1139. Such a process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 01-2022 of 2 May 2022 on the procedure to be applied by EASA for the issuing of opinions, certification specifications and other detailed specifications, acceptable means of compliance and guidance material ('Rulemaking Procedure'), and repealing Management Board Decision No 18-2015 (https://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-01-2022-rulemaking-procedure-repealing-mb).

3 European Plan for Aviation Safety 2023-2025 | EASA (europa.eu)

4 ToR RMT.0682

5 https://www.enaire.es/home_en

6 In case of technical problems, please send an email to crt@easa.europa.eu with a short description.

7 Commission Implementing Regulation (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulation (EC) No 482/2008, Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377 and amending Regulation (EU) No 677/2011 (OJ L 62, 8.3.2017, p. 1) (https://eur-lex.europa.eu/search.html?scope=EURLEX&text=2017%2F373&lang=en&type=quick&qid=1681895295434).

Regulation (EU) No 1332/2011[8], and Commission Regulation (EU) 2018/1048[9]. The Opinion will be submitted to the European Commission which shall consider its content and decide whether to issue amendments to the related Regulations.

Following publication of the regulation introducing amendments to the aforementioned Regulations, EASA will publish a Decision to amend the related AMC and GM to support the implementation of the amended requirements.

It should be noted that a Decision on the introduction of ACAS X in CS-ACNS[10] and CS-ETSO[11] is not conditioned by the publication of the amended Regulations, rather by the need to assist the industry and permit certification for operations outside the SES.

[8] Commission Regulation (EU) No 1332/2011 of 16 September 2011 laying down common airspace usage requirements and operating procedures for airborne collision avoidance (OJ L 336 20.12.2011, p. 20) (https://eur-lex.europa.eu/search.html?scope=EURLEX&text=1332%2F2011&lang=en&type=quick&qid=1681895358065).

[9] Commission Implementing Regulation (EU) 2018/1048 of 18 July 2018 laying down airspace usage requirements and operating procedures concerning performance-based navigation (OJ L 189, 26.7.2018, p. 3) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R1048&qid=1681895433823).

[10] ED Decision 2022/008/R of 22 March 2022 issuing the following: Issue 4 of the Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance 'CS-ACNS – Issue 4' (https://www.easa.europa.eu/en/document-library/agency-decisions/ed-decision-2022008r).

[11] ED Decision 2022/018/R of 31 August 2022 issuing the following: 'CS-ETSO — Amendment 17' (https://www.easa.europa.eu/en/document-library/agency-decisions/ed-decision-2022018r)

# 2. In summary — why and what

## 2.1. Why we need to amend the rules — issue/rationale

This NPA addresses two separate issues:

— the use of ACAS Xa in the SES airspace, and

— the harmonised use of oceanic PBN specifications in the SES airspace.

### 2.1.1. Enable the use of ACAS Xa in the SES airspace and update the regulatory framework to align it with the latest ICAO Annex 10 Volume IV Amdt 91 changes

#### 2.1.1.1 Enabling the use of ACAS Xa in the SES airspace

Amendment 91 to the International Standards and Recommended Practices, Aeronautical Telecommunications — Surveillance and Collision Avoidance Systems (Annex 10, Volume IV to the Convention on International Civil Aviation) introduced the airborne collision avoidance system X (ACAS X) as an alternate to the TCAS II collision avoidance logic version 7.1 (TCAS II version 7.1). It should be noted that in Annex 10 Volume IV, ICAO refers to TCAS II version 7.1 as TCAS version 7.1. Furthermore, ICAO refers to both ACAS X and TCAS version 7.1 as ACAS II systems.

The following EU requirements are relevant for enabling the ACAS Xa use:

— Commission Regulation (EU) No 1332/2011 (the ACAS Regulation): Article 3 'Airborne collision avoidance system' and its Annex (Part-ACAS) currently allow only the use of ACAS II collision avoidance logic version 7.1 (ACAS II version 7.1);

— Commission Regulation (EU) No 965/2012[12] (the Air OPS Regulation): points CAT.IDE.A.155, NCC.IDE.A.140 and SPO.IDE.A.131 refer to the airspace requirements defined in Commission Regulation (EU) No 1332/2011;

— Commission Regulation (EU) No 452/2014[13]: point TCO.205 states that when undertaking operations within the airspace above the territory to which the Treaty applies, third-country operators shall equip their aircraft with and operate such navigation, communication and surveillance equipment as required in that airspace. Within the SES airspace, the relevant applicable rule for this purpose is the ACAS Regulation.

The ACAS Regulation and the Air OPS Regulation refer either directly or indirectly (through the reference to the ACAS Regulation) specifically to ACAS II version7.1. Therefore, unless the airspace requirements defined in the ACAS Regulation are amended, aircraft of European and non-European operators equipped with ACAS X will not be permitted to access the SES airspace.

ACAS X includes ACAS Xa (active surveillance), Xo (operation specific) and other versions supporting specific applications. However, as only the validation of ACAS Xa was considered for operation in the

[12] Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296 25.10.2012, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012R0965&qid=1681899568892).

[13] Commission Regulation (EU) No 452/2014 of 29 April 2014 laying down technical requirements and administrative procedures related to air operations of third country operators pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 133 6.5.2014, p. 12) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0452&qid=1681899646487).

SES airspace at this time, this regulatory proposal concerns only the permission to use ACAS Xa within the SES airspace and provides alignment of the EU regulatory framework with the ICAO SARPs concerning the use of ACAS Xa.

#### 2.1.1.2 Provide certification specifications for the installation of ACAS and in particular ACAS Xa

It is necessary that EASA provides aircraft certification specifications that respond to stakeholders' needs.

Certification Specification and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance (CS-ACNS), currently at Issue 4, does not contain a section defining the certification specifications and means of compliance for the installation of ACAS.

Furthermore, EASA currently only provides regulatory material relevant to ACAS in AMC 20-15[14] on certification considerations for ACAS with optional hybrid surveillance (TCAS II). Therefore, there is a need to provide certification specifications for the installation of the ACAS II equipment (which includes TCAS II version 7.1 and ACAS Xa). Since the AMC 20-15 content is focused on airworthiness and through the current proposal it has been transferred to CS-ACNS, it is proposed that the AMC 20-15 to be cancelled.

#### 2.1.1.3 Provide a technical specification order for ACAS X

In the Certification Specifications for European Technical Standard Orders (CS-ETSO) there is currently no technical specification order for ACAS X. There is a need to update CS-ETSO and provide the technical specifications for ACAS X.

#### 2.1.1.4 Update Commission Regulation (EU) 2017/373 to align with ICAO Annex 10 Volume IV up to Amdt 91

Point CNS.TR.100 (d) of Commission Regulation (EU) 2017/373 stipulates the requirements for CNS providers and refers to ICAO Annex 10 Volume IV on surveillance radar and collision avoidance systems in its 4th edition of July 2007, including all amendments up to and including No 89.

Such reference needs however to be updated, as Amendments 90 and 91 to ICAO Annex 10 Vol IV have since been adopted; in particular, Amendment 91 introduces the ICAO provisions enabling the use of ACAS Xa. Therefore, this reference needs to be synchronised with the latest ICAO amendments.

#### 2.1.1.5 Update other documentation

The existing guidance material related to the Air OPS Regulation needs to be updated for alignment with the other proposed amendments allowing the use of ACAS Xa. Such updates refer primarily to the ACAS flight crew training programme.

### 2.1.2. Changes to PBN airspace usage requirements

Commission Regulation (EU) 2018/1048 (the PBN Regulation) requires the deployment of PBN approach procedures, standard instrument departures (SIDs), standard instrument arrival routes (STARs), and ATS routes for the en-route phase of flight. Such PBN routes and approach procedures are to be implemented in the SES airspace by providers of air traffic management/air navigation services (ATM/ANS) and aerodrome operators.

[14] Airworthiness Certification Considerations for the Airborne Collision Avoidance System (ACAS II) with optional Hybrid Surveillance (https://www.easa.europa.eu/en/downloads/1694/en)

Following the discussion with Member States at meeting 1-2021 of the ATM/ANS TeB, EASA agreed to evaluate potential amendments to the PBN Regulation in response to the following issues:

Point 6 of AUR.PBN.2005 of the Annex to the PBN Regulation requires the implementation of ATS routes in accordance with the requirements of the RNAV 5 specification for all SES en route operations. The RNAV 5 specification was developed to support operations in continental airspace; however, SES also has oceanic airspace. In this regard, EASA's attention was drawn to the fact that, for instance, in the vicinity of the Canary Islands, there is an oceanic sector where there are some ATS routes already designed in accordance with the RNAV 10 specification. Unlike RNAV 5, RNAV 10 was developed to support the implementation of routes in oceanic (and remote continental) airspace; however, the existing routes are not compliant with the PBN Regulation, thus forcing the service provider to implement routes based on an ICAO specification that was not designed for oceanic applications.

Point 5 of AUR.PBN.2005 of the Annex to the PBN Regulation prescribes the use of the RNP 1 specification together with some additional navigation functionalities. In particular, the use of, at least, one of the functionalities listed in point 5 was made mandatory, which could be incompatible with the required operations. However, a minor correction would allow the use of such functionalities only where necessary, i.e. subject to local needs instead of mandatory implementation.

Apart from the above changes, at meeting 1-2022 of the ATM/ANS TeB, EASA discussed a change to the EASA GM to the PBN Regulation. In particular, EASA explained that GM1 to Article 5 would need to be revised, as part of the text is not fully aligned with the PBN Regulation; in particular, the present text argues that, at locations at which SBAS approaches cannot offer CAT I minima, other instrument approach procedures (e.g. based on ILS) may be retained; however, it is important to clarify that ILS CAT I procedures cannot be retained and used in normal conditions (outside PBN contingencies) indefinitely, but only until the deadline imposed by the PBN Regulation, i.e. 6 June 2030.

As for Article 5 of the PBN Regulation, alignment with Regulation (EU) 2021/2237[15] is also necessary. This Regulation became applicable on 30 October 2022 to amend the Air OPS Regulation (EU); in particular, it deletes points (13) to (16) of Annex I to the Air OPS Regulation, which contained the definitions for CAT I, CAT II, CAT IIIA, and CAT IIIB. Regulation (EU) 2021/2237 has replaced these definitions with point (120e), which is consistent with the new ICAO approach classification and no longer differentiates between CAT IIA and CAT IIIB operations, but simply refers to CAT III operations instead. If Article 5 is not amended in line with the amendments made to the Air OPS Regulation (EU), the PBN Regulation would point at definitions of Category III operations that no longer exist, thus adding to confusion.

In July 2022, EASA informed the EASA ATM/ANS TeB and TEC Members that the EC and EASA had concluded that GBAS landing systems (GLS) CAT I procedures were outside the scope of the PBN Regulation and, therefore, they could be used in normal conditions and without limitations after 6 June 2030. Hence, the existing references to GLS CAT I procedures in EASA GM to the PBN Regulation may lead to misinterpretations regarding their use.

As for the implications of the mandatory use of RNAV 5 in oceanic airspace, a simplified impact assessment, commensurate with the consequences of the change, has been included in Appendix 1

[15] Commission Implementing Regulation (EU) 2021/2237 of 15 December 2021 amending Regulation (EU) No 965/2012 as regards the requirements for all-weather operations and for flight crew training and checking (OJ L 450, 16.12.2021, p. 21) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R2237&qid=1681906635721).

(see Chapter 7). This assessment concludes that the PBN Regulation should be amended to permit the use of oceanic specifications for the sake of safety.

The other amendments just introduce minor corrections, whose impact is negligible; therefore, no further assessment is necessary.

## 2.2. What we want to achieve — objectives

The primary objectives of the EASA system are defined in Article 1 of the Basic Regulation; specific objectives are detailed in Sections 2.2.1 and 2.2.2.

### 2.2.1. Enabling the use of ACAS Xa avionics in the SES airspace

The objectives of this proposal are to:

— support harmonisation of the EU regulatory framework with the subject matter ICAO SARPs, including with other regions (i.e. USA).

— enable the safe use of ACAS Xa in the SES airspace and thus prevent inappropriate limitations for ACAS Xa-equipped aircraft to the access of SES airspace;

— reflect the state of the art and best industry practices by introducing the ACAS X technical specification as part of CS-ETSO as well as the ACAS II installations requirements as part of CS-ACNS.

### 2.2.2. Changes to PBN airspace usage requirements

The primary objectives of the proposal are to:

— avoid a potential safety regression linked to the mandatory use of the RNAV 5 specification in airspace other than continental airspace;

— harmonise the use of ICAO navigation specifications that were specifically designed to support operations in oceanic and remote continental airspace; and

— promote the use of the radius to fix (RF) functionality and/or altitude constraints together with RNP 1 SID and STAR in a flexible manner, i.e. only where necessary.

## 2.3. How we want to achieve it — overview of the proposed amendments

### 2.3.1. Enable the use of ACAS Xa in the SES airspace and update the EASA regulatory framework to align it with the latest ICAO Annex 10 Volume IV Amdt 91

Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 and 3.7 of this NPA propose changes to various regulations, acceptable means of compliance and guidance material and certification specifications. The subsections are organised consistent with the way the issues were presented in Section 2.1.

#### 2.3.1.1 Enable the use of ACAS Xa avionics in the SES airspace

It is proposed to update AUR.ACAS.1005 'Performance requirement' of Annex (Part-ACAS) to the ACAS Regulation, to remove the specific reference to ACAS II collision logic version 7.1. The proposed text will only refer to ACAS II.

Since in accordance with ICAO Annex 10 Volume IV Amdt 91, both ACAS Xa and TCAS II version 7.1 are considered ACAS II, referring to ACAS II at the implementing rule level complemented by a relevant

AMC detailing ACAS II, will allow operators equipped with either ACAS Xa or TCAS II version 7.1 to access and operate within the SES airspace.

It is proposed to add an AMC to AUR.ACAS.1005 'Performance requirement' to specify the acceptable ACAS II equipment and the relevant installation requirements.

AMC1 AUR.ACAS.1010 is proposed to be amended to update the references.

It is proposed that aircraft equipped with TCAS II version 7.1 installations certified in accordance with AMC 20-15, or installations that comply with CS-ACNS Subpart D — Surveillance (SUR), Section 5 – Airborne Collision Avoidance System, are considered compliant with the provisions of AUR.ACAS.1005.

#### 2.3.1.2 Update Air OPS guidance material to support ACAS X operations

It is proposed to add new guidance material (GM1 CAT.IDE.A.155, GM1 NCC.IDE.A.140 and GM1 SPO.IDE.A.131) to clarify that both ACAS X and TCAS II version 7.1 are considered ACAS II systems.

It is proposed to update the following guidance material: GM1 CAT.OP.MPA.295, GM1 NCC.OP.220 and GM1 SPO.OP.205 to:

— take into account the provisions of the ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual which has been updated to include ACAS X;

— take into account the changes introduced by ACAS X into the ACAS flight crew training programmes in various paragraphs;

— further align the ACAS flight crew training programmes with regard to the use of TA-only mode with the provisions of point (a) of SERA.11014 of Commission Regulation (EU) No 923/2012[16] (the SERA Regulation).

It should be noted that the Air OPS guidance material above refers to ACAS X in general (which includes ACAS Xa and ACAS Xo). Thus, the proposal adds guidance for European operators operating outside the SES airspace, where the use of ACAS X may not be limited only to ACAS Xa.

#### 2.3.1.3 Provide certification specifications for the installation of ACAS and in particular ACAS X

CS-ACNS is proposed to be amended to mainly incorporate a new Section 5 'Airborne Collision Avoidance System' into Subpart D (SUR) of CS-ACNS. This new section introduces the certification specifications and acceptable means of compliance and guidance material for ACAS II (TCAS II version 7.1 and ACAS Xa) installations.

It should be noted that the CS-ACNS proposal requires ACAS II version 7.1 with hybrid surveillance, with equipment authorisation ETSO-C119e. ETSO-C119e has been already published and included in the CS-ETSO Amendment 17.

For ACAS Xa, the necessary equipment authorisation is proposed to be defined by the newly introduced ETSO-C219a — see Section 3.6 of this NPA. Both proposals for CS-ACNS and ETSO-C219a

[16] Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010 (OJ L 281, 13.10.2012, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012R0923&qid=1681983926077).

refer to the EUROCAE standard ED-256 at Revision A. ED-256 Revision A is currently under consultation[17] and further details are provided in Section 2.3.1.4.

It should be noted that the proposed NPA states that the ACAS (including ACAS X) installation approval requires minimum performance levels for Mode S transponder defined in the relevant part of CS-ACNS Subpart D on Surveillance (SUR).

It is proposed to revise, for consistency reasons, certain definitions included in CS ACNS.A.GEN.005 'Definitions'.

Aircraft documentation is proposed to be revised to indicate ACAS II equipage options e.g. TCAS II version 7.1 or ACAS Xa. The difference in equipage may result in some additional features being made available to the flight crew.

AMC 20-15 on Certification considerations for the Airborne Collision Avoidance System (ACAS II) with optional Hybrid Surveillance is proposed to be cancelled, as the installation requirements for ACAS II (including ACAS Xa) are proposed to be provided in a new Section 5 'Airborne Collision Avoidance System' of Subpart D (SUR) of CS-ACNS.

#### 2.3.1.4 Provide the technical specification order for ACAS X

In CS-ETSO there is currently no technical specification order for ACAS X. There is a need to update CS-ETSO and provide the related certification specifications. It should be noted that 'ACAS X' in the proposed ETSO-C219a defines the technical specifications for ACAS Xa/Xo equipment. This ETSO references EUROCAE ED-256A Minimum Operational Performance Standards (MOPS) for Airborne Collision Avoidance System X (ACAS Xa and ACAS Xo).

As stated in the previous section, ED-256 Revision A is under consultation and the standard's publication is expected in Q3 2023. ED-256 Revision A incorporates various change proposals, including change proposal (CP01) of the algorithm tested and validated for suitability for the European airspace. Following the ED-256 Revision A publication, EASA will issue a decision on CS-ETSO (ETSO-C219a) which will support the issuance of a Decision on CS-ACNS. It should be noted that the revision of ETSO-C219 is proposed to be 'a', for consistency with corresponding to be revised in the future FAA TSO.

#### 2.3.1.5 Update Commission Regulation (EU) 2017/373 to align with the ICAO Annex 10 Volume IV latest amendment

Point (d) of CNS.TR.100 of Regulation (EU) 2017/373 is proposed to be updated by introducing the reference to the latest amendment to ICAO Annex 10 Volume IV on surveillance radar and collision avoidance systems which introduces ACAS X.

### 2.3.2. Changes to PBN airspace usage requirements

Section 3.7 contains changes to the PBN Regulation and the related EASA GM. The proposed amendments to the PBN Regulation will:

— permit the use of the ICAO RNAV 10 or RNP 4 navigation specifications in oceanic and remote continental airspace;

[17] https://www.eurocae.net/news/posts/2022/november/eurocae-open-consultation-ed-256a-vol-ii/

— remove the obligations that impose the use of the RF functionality or altitude constraints together with RNP 1 SID and STAR, so that the design of the routes is consistent with the local performance and operational needs; and

— ensure alignment with the current definition of CAT III operations, as per the Air OPS Regulation.

It is also proposed that the EASA GM to Article 5 is amended to:

— make clear that, at those locations where SBAS approaches cannot offer CAT I minima, other instrument approach procedures based on ILS or MLS can be retained and used in normal conditions until 5 June 2030, and, in the event of contingencies, also afterwards; and

— delete the existing references to GLS CAT I procedures, as those procedures are not within the scope of the PBN Regulation and, therefore, remain unaffected, so any references to them may be misleading.

As for the changes proposed to the EASA GM, in July 2022, EASA revised its replies to frequently asked questions (FAQ) on PBN Regulation implementation in line with the above proposal.

Table 1 summarises the changes proposed to address the issues presented in Section 2.1.2.

**Table A: 'Summary of PBN related changes'**

| ***Reference*** | ***Proposed change*** |
|---|---|
| PBN Regulation | Inclusion of ICAO RNAV 10 and RNP 4 specifications for oceanic ATS routes |
| PBN Regulation | Use of the RF and/or altitude constraints for RNP 1 routes, only where and if necessary |
| PBN Regulation | Update of the references made in Article 5 of the PBN Regulation to the definitions in Annex I to the Air OPS Regulation |
| EASA GM | Clarification on the deadline for use of ILS/MLS approaches down to CAT I minima in normal conditions |
| EASA GM | Removal of references to GLS CAT I procedures |

## 2.4. What are the expected benefits and drawbacks of the proposed amendments

The expected benefits and drawbacks of the proposed amendments are summarised in the sections below.

### 2.4.1. Enabling the use of ACAS Xa avionics

Technology is continuously evolving and thus certification requirements need to evolve to ensure that equipment installed on aircraft meets the latest and safest standards and benefit from the most advanced technological solutions.

As regards the use of ACAS Xa within the SES airspace, two options were proposed: a voluntary equipage and a mandatory implementation of ACAS Xa. The safety benefit from the upgrade from TCAS II version 7.1 to ACAS Xa was not proven to justify a mandate. Therefore, at this time, it is proposed that operators should be able to either opt for equipage with ACAS Xa or continue using TCAS II version 7.1; the continued operation of aircraft equipped with either TCAS II version 7.1 or ACAS Xa is being considered acceptable.

The analysis of the impacts concluded that the use of ACAS Xa in the SES airspace brings an overall safety benefit. Nonetheless, a limited cost is incurred by operators and ANSPs.

For the regulatory impact assessment on the introduction of ACAS X, please refer to Chapter **Error! Reference source not found.**.

### 2.4.2. Changes to the PBN airspace usage requirements

The existing oceanic routes in the SES airspace have already been designed as RNAV 10 (RNP 10) routes, hence they can remain published and unchanged. Therefore, the proposal will:

— keep consistency between aircraft's performance requirements (the PBN specification) and the navigational performance required for the intended operations;

— result in no economic impacts, whereas the legitimate use of RNAV 10 (or RNP 4 for future routes) will maintain the high level of safety in operations along oceanic routes.

Other changes proposed are, in general, expected to improve clarity and, in particular, preserve flexibility and coherency of SID/STAR route design with operational needs, if based on the RNP 1 specification.

The proposed amendments to the PBN airspace usage requirements are of a non-controversial nature, have a negligible impact on operations, and affect a limited volume of the SES airspace. No drawbacks are expected to result from the proposed changes, but enhanced requirements resulting from EASA's discussions with stakeholders.

A simplified impact assessment regarding the use of oceanic specifications has been included in Appendix 1 (See Chapter 7).

# 3. Proposed amendments and rationale

The amendment is arranged to show deleted, new or amended, and unchanged text as follows:

— deleted text is ~~struck through~~;

— new or amended text is highlighted in blue;

— an ellipsis '[…]' indicates that the rest of the text is unchanged.

Where necessary, the rationale is provided in *blue italics.*

## 3.1. Proposed amendment to Regulation (EU) 2017/373

## CNS.TR.100 Working methods and operating procedures for providers of communication, navigation or surveillance services

A communication, navigation or surveillance services provider shall be able to demonstrate that its working methods and operating procedures are compliant with the standards of Annex 10 to the Chicago Convention on aeronautical telecommunications in the following versions as far as they are relevant to the provision of communication, navigation or surveillance services in the airspace concerned:

[…]

(d) Volume IV on surveillance radar and collision avoidance systems in its 5th~~4th~~ edition of July 2014~~07~~, including all amendments up to and including No ~~89~~ 91;

[…]

***Rationale***

*This proposed amendment aligns the reference to ICAO Annex 10 Volume IV with the latest Amendment 91 which provides ACAS X standards and specifications.*

## 3.2. Proposed amendments to Regulation (EU) No 1332/2011 and related AMC

**Airborne collision avoidance systems (ACAS) II**

**(Part-ACAS)**

## AUR.ACAS.1005 Performance requirement

(1) The following turbine-powered aeroplanes shall be equipped with ~~collision avoidance logic version 7.1 of~~ an ACAS II:

(a) aeroplanes with a maximum certificated take-off mass exceeding 5 700 kg;

(b) aeroplanes authorised to carry more than 19 passengers.

(2) Aircraft not referred to in point 1 but which are equipped on a voluntary basis with a collision avoidance system shall be equipped with an ACAS II ~~shall have collision avoidance logic version 7.1~~.

(3) Point 1 shall not apply to unmanned aircraft systems.

***Rationale***

*The proposed amendment enables the access to the SES airspace for aircraft equipped with ACAS II. By removing the specific link to ACAS II version 7.1 in the implementing rule, the proposed text enables the use in the SES airspace of both TCAS II version 7.1 and of ACAS Xa which are both ACAS II in accordance with ICAO Annex 10 Vol IV Amdt 91.*

## AMC1 AUR.ACAS.1005 Performance requirement

An ACAS II should be either:

(a) a TCAS II collision avoidance logic version 7.1 (TCAS II version 7.1)

TCAS II version 7.1 installations certified in accordance with AMC 20-15, or installations certified in accordance with CS-ACNS Subpart D — Surveillance (SUR), Section 5 – Airborne Collision Avoidance System, are considered acceptable; or

(b) an ACAS Xa

ACAS Xa installations certified in accordance with CS-ACNS Subpart D — Surveillance (SUR), Section 5 – Airborne Collision Avoidance System, are considered acceptable.

Aircraft installations of third-country operators (TCOs) that operate within the single European sky airspace, should comply with standards referred to in points (a) or (b) or their equivalent, as applicable.

***Rationale***

*The proposed amendment establishes that within the context of this Regulation ACAS II are considered to be either TCAS II with software version 7.1 or ACAS Xa. It should be noted that out of the ACAS X family, only ACAS Xa has been validated in the SES airspace.*

## AMC1 AUR.ACAS.1010 ACAS II operational procedures and training

The ACAS II operational procedures and training programmes established by the operator should take into account ~~the guidance material contained in~~:

(a) ICAO PANS-OPS[1], Volume 1 Flight Procedures, Attachment A (ACAS Training Guidelines for Pilots) and Attachment B (ACAS High Vertical Rate Encounters) to Part III, Section 3, Chapter 3; and

(b) ~~ICAO PANS-ATM[2] Chapters 12 and 15, in regard to ACAS phraseology and applicable procedures. Commission~~SERA.11014 ACAS resolution advisory (RA) for applicable procedures and Appendix 1 to AMC1 SERA.14001 General for phraseology, as per the Annex to Regulation (EU) No 923/2012.

1 ICAO Doc 8168-OPS/611 - PANS-OPS (Procedures for Air Navigation Services-Aircraft Operations), Volume I - Flight Procedures — ~~Fifth~~Sixth edition amendment ~~4~~10.



An agency of the European Union

~~2 ICAO Doc 4444-ATM/501 - PANS-ATM (Procedures for Air Navigation Services-Air Traffic Management) Fifteenth edition amendment 3.~~

***Rationale***

*The references in points (a) and (b) have been updated.*

## GM1 AUR.ACAS.1010 operational procedures and training

Additional information on procedures and training for ACAS can be found in ICAO PANS-ATM[1] Chapter 15.

1 ICAO Doc 4444-ATM/501 - PANS-ATM (Procedures for Air Navigation Services-Air Traffic Management) Sixteenth Edition, Amendment 11.

***Rationale***

*Additional information on ACAS operational procedures and training can be found in ICAO PANS-ATM.*

### 3.3. Draft amendments to the AMC & GM to Regulation (EU) No 965/2012

## GM1 CAT.IDE.A.155 Airborne collision avoidance system (ACAS)

ACAS X and TCAS II version 7.1 are considered to be ACAS II as defined in ICAO Annex 10.

***Rationale***

*New guidance material is proposed to clarify what constitutes an ACAS II. The GM refers to TCAS II version 7.1 and ACAS X. With regard to ACAS X, in the SES airspace only ACAS Xa has been validated.*

## GM1 NCC.IDE.A.140 Airborne collision avoidance system (ACAS)

ACAS X and TCAS II version 7.1 are considered to be ACAS II as defined in ICAO Annex 10.

***Rationale***

*New guidance material is proposed to clarify what constitutes an ACAS II. The GM refers to TCAS II version 7.1 and ACAS X. With regard to ACAS X, in the SES airspace only ACAS Xa has been validated.*

## GM1 SPO.IDE.A.131 Airborne collision avoidance system (ACAS)

ACAS X and TCAS II version 7.1 are considered to be ACAS II as defined in ICAO Annex 10.

***Rationale***

*New guidance material is proposed to clarify what constitutes an ACAS II. The GM refers to TCAS II version 7.1 and ACAS X. With regard to ACAS X, in the SES airspace only ACAS Xa has been validated.*

# GM1 CAT.OP.MPA.295 Use of airborne collision avoidance system (ACAS)

**GENERAL**

(a) The ACAS operational procedures and training programmes established by the operator should take into account this GM. It incorporates advice contained in:

(1) ICAO Doc 8168 (PANS-OPS), Volume III Aircraft Operating Procedures, Chapter 3 and Attachment A (ACAS training guidelines for pilots) and Attachment B (ACAS high vertical rate (HVR) encounters) to Section 4, Chapter 3; and

(2) ICAO PANS-ATM Chapters 12 and 15 phraseology requirements;

(3) ICAO Annex 10, Volume IV;

(4) ICAO PANS-ATM; and~~.~~

(5) ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual

[…]

**ACAS FLIGHT CREW TRAINING PROGRAMMES**

[…]

(e) The information provided is valid for TCAS II version ~~7 and~~ 7.1 and ACAS Xa (ACAS II). Where differences arise, these are identified.

[…]

(g) ACAS academic training

[…]

(2) Essential items

(i) Theory of operation. The flight crew member should demonstrate an understanding of the ACAS II operation and the criteria used for issuing TAs and RAs. This training should address the following topics:

(A) System operation

Objective: to demonstrate knowledge of how ACAS functions.

Criteria: the flight crew member should demonstrate an understanding of the following functions:

(a) Surveillance

(1) ACAS interrogates other transponder-equipped aircraft within a nominal range of 14 NM.

(2) ACAS-compliant systems may use ADS-B broadcast data from intruder aircraft.

~~(2)~~(3) ACAS surveillance range can be reduced in geographic areas with a large number of ground interrogators and/or ACAS II-equipped aircraft. A minimum surveillance range of 8.3 km (4.5 NM) is guaranteed for ACAS aircraft that are airborne.

~~(3)~~(4) If the operator's ACAS implementation provides for the use of the Mode S extended squitter, the normal surveillance range may be increased beyond the nominal 14 NM. However, this information is not used by TCAS II version 7.1 for collision avoidance purposes.

(b) Collision avoidance

(1) TAs can be issued against any transponder-equipped aircraft ~~which responds to the ICAO Mode C interrogations~~, even if the aircraft does not have altitude reporting capability. For ACAS X-compliant systems, TAs can also be issued against an aircraft transmitting ADS-B only (no active transponder replies), in which case the TA will not turn into an RA (ADS-B only TA-only (AOTO) mode). This functionality is optional.

(2) RAs can be issued only against aircraft that are reporting altitude and in the vertical plane only.

(3) RAs issued against an ACAS-equipped intruder are co-ordinated to ensure complementary RAs are issued.

(4) For ACAS X-compliant systems, special operational modes (Xo) can be selected against a designated intruder. In this case, the timing of RAs and types of RAs can be different from those operating in normal Xa mode. This functionality is not implemented in all ACAS X installations; if installed, the ACAS Xo capability should not be used in the single European sky airspace.

(~~4~~5) Failure to respond to an RA deprives own aircraft of the collision protection provided by own ACAS.

(~~5~~6) Additionally, in ACAS-ACAS encounters, failure to respond to an RA also restricts the choices available to the other aircraft's ACAS and thus renders the other aircraft's ACAS less effective than if own aircraft were not ACAS-equipped.

[…]

(ii) Operating procedures

[…]

(B) Display interpretation

[…]

(h) RAs (RA display): flight crew members should demonstrate knowledge of the meaning of the red and green areas or the meaning of pitch or flight path angle cues displayed on the RA display. Flight crew members should also demonstrate an understanding of the RA display limitations, i.e. if a vertical speed tape is used and the range of the tape is less than 2 500 ft/min, an increase rate RA cannot be properly displayed; ~~and~~

(i) AOTO TAs (for ACAS X compliant systems). If enabled on their aircraft, pilots should demonstrate knowledge about the AOTO (ADS-B only — TA-only) TA, which is depicted with a symbol different from that of a normal TA. Pilots need to be aware of the fact that AOTO TAs will not turn into an RA if the threat increases; and

(~~i~~j) if appropriate, awareness that navigation displays oriented on 'Track-Up' may require a flight crew member to make a mental adjustment for drift angle when assessing the bearing of proximate traffic.

(C) Use of the TA-only mode

Objective: to verify that a flight crew member understands the appropriate times to select the TA-only mode of operation and the limitations associated with using this mode.

Criteria: the flight crew member should demonstrate the following:

(a) Knowledge of the operator's guidance for the use of TA-only.

(b) Reasons for using this mode, if not prohibited by the applicable airspace requirements or in the event of particular flight failures or performance-limiting conditions as specified in the AFM: If TA-only is not selected when an airport is conducting simultaneous operations from parallel runways separated by less than 1 200 ft, and to some intersecting runways, RAs can be expected. If for any reason TA-only is not selected and an RA is received in these situations, the ~~response should comply with the operator's approved procedures~~ pilot should follow the RA.

(c) All TA aural annunciations are inhibited below 500 ft AGL. As a result, TAs issued below 500 ft AGL may not be noticed unless the TA display is included in the routine instrument scan.

[…]

(h) ACAS manoeuvre training

[…]

(E) When visual acquisition is attained, and as long as no RA is received, normal right-of-way rules should be used to maintain or attain safe separation. No unnecessary manoeuvres should be initiated. The limitations of making manoeuvres based solely on visual acquisition, especially at high altitude or at night, or without a definite horizon should be demonstrated as being understood.

(F) For ACAS X-compliant systems, recognition of AOTO TA (if enabled on aircraft) and demonstrating appropriate action.

[…]

(i) ACAS initial evaluation

(2) The flight crew member's understanding of the manoeuvre training items should be assessed in a full flight simulator equipped with an ACAS display and controls similar in appearance and operation to those in the aircraft the flight crew member will fly, and the results assessed by a qualified instructor, inspector, or check airman. The range of scenarios should include: corrective RAs; initial preventive RAs; maintain rate RAs; altitude crossing RAs; increase rate RAs; RA reversals; weakening RAs; and multi-threat encounters~~.~~; for ACAS X-compliant systems, AOTO TAs (if enabled on aircraft). The scenarios should also include demonstrations of the consequences of not responding to RAs, slow or late responses, and manoeuvring opposite to the direction called for by the displayed RA.

***Rationale***

*To add relevant information about ACAS X and align with the SERA provisions.*

## GM1 NCC.OP.220 Airborne collision avoidance system (ACAS)

**GENERAL**

(a) The ACAS operational procedures and training programmes established by the operator should take into account this Guidance Material. It incorporates advice contained in:

(1) ICAO Annex 10, Volume IV;

(2) ICAO Doc 8168 (PANS-OPS), Volume III; and

(3) ICAO PANS-ATM~~.~~; and

(4) ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual

[…]

[…]

**ACAS FLIGHT CREW TRAINING**

[…]

(e) The information provided is valid for TCAS II version ~~7 and~~ 7.1 and ACAS Xa (ACAS II). Where differences arise, these are identified.

[…]

(g) ACAS academic training

[…]

(2) Essential items

(i) Theory of operation. The flight crew member should demonstrate an understanding of the ACAS II operation and the criteria used for issuing TAs and RAs. This training should address the following topics:

(A) System operation

Objective: to demonstrate knowledge of how ACAS functions.

Criteria: the flight crew member should demonstrate an understanding of the following functions:

(a) Surveillance

(1) ACAS interrogates other transponder-equipped aircraft within a nominal range of 14 NM.

(2) ACAS-compliant systems may use ADS-B broadcast data from intruder aircraft.

~~(2)~~(3) ACAS surveillance range can be reduced in geographic areas with a large number of ground interrogators and/or ACAS II-equipped aircraft. A minimum surveillance range of 8.3 km (4.5 NM) is guaranteed for ACAS aircraft that are airborne.

~~(3)~~(4) If the operator's ACAS implementation provides for the use of the Mode S extended squitter, the normal surveillance range may be increased beyond the nominal 14 NM. However, this information is not used by TCAS II version 7.1 for collision avoidance purposes.

(b) Collision avoidance

(1) TAs can be issued against any transponder-equipped aircraft ~~which responds to the ICAO Mode C interrogations~~, even if the aircraft does not have altitude reporting capability. For ACAS X-compliant systems, TAs can also be issued against an aircraft transmitting ADS-B only (no active transponder replies), in which case the TA will not turn into an RA (ADS-B only TA-only (AOTO) mode). This functionality is optional.

(2) RAs can be issued only against aircraft that are reporting altitude and in the vertical plane only.

(3) RAs issued against an ACAS-equipped intruder are co-ordinated to ensure complementary RAs are issued.

(4) For ACAS X-compliant systems, special operational modes (Xo) can be selected against a designated intruder. In this case, the timing of RAs and types of RAs can be different from those operating in normal Xa mode. This functionality is not

implemented in all ACAS X installations; if installed, the ACAS Xo capability should not be used in the single European sky airspace.

(~~4~~5) Failure to respond to an RA deprives own aircraft of the collision protection provided by own ACAS.

(~~5~~6) Additionally, in ACAS-ACAS encounters, failure to respond to an RA also restricts the choices available to the other aircraft's ACAS and thus renders the other aircraft's ACAS less effective than if own aircraft were not ACAS-equipped.

[…]

(ii) Operating procedures

[…]

(B) Display interpretation

[…]

(i) AOTO TAs (for ACAS X compliant systems). If enabled on their aircraft, pilots should demonstrate knowledge about the AOTO (ADS-B only — TA-only) TA, which is depicted with a symbol different from that of a normal TA. Pilots need to be aware of the fact that AOTO TAs will not turn into an RA if the threat increases.

(j) If appropriate, awareness that navigation displays oriented on 'Track-Up' may require a flight crew member to make a mental adjustment for drift angle when assessing the bearing of proximate traffic.

(C) Use of the TA-only mode

Objective: to verify that a flight crew member understands the appropriate times to select the TA-only mode of operation and the limitations associated with using this mode.

Criteria: the flight crew member should demonstrate the following:

(a) Knowledge of the operator's guidance for the use of TA-only.

(b) Reasons for using this mode, if not prohibited by the applicable airspace requirements or in the event of particular flight failures or performance-limiting conditions as specified in the AFM: If TA-only is not selected when an airport is conducting simultaneous operations from parallel runways separated by less than 1 200 ft, and to some intersecting runways, RAs can be expected. If for any reason TA-only is not selected and an RA is received in these situations, the ~~response should comply with the operator's approved procedures~~ pilot should follow the RA.

(c) All TA aural annunciations are inhibited below 500 ft AGL. As a result, TAs issued below 500 ft AGL may not be noticed unless the TA display is included in the routine instrument scan.

[…]

(h) ACAS manoeuvre training

[…]

(E) When visual acquisition is attained, and as long as no RA is received, normal right-of-way rules should be used to maintain or attain safe separation. No unnecessary manoeuvres should be initiated. The limitations of making manoeuvres based solely on visual acquisition, especially at high altitude or at night, or without a definite horizon should be demonstrated as being understood.

(F) For ACAS X-compliant systems, recognition of AOTO TA (if enabled on aircraft) and demonstrating appropriate action.

[…]

(i) ACAS initial evaluation

[…]

(2) The flight crew member's understanding of the manoeuvre training items should be assessed in a full flight simulator equipped with an ACAS display and controls similar in appearance and operation to those in the aircraft the flight crew member will fly, and the results assessed by a qualified instructor, inspector, or check airman. The range of scenarios should include: corrective RAs; initial preventive RAs; maintain rate RAs; altitude crossing RAs; increase rate RAs; RA reversals; weakening RAs; and multi-threat encounters~~.~~; for ACAS X-compliant systems, AOTO TAs (if enabled on aircraft). The scenarios should also include demonstrations of the consequences of not responding to RAs, slow or late responses, and manoeuvring opposite to the direction called for by the displayed RA.

***Rationale***

*To add relevant information about ACAS X and align with the SERA provisions.*

# GM1 SPO.OP.205 Airborne collision avoidance system (ACAS)

**GENERAL**

(a) The ACAS operational procedures and training programmes established by the operator should take into account this Guidance Material. It incorporates advice contained in:

(1) ICAO Annex 10, Volume IV;

(2) ICAO Doc 8168 (PANS-OPS), Volume III; ~~and~~

(3) ICAO PANS-ATM~~.~~; and

(4) ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual

[…]

**ACAS FLIGHT CREW TRAINING**

[…]

(e) The information provided is valid for TCAS II version ~~7 and~~ 7.1 and ACAS Xa (ACAS II). Where differences arise, these are identified.

[…]

(g) ACAS academic training

[…]

(2) Essential items

(i) Theory of operation. The flight crew member should demonstrate an understanding of ACAS II operation and the criteria used for issuing TAs and RAs. This training should address the following topics:

(A) System operation

Objective: to demonstrate knowledge of how ACAS functions.

Criteria: the flight crew member should demonstrate an understanding of the following functions:

(a) Surveillance

(1) ACAS interrogates other transponder-equipped aircraft within a nominal range of 14 NM.

(2) ACAS-compliant systems may use ADS-B broadcast data from intruder aircraft.

~~(2)~~(3) ACAS surveillance range can be reduced in geographic areas with a large number of ground interrogators and/or ACAS II-equipped aircraft. A minimum surveillance range of 8.3 km (4.5 NM) is guaranteed for ACAS aircraft that are airborne.

~~(3)~~(4) If the operator's ACAS implementation provides for the use of the Mode S extended squitter, the normal surveillance range may be increased beyond the nominal 14 NM. However, this information is not used TCAS II version 7.1 for collision avoidance purposes.

(b) Collision avoidance

(1) TAs can be issued against any transponder-equipped aircraft ~~which responds to the ICAO Mode C interrogations,~~ even if the aircraft does not have altitude reporting capability. For ACAS X-compliant systems, TAs can also be issued against an aircraft

transmitting ADS-B only (no active transponder replies), in which case the TA will not turn into an RA (ADS-B only TA-only (AOTO) mode). This functionality is optional.

(2) RAs can be issued only against aircraft that are reporting altitude and in the vertical plane only.

(3) RAs issued against an ACAS-equipped intruder are co-ordinated to ensure complementary RAs are issued.

(4) For ACAS X-compliant systems, special operational modes (Xo) can be selected against a designated intruder. In this case, the timing of RAs and types of RAs can be different from those operating in normal Xa mode. This functionality is not implemented in all ACAS X installations; if installed, the ACAS Xo capability should not be used in the single European sky airspace.

(~~4~~5) Failure to respond to an RA deprives own aircraft of the collision protection provided by own ACAS.

(~~5~~6) Additionally, in ACAS-ACAS encounters, failure to respond to an RA also restricts the choices available to the other aircraft's ACAS and thus renders the other aircraft's ACAS less effective than if own aircraft were not ACAS-equipped.

[…]

(ii) Operating procedures

[…]

(B) Display interpretation

[…]

(i) AOTO TAs (for ACAS X compliant systems). If enabled on their aircraft, pilots should demonstrate knowledge about the AOTO (ADS-B only — TA-only) TA, which is depicted with a symbol different from that of a normal TA. Pilots need to be aware of the fact that AOTO Tas will not turn into an RA if the threat increases.

(j) If appropriate, awareness that navigation displays oriented on ‘Track-Up’ may require a flight crew member to make a mental adjustment for drift angle when assessing the bearing of proximate traffic.

(C) Use of the TA-only mode

Objective: to verify that a flight crew member understands the appropriate times to select the TA-only mode of operation and the limitations associated with using this mode.

Criteria: the flight crew member should demonstrate the following:

(a) Knowledge of the operator’s guidance for the use of TA-only.

(b) Reasons for using this mode, if not prohibited by the applicable airspace requirements or in the event of particular flight failures or performance-limiting conditions as specified in the AFM: If TA-only is not selected when an airport is conducting simultaneous operations from parallel runways separated by less than 1 200 ft, and to some intersecting runways, RAs can be expected. If for any reason TA-only is not selected and an RA is received in these situations, the ~~response should comply with the operator's approved procedures~~ pilot should follow the RA.

(c) All TA aural annunciations are inhibited below 500 ft AGL. As a result, TAs issued below 500 ft AGL may not be noticed unless the TA display is included in the routine instrument scan.

[…]

(h) ACAS manoeuvre training

[…]

(E) When visual acquisition is attained, and as long as no RA is received, normal right-of-way rules should be used to maintain or attain safe separation. No unnecessary manoeuvres should be initiated. The limitations of making manoeuvres based solely on visual acquisition, especially at high altitude or at night, or without a definite horizon should be demonstrated as being understood

(F) For ACAS X-compliant systems, recognition of AOTO TA (if enabled on aircraft) and demonstrating appropriate action.

[…]

(i) ACAS initial evaluation

(2) The flight crew member's understanding of the manoeuvre training items should be assessed in a full flight simulator equipped with an ACAS display and controls similar in appearance and operation to those in the aircraft the flight crew member will fly, and the results assessed by a qualified instructor, inspector, or check airman. The range of scenarios should include: corrective RAs; initial preventive RAs; maintain rate RAs; altitude crossing RAs; increase rate RAs; RA reversals; weakening RAs; and multi-threat encounters~~.~~; for ACAS X-compliant systems, AOTO TAs (if enabled on aircraft). The scenarios should also include demonstrations of the consequences of not responding to RAs, slow or late responses, and manoeuvring opposite to the direction called for by the displayed RA.

***Rationale***

*To add relevant information about ACAS X (i.e. ACAS ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual), adapt the 'ACAS FLIGHT CREW TRAINING' to include ACAS X, and align the training on operating procedures, 'Use of TA-only mode', with the SERA provisions.*

## 3.4. Draft amendment to the General Acceptable Means of Compliance for Airworthiness of Products, Parts and Appliances (AMC-20)

TABLE OF CONTENT



[…]

SUBPART A - GENERAL

# ~~AMC 20-15 Airworthiness Certification Considerations for the Airborne Collision Avoidance System (ACAS II) with optional Hybrid Surveillance~~

[…]

SUBPART B — LIST OF AMC-20 ITEMS
LIST OF AMC-20 ITEMS

| EASA AMC-20 reference | Title | Last amended by |
|---|---|---|
| AMC 20-15 | AMC 20-15 Airworthiness Certification Considerations for the Airborne Collision Avoidance System (ACAS II) with optional Hybrid Surveillance | ~~AMC 20 Amdt 8~~ Cancelled (by AMC-20 Amdt YY) |

***Rationale***

*Cancel AMC 20-15 as it is replaced by a new Section in Subpart D (SUR) on ACAS to be introduced at CS-ACNS Issue 5.*

## 3.5. Draft amendments to the Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance (CS-ACNS)

# CS ACNS.A.GEN.005 Definitions

This point contains the definitions of terms used in CS-ACNS:

**Airborne collision avoidance system (ACAS)** refers to an aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders.

**ACAS equipment** includes all components or units necessary (as determined by the manufacturer or installer) for the equipment to perform the ACAS function properly with the exception of the Mode S transponder.

**ACAS processor unit** is the principal ACAS functional unit which includes the ACAS performance monitor, the ACAS logic and the surveillance subsystem, including the ACAS receiver and transmitter.

**ACAS II** is an ACAS that provides vertical resolution advisories (RAs) in addition to traffic advisories (TAs).

**ACAS X** is a family of ACAS II using probabilistic models (as opposed to deterministic algorithms as used in TCAS II v7.1), to define the most optimal and efficient resolution of the collision threat.

**ACAS Xa** is an ACAS X as defined in EUROCAE ED-256 Rev A.

**Active surveillance** is the process of tracking an intruder by using the information obtained from the replies to own ACAS interrogations.

[…]

**Airborne surveillance applications system (ASA)** is an avionics system that provides the platforms for aircraft-to-aircraft applications using surveillance such as ADS-B (Broadcast). These systems include sub-systems for surveillance data processing (ASA) and display and control (CDTI).

[…]

**Cockpit display of traffic information (CDTI)** is a subsystem of the ASA that provides the flight crew interface. The CDTI includes the actual display media and the necessary controls to interface with the flight crew. Thus, the CDTI consists of all displays and controls necessary to support the applications. The control may be a dedicated CDTI control panel or may be incorporated into other controls (e.g. multi-function control display unit (MCDU)). The CDTI may be (a) stand-alone dedicated display(s) or the CDTI information may be present on (an) existing display(s) (e.g. multi-function display). As a minimum, a CDTI includes a graphical plan-view (top down) traffic display, referred to as the traffic display, and the controls for the display and application (as required).

[…]

**Electronic flight instrument system (EFIS)** is a flight deck instrument display system. A typical EFIS comprises a primary flight display (PFD) (electronic attitude direction indicator (EADI)) and an electronic horizontal situation indicator (EHSI) (navigation display). In some designs the two displays are integrated into one.

[…]

**Extended hybrid surveillance** is the process of using qualified ADS-B airborne position messages via 1 090 MHz extended squitter without validating 1 090 MHz extended squitter data for the track by ACAS active interrogations.

[…]

**Hybrid surveillance** is the process of using a combination of active surveillance and passive surveillance with validated data to update an ACAS track in order to preserve ACAS independence.

[…]

**Instantaneous vertical speed indicator (IVSI)** is an instrument which indicates the rate of climb or descent of an aircraft.

[…]

**Intruder** refers to an aircraft satisfying the traffic advisory detection criteria.

[…]

**Passive surveillance** is the process of tracking another aircraft without interrogating it, by using the other aircraft's extended squitters. ACAS uses the information obtained via 1 090 MHz extended squitter to monitor the need for active surveillance, but not for any other purpose. Passive surveillance applies to both hybrid and extended hybrid surveillance.

[…]

**Resolution advisory (RA)** refers to aural voice and display information provided by ACAS to a flight crew, advising that a particular manoeuvre should, or should not, be performed to attain or maintain minimum safe vertical separation from an intruder.

[…]

**Threat** refers to an intruder that satisfies the threat detection logic and thus requires an RA.

[…]

**Traffic advisory (TA)** refers to aural voice and display information from ACAS to a flight crew, identifying the location of nearby traffic meeting certain minimum separation criteria.

[…]

# AMC1 ACNS.A.GEN.015 Aircraft documentation

[…]

An acceptable means of compliance in the case of aircraft with ACAS capabilities is to specify in the documentation which of the following surveillance specifications and functionalities the aircraft is certified for:

(a) TCAS II version 7.1,

(b) ACAS Xa.

Note: Appendix D to Subpart D Section 5 provides further information including a template for AFM.

# SUBPART D — SURVEILLANCE (SUR)

## SECTION 5 — AIRBORNE COLLISION AVOIDANCE SYSTEM

## APPLICABILITY

### CS ACNS.D.ACAS.001 Applicability

(See GM1 ACNS.D.ACAS.001)

This section provides the qualification, functional and performance criteria that are applicable to ACAS.

### GM1 ACNS.D.ACAS.001 Applicability

_Note 1: Appendix A to Subpart D Section 5 provides a list of ACAS-related documents._

_Note 2: In this section, the following naming principles are applied:_

— _The terms ACAS II or ACAS are used when referring to the standard, concept and implementation, covering both TCAS II and ACAS Xa, unless specifically noted;_

— _TCAS II or TCAS are used when referring to the implementation of TCAS version 7.1 as referred to in ICAO Annex 10;_

_Note 3: Appendix C to Subpart D Section 5 provides guidance material for testing the aircraft's ACAS._

## SYSTEM QUALIFICATION CRITERIA

### CS ACNS.D.ACAS.010 ACAS approval

(See AMC1 ACNS.D.ACAS.010)

(a) ACAS is approved.

(b) The Mode S transponder and its connected pressure altitude source are approved.

(c) The horizontal position and velocity information are obtained from an approved GNSS source.

(d) The airspeed source is obtained from an approved source.

(e) The aircraft's height above the ground is obtained from an approved radio altimeter.

(f) The heading is obtained from an approved source.

## AMC1 ACNS.D.ACAS.010 ACAS approval

(a) To be approved, ACAS should hold an EASA equipment authorisation in accordance with European Technical Standard Order ETSO-C119e (ACAS II version 7.1 with Hybrid Surveillance) or European Technical Standard Order ETSO-C219a (ACAS Xa/Xo) or equivalent.

(b) To be approved, the Mode S transponder and the pressure altitude source should meet the requirements defined in the relevant parts of CS-ACNS Subpart D.

*Note: The Mode S transponder DDP should indicate the letter 'a' for the ACAS capability.*

(c) The horizontal position and velocity information used for passive surveillance are obtained from the same data source that supplies the ADS-B Out function, and therefore to be approved, the GNSS source should meet the requirements as defined in the relevant parts of CS-ACNS Subpart D.

(d) An air data computer meeting the minimum performance requirements of ETSO-C106A1 is an acceptable approved airspeed source.

(e) A heading source holding an EASA equipment authorisation in accordance with ETSO-C5e or ETSO-C6d or later revisions is an acceptable approved source.

(f) A radio altitude source holding an EASA equipment authorisation in accordance with ETSO C-87a is an acceptable approved source.

## FUNCTIONAL CRITERIA

## CS ACNS.D.ACAS.015 Flight deck interface

(See AMC1 ACNS.D.ACAS.015(a) to (h), AMC1 ACNS.D.ACAS.015(b), AMC1 ACNS.D.ACAS.015(c), AMC1 ACNS.D.ACAS.015(b);(c), AMC1 ACNS.D.ACAS.015(d), AMC1 ACNS.D.ACAS.015(h))

A means is provided to:

(a) display the traffic information;

(b) display the traffic advisory (TA) information to each flight crew member;

(c) display the resolution advisory (RA) information to each flight crew member;

(d) display the appropriate failure alerts when the ACAS function has failed or degraded;

(e) display to the flight crew that an ACAS function has been inhibited either automatically (for example, TAWS) or through flight crew action;

(f) display the operational state of ACAS system (standby, TA-only, and TA/RA mode) on a continual basis, and the annunciation of any change to operational states;

(g) display the ACAS function coupling to the autopilot and/or flight director and/or autothrust, if available;

(h) generate TAs, RAs and monitoring aural alerts presented by the prescribed voice announcements via flight deck loudspeakers or via headsets at a pre-set level;

(i) select the TA-only mode;

(j) select the TA/RA mode;

(k) select the standby mode for the ACAS function;

(l) initiate a self-test for the ACAS function;

(m) select the relative or absolute intruder altitude for the displayed intruders (optional);

(n) select the range of relative altitudes for which an intruder is displayed (optional);

(o) select the range displayed by the traffic display (optional);

(p) if the autopilot/flight director/autothrust ACAS RA mode is available:

(1) couple the ACAS function with the autopilot and/or flight director and/or autothrust systems by manual or automatic means;

(2) manually disengage the autopilot/flight director/autothrust ACAS RA mode without deactivating the ACAS function;

*Note 1: The manual disengagement of the autopilot/flight director/autothrust ACAS RA mode should also interrupt the automatic response (AP/FD/AT coupling) to an ongoing RA. The RA is still active and should be followed manually by the pilot.*

*Note 2: Disengaging the autopilot/flight director/autothrust will disengage the autopilot/flight director/autothrust ACAS RA mode.*

(q) cancel active aural alerts and visual indicators but should not be necessary where voice announcements have a specific duration.

*Note 1: CS ACNS.D.ACAS.015 (a) to (h) focus on ACAS displays and aural alerts and CS ACNS.D.ACAS.015 (i) to (q) on ACAS pilot control.*

*Note 2: AMC1 ACNS.D.ACAS.015(a) to (h) focuses on all ACAS displays and aural alerts, AMC1 ACNS.D.ACAS.015(b) on TA display, AMC1 ACNS.D.ACAS.015(c) on RA display, AMC1 ACNS.D.ACAS.015(b);(c) on TA and RA display, AMC1 ACNS.D.ACAS.015(d) on ACAS performance monitoring, and AMC1 ACNS.D.ACAS.015(h) on aural annunciations.*

*Note 3: It is recommended that the controls for the Mode S transponder and ACAS be located on a single control panel.*

*Note 4: The exact implementation of the ACAS controls shall be compatible with the flight deck design philosophy.*

*Note 5: Except for the three items mentioned in AMC1 CS ACNS.D.ACAS.015(d), the implementation of hybrid surveillance is transparent (not observable) to the flight crew. All displays, control panels and procedures for using ACAS are the same with or without hybrid surveillance.*

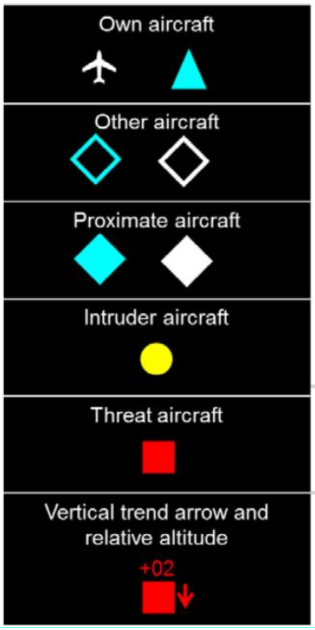
## AMC1 ACNS.D.ACAS.015(a) to (h) Flight deck interface

(a) The adequacy of display visibility should be verified. The display brilliance should be such that the display can be interpreted under all probable cockpit conditions of ambient light.

(b) ACAS display symbology

(1) It should be verified that the ACAS display symbology is as per the table below.

*Note: Other information can be found in ED-143 Section 2.2.6 or ED-256A Section 2.2.6 as applicable.*




(2) If new symbology is used, it should be agreed with EASA as early as possible in the development cycle. The appropriate human factors test and evaluation methods should be considered as defined in Appendix C to Subpart D Section 5. The use of new ACAS symbology will require testing throughout the flight envelope to determine accuracy, over/under shoot tendencies, flight technical error, and potential confusion resulting from the proposed symbology.

(c) A means to display traffic information to each flight crew member should be provided.

(1) If a dedicated traffic display is used, it should be readily visible to both pilots.

(2) If a multi-function display is used, it should meet the requirements of ETSO-C113 'Airborne Multipurpose Electronic Displays'.

(i) When the part-time (pop-up) mode is enabled, it should be verified that there is a visual indicator/label to distinguish that the display is in traffic mode.

(ii) When the traffic information is turned 'off', it should be verified that the RA display and aural indication are provided in the flight deck when the RA is issued.

(iii) Traffic information may be provided on weather radar (WXR), electronic flight instrument system (EFIS), instantaneous vertical speed indicator (IVSI) or other compatible display screen which has been demonstrated to follow the guidance of AMC 25-11 'Electronic Display Systems', provided their primary functions are not compromised.

## AMC1 ACNS.D.ACAS.015(b) Flight deck interface

The following TA display information characteristics should be verified:

(a) The TA display information is displayed in accordance with the manufacturer's installation instructions.

(b) An indication that ACAS is operating in TA mode is provided.

(c) If a written text message is shown on the display, the text displayed, such as 'Traffic, Traffic', corresponds with the aural annunciation.

(d) The TA visual alerts remain on until the conditions for a TA no longer exist.

(e) ACAS automatically switches to TA-only mode when a higher-priority alert from other systems (e.g. wind shear warning, TAWS, stall warning) occurs as defined in CS ACNS.D.ACAS.020.

*Note 1: TAs give the flight crew the opportunity to visually acquire the intruding aircraft out of the window, and prepare the flight crew to respond to a possible RA.*

*Note 2: The TA visual alert may also be integrated into a head-up display (HUD) or a head-mounted display (HMD).*

## AMC1 ACNS.D.ACAS.015(c) Flight deck interface

The following RA display information characteristics should be verified:

(a) The proper RA display information is displayed in accordance with the manufacturer's installation instructions.

(b) The RA guidance is presented at each pilot station in the pilot's primary field of view. *Note: RAs may be presented on EFIS or IVSI displays provided that their primary functions are not compromised.*

(c) The RA visual alert corresponds with the aural annunciation.

*Note: The red arcs on an RA/IVSI display, conspicuous illumination of the red zones on the vertical speed tape, appropriate pitch guidance, or suitable written text message on a PFD fulfil this requirement.*

(d) The RA visual alerts remain until the conditions for an RA no longer exist. In this case, a 'Clear of Conflict' alert is generated.

*Note 1: The RA display provides guidance on the vertical speed or pitch angle to be flown, and the range of vertical speeds or pitch angles to be avoided, to attain or maintain the desired vertical miss distance from an aircraft causing an RA.*

*Note 2: The purpose of the RA display is to provide each pilot with the information to readily correct the aircraft flight path or to prevent a manoeuvre that would significantly reduce the vertical separation between the pilot's aircraft (own aircraft) and a threat aircraft.*

*Note 3: The RA display may also be integrated into a HUD or an HMD.*

## AMC1 ACNS.D.ACAS.015(b);(c) ACAS flight deck interface

The following TA and RA display information characteristics should be verified:

(a) the Warning and Caution alerts comply with CS 25.1322 'Flight Crew Alerting' for large aeroplanes, or corresponding paragraphs applicable to other aircraft categories and addressing the flight crew alerting system.

(b) the display of traffic and resolution advisory information is consistent with CS 25.1322 'Alerting Systems' and with paragraph 5.4 'Presentation of Information' of CS 25.1302 'Installed Systems and Equipment for Use by the Flight Crew' for large aeroplanes, or corresponding paragraphs applicable to other aircraft categories and addressing the flight crew alerting system.

## AMC1 ACNS.D.ACAS.015(d) Flight deck interface

(a) The ACAS performance monitoring should be verified as follows:

(1) The results of an ACAS function self-test initiated by the flight crew are displayed.

(2) The results of automatic ACAS function performance monitoring, which detects malfunctions that degrade or preclude ACAS protection, are displayed.

(b) ACAS alerts should comply with the applicable Certification Specification requirements such as CS 25.1302 'Installed systems and equipment for use by the flight crew', CS 25.1309(c) System design and analysis, and CS 25.1322 'Flight Crew Alerting' for large aeroplanes, or corresponding paragraphs applicable to other aircraft categories and addressing the flight crew alerting system.

*Note 1: The ACAS failure alerts are recommended to be interfaced with the aircraft's master caution and warning system. However, the RA and TA alerts should not trigger the aircraft's master caution and warning system.*

*Note 2: The review of past accidents shows that the loss of the ACAS RA functionality requires flight crew awareness (amber or yellow annunciation) and may require subsequent flight crew response. This response includes checking for proper ACAS settings and operation as well as Mode S transponder settings and operation.*

(d) It should be verified that if the ACAS processor unit is determined to be failed, an ACAS failure is annunciated to the flight crew.

(e) It should be verified that if the coordination timing requirements with other ACAS-equipped aircraft are determined to be failed, an ACAS failure is annunciated to the flight crew.

(f) Monitoring of Mode S transponder

It should be verified that:

(1) if the own aircraft transponder status is determined to be standby or failed when the aircraft is airborne, the ACAS function provides visual annunciations of this status to the flight crew.

(2) If the own aircraft transponder is not reporting altitude, the ACAS function declares an ACAS failure.

(g) Monitoring of traffic display(s) and RA display(s)

It should be verified that the ACAS function determines the appropriate ACAS system level operating mode based on the status of the installed traffic display(s) and RA displays.

(1) if all the RA displays have failed, the ACAS function does not allow RAs (TA-only mode);

(2) if all the traffic displays have failed, the ACAS function declares an ACAS failure.

(h) Monitoring of barometric altitude source

It should be verified that, in case of a barometric altitude failure, the ACAS function declares an ACAS failure.

(i) Monitoring of radio altitude source

It should be verified that, in case of a radio altimeter failure, the ACAS function declares an ACAS failure.

(j) Monitoring specific to hybrid surveillance

It should be verified, if a monitoring is available, that the ACAS function provides an output to the aircraft display or the aircraft maintenance systems to alert the flight crew and/or maintenance crew that the capabilities of hybrid surveillance have been degraded due to the failure or loss of GNSS source or heading source or ground speed source.

*Note 1: The loss of own aircraft position source will not cause ACAS to fail. Instead, ACAS will transition to a mode where all surveillance is performed using active interrogations and replies exclusively.*

*Note 2: The passive surveillance quality requirements for the own aircraft position source are defined in CS ACNS.D.ACAS.045.*

*Note 3: ACAS switches from hybrid surveillance to active surveillance in case of a failure or loss of GNSS source or own ground speed source.*

*Note 4: If the own aircraft ground speed source is declared invalid or unavailable, the use of own aircraft ground speed for determination of whether own aircraft is operating on the surface or is taking off/airborne is not permitted. The state 'on the surface' is used to determine whether the exclusive use of 1090 MHz ADS-B reports is permitted.*

(k) Monitoring of ACAS Xa transmitter

It should be verified that the ACAS function detecting a loss of ACAS Xa transmitter functionality declares an ACAS Xa failure.

*Note: The review of past accidents show that the loss of the ACAS RA functionality requires flight crew awareness (amber or yellow annunciation) and may require subsequent flight crew response.*

*This response includes checking for proper ACAS settings and operation as well as Mode S transponder settings and operation.*

# AMC1 ACNS.D.ACAS.015(h) Flight deck interface

(a) The generation of aural annunciations should be verified as follows:

(1) The suite of aural annunciations is installed as defined in ED-143 (TCAS II version 7.1) or ED-256A (ACAS Xa).

*Note: For rotorcraft, TA and RA aural alerts should be presented via headsets at a pre-set level.*

(2) The RA aural annunciations are phrased as a positive action (for example, use 'LEVEL OFF' rather than 'DON'T CLIMB').

(3) The aural annunciations are generated when the TA and/or the first RA of an encounter is displayed and each time a subsequent change in the RA is displayed (strengthened, weakened or reverse).

(4) An aural annunciation is generated when the RA is cleared to indicate that the aircraft is 'clear of conflict' with all threat aircraft.

(5) For each TA or RA aural annunciation, there is a corresponding text or visual indication as defined in ED-143 or ED-256A.

(6) For new ACAS installations, a monitoring aural annunciation to the crew occurs in conjunction with a visual annunciation as defined in AMC1 ACNS.D.ACAS.015(d), when the own Mode S transponder status is determined to be standby or failed during airborne operation.

*Note 1: This annunciation could be provided by a centralised crew alerting system.*

*Note 2: For ACAS Xa systems designed for installation on aircraft that will not have a centralised crew alerting system capable of annunciating this condition, the new ACAS should provide an aural indication (e.g. 'transponder off') upon detection of these conditions. It is assumed that there is an existing visual annunciation of the ACAS fail or ACAS standby state.*

(b) It should be verified that the ACAS aural alerts are consistent with the other flight deck aural alerting systems.

*Note 1: Altitude call-out advisories which occur simultaneously with ACAS advisories are permitted, but the audibility of each voice alert will need to be understandable.*

*Note 2: RAs and TAs which trigger the master warning system will not be accepted.*

*Note 3: Audio cautions and warnings should be prioritised at aircraft level. Typically, 'stall' or 'over speed', 'reactive windshear', 'TAWS pull-up', etc. warnings should have a higher priority than an RA warning, which has a higher priority than a TA warning.*

## CS ACNS.D.ACAS.020 System inhibits

(a) All ACAS aural annunciations are automatically inhibited:

(1) below 500 ft AGL (±100 ft);

*Note: +100 ft values are used for climbing aircraft, –100 ft for descending aircraft.*

(2) when higher-priority alerts are issued by other systems (e.g. wind shear warning system, TAWS, stall warnings).

*Note: When a higher-priority alert system (wind shear or TAWS) has an active alert, ACAS is placed into the TA-only mode of operation. ACAS will automatically be placed into TA-only mode and TA aural annunciation is suppressed. ACAS will remain in TA-only mode for 10 seconds after the TAWS or wind shear alert is removed. During this 10-second suppression period, the TA aural annunciation is not suppressed.*

(b) RA aural and visual annunciations:

(1) are inhibited:

(i) when the TA-only mode is selected;

(ii) at lower altitudes to prevent RAs in proximity to the ground:

— below 1 000 ft (+/- 100 ft) AGL for all RAs;

— below 1 100 ft (+/- 100 ft) AGL for the 'descend' RA;

— below 1 550 ft (±100 ft) AGL for 'increase descent' RA;

*Note 1: +100 ft values are used for climbing aircraft, –100 ft for descending aircraft.*

*Note 2: RAs are inhibited based on radar (radio) altimeter reported heights. Hysteresis values of +100 ft (for climbing aircraft) and –100 ft (for descending aircraft) ensure that the inhibition state does not oscillate rapidly should the aircraft be flying close to the nominal altitude boundary but periodically passing above and below that boundary (e.g. when flying over hilly terrain);*

(2) may be inhibited (applicable to TCAS only) for 'climb' or 'increase climb' RAs due to the aircraft climb performance limitations at high altitudes, or when the aircraft is in the landing configuration.

*Note: These limitations are known by the ACAS function, which will then choose a viable alternative RA. The limitations are set beforehand by EASA to the type of aircraft.*

*Note 1: A valid radio altitude is required for inhibition of descent advisories at low altitudes.*

*Note 2: For all aircraft, predefined limitations apply at lower altitudes to ACAS alert generation in proximity to the ground (see Figure 1 below).*

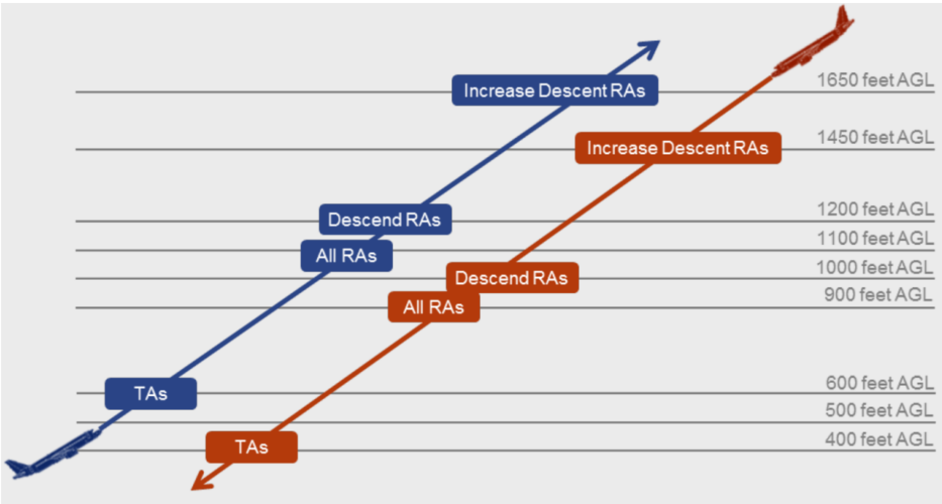



Figure 1: Illustration of ACAS alert generation inhibitions

*Note 3: The parameters for the inhibits are defined in the table below.*

| INHIBIT | PARAMETERS |
|---|---|
| Increase descent RA | Inhibited below 1 650 ft AGL while climbing and inhibited below 1 450 ft AGL while descending. |
| Descend RA | Inhibited below 1 200 ft AGL while climbing and inhibited below 1 000 ft AGL while descending. |
| TA voice messages | Inhibited below 400 ft AGL while descending and inhibited below 600 ft AGL while climbing. |
| RAs | Inhibited below 1 100 ft AGL while climbing and inhibited below 900 ft AGL while descending (ACAS automatically reverts to TA-only). |
| Self-test | Can be inhibited when airborne. |
| Advisory priority | Automatically reverts to TA-only when higher-priority advisories (such as GPWS/TAWS and windshear) occur. |
| Climb RA | Can be inhibited, based upon aircraft performance capability. |
| Increase climb RA | Can be inhibited, based upon aircraft performance capability. |

## CS ACNS.D.ACAS.025 Communication with ATC

ACAS transmits the following information through the paired Mode S transponder to the ATC ground station:

(a) RA Report;

(b) ACAS version including extended version for ACAS X

(c) TCAS Unit Part Number and TCAS Software Part Number.

## CS ACNS.D.ACAS.030 Paired Mode S transponder

(See AMC1 ACNS.D.ACAS.030)

The ACAS unit operates with a compatible paired Mode S transponder.

## AMC1 ACNS.D.ACAS.030 Paired Mode S transponder

(a) For the initial approval of a new pairing of an ACAS unit and a Mode S transponder, the combination of equipment should pass interoperability tests on the aircraft. It should be verified that the information received from the ACAS unit is correctly interpreted by the Mode S transponder and that the pairing is robust enough (no failure) while receiving a high number of interrogations per second.

*Note 1: Tests properly selected from ED-143 Section 2.4 or ED-256A Section 2.4 are an acceptable means of compliance.*

*Note 2: Interoperability tests are not required if the ACAS equipment manufacturer has demonstrated the pairing with the Mode S transponder. Evidence may be provided in the DDP or in the installation manual.*

*Note 3: Interoperability tests cover the verification of the correct reporting of the ACAS version, TCAS Unit Part Number and Software Part Number, its operational status and the RA reported by the Mode S transponder.*

(b) If the aircraft-based interoperability tests are not practical, the tests of a new pairing of an ACAS unit and a Mode S transponder may be conducted in labs.

## CS ACNS.D.ACAS.040 Interoperability with other ACAS

(See AMC1 ACNS.D.ACAS.040)

ACAS operates with other compatible external ACAS.

## AMC1 ACNS.D.ACAS.040 Interoperability with other ACAS

Unless this is performed as part of the ETSO process, for the initial approval of an ACAS, it should be verified by flight testing that ACAS is able to communicate and to perform ACAS operations with dissimilar ACAS such as another manufacturers' approved ACAS. The test should include an ACAS-to-ACAS coordination demonstration with actual RA manoeuvres.

## CS ACNS.D.ACAS.045 Horizontal position and velocity data source

To be used as a data source for ACAS, the GNSS source for latitude, longitude and geometric velocity should meet the GNSS receiver qualification requirements and acceptable means of compliance as defined in ACNS.D.ADSB.070 and AMC1 ACNS.D.ADSB.070.

## CS ACNS.D.ACAS.050 Pressure altitude source

(See AMC1 ACNS.D.ACAS.050)

(a) Pressure altitude information is obtained from the same sensor source that supplies the Mode S transponder(s) and the flight deck altitude display(s).

(b) Pressure altitude source should be the most accurate source available on the aircraft.

*Note: ICAO Gray (Gillham) code should not be used.*

## AMC1 ACNS.D.ACAS.050 Pressure altitude source

(a) The accuracy of the altitude data must be at least the one specified in ED-143 Section 3.2.8.

(b) When available, the resolution should be in increments of 10 ft or less.

## CS ACNS.D.ACAS.055 Radio altitude source

(See AMC1 ACNS.D.ACAS.055)

An interface to a radio altitude source is provided.

*Note: A connection with the radar (radio) altimeter is needed to inhibit RAs when the aircraft is in close proximity to the ground and to determine whether aircraft tracked by ACAS are on the ground.*

## AMC1 ACNS.D.ACAS.055 Radio altitude source

It should be verified that the radio altitude source operates as a minimum up to 1 850 ft AGL.

## CS ACNS.D.ACAS.060 Aircraft heading and attitude source

The ACAS Xa function receives true heading from an own aircraft source when available.

*Note: True heading may be used to compute the relative bearing of ADS-B-equipped intruders, to improve the estimated relative cross range velocity of an intruder and to determine the appropriate intruder placement on the traffic display.*

## CS ACNS.D.ACAS.065 On-the-ground status

(See AMC1 ACNS.D.ACAS.065)

The on-the-ground status indicator is provided to the ACAS unit.

## AMC1 ACNS.D.ACAS.065 On-the-ground status

It should be verified on the ground and in the air that the sensor(s) providing on-the-ground status indicator to the ACAS unit is installed.

*Note: If an aircraft reports on-the-ground status, that aircraft will not be interrogated by ACAS in order to reduce unnecessary interrogation activity.*

## CS ACNS.D.ACAS.070 ACAS coupling with the Flight Guidance System (FGS)

(See AMC1 ACNS.D.ACAS.070)

(a) The RAs generated by the ACAS may be used by the autopilot and/or flight director and/or autothrust systems to execute the RAs.

(b) If a means to manually inhibit an RA is available, the autopilot remains engaged and returns to path when the inhibit is selected.

*Note: Some FGS implementations may not contain all the autopilot, flight director and autothrust functions. In this case, the requirements included in CS ACNS.D.ACAS.070 only apply to the implemented functions.*

## AMC1 ACNS.D.ACAS.75 ACAS Coupling with Flight Guidance System (FGS)

(a) ED-224 is an acceptable means of compliance for the ACAS coupling with the FGS.

(b) The ACAS function may be automatically coupled when the autopilot and/or flight director and/or autothrust is engaged.

*Note 1: The FGS typically includes the following functions:*

— *an autopilot, which provides aircraft guidance such as an automatic response to RAs;*

— *a Flight Director, which provides display cues to support manual piloting and consequently to provide manual responses to RAs by the pilots;*

— *an Autothrust, which provides thrust control to ensure a safe speed during any phase of a flight in particular the control of speed during the RA manoeuvre.*

*Note 2: The coupling to the autopilot is considered to provide the most efficient ACAS manoeuvre, removing any delay which may be caused by flight crew reaction.*

# PERFORMANCE CRITERIA

## CS ACNS.D.ACAS.100 Aircraft performance considerations

The minimum aircraft vertical rate performance criteria for each type of installation are 1 500 ft per minute for 1 minute for a sustained climb and descent and 2 500 ft per minute for increase climb actions, under normal operating conditions, to attain a total altitude change of 1 500 ft for vertical manoeuvres when an RA is issued.

*Note 1: The following pilot response times to RAs are assumed to be:*

(i) within 5 seconds to respond to an initial vertical RA;

*(ii) within 2 ½ seconds to respond to a reversal RA.*

*Note 2: The nominal TA warning time is 20 s or less before the generation of the RA.*

## CS ACNS.D.ACAS.110 Failure conditions and integrity

The integrity of ACAS supports the values provided in Appendix B to Subpart D Section 5.

## CS ACNS.D.ACAS.120 Failure conditions and continuity

The continuity of ACAS supports the values provided in Appendix B to Subpart D Section 5.

# INSTALLATION REQUIREMENTS

## CS ACNS.D.ACAS.200 Antenna installation

(See AMC1 ACNS.D.ACAS.200)

Either a directional antenna and an omni-directional antenna, or two directional antennas are installed for ACAS.

*Note 1: When installing a directional antenna and an omni-directional antenna, the omni-directional antenna should be the lower antenna.*

*Note 2: The antennas and wiring required for ACAS are not changed if hybrid surveillance is implemented. To take advantage of hybrid surveillance, an aircraft needs the ability to receive passive 1090 MHz squitters from other aircraft and the ability to provide own aircraft position to ACAS. Passive squitters are received using the same antennas and receivers as non-hybrid ACAS. No wiring or antenna changes are required.*

## AMC1 ACNS.D.ACAS.200 Antenna installation

(a) The ACAS omni-directional antenna should be mounted on the bottom of the aircraft fuselage.

(b) Directional antenna

(1) The ACAS directional antenna should be installed on the top of the forward fuselage.

(2) If ACAS has more than one directional antenna, the second antenna should be installed on the lower fuselage.

(c) Both antennas should be mounted as near as possible to the centre line of the fuselage.

*Note: ACAS antennas may be installed with an angular offset from the aircraft centreline not exceeding 5 degrees.*

(d) The horizontal distance between the top and the bottom antennas shall be not greater than 7.6 m (25 ft).

(e) Antennas shall be located to minimise obstruction to their fields in the horizontal plane.

(f) The ACAS antennas should be installed with at least 20 decibel (dB) isolation from other L-band antennas.

(g) The physical location of both ACAS antennas should ensure that propellers or rotors, if applicable, do not interfere with ACAS operation.

(h) When the installation uses a shared antenna for 1090ES ADS-B In and ACAS, AMC1 ACNS.D.ACAS.200 applies as well.

## CS ACNS.D.ACAS.210 Transmit power

(a) The effective radiated power (ERP) in the forward direction associated with each radiated transmission pulse should be a maximum of +56 dBm (400 W), and a minimum of +52 dBm (160 W), assuming full power operation.

(b) The directional interrogation radiated power should be in line with ED-143 Section 2.2.4.5.4.2.2 or with ED-256A Section 2.2.4.5.4.2.2.

# APPENDICES

## Appendix A — Background information about ACAS

(a) General

This appendix provides a list of documents useful to understand ACAS as defined in CS ACNS.D.ACAS and its associated AMC.

(b) Related material

(1) EASA

ETSO-C112e Minimum Operational Performance Specification for SSR Mode S Transponders

ETSO-C119e, Airborne Collision Avoidance System II (ACAS II) Version 7.1 with Hybrid Surveillance

(2) FAA

TSO-C219a, Minimum Operational Performance Specification for ACAS Xa/Xo

(3) ICAO

(i) ICAO Annex 10 *Aeronautical Telecommunications* — Volume IV *Surveillance Radar and Collision Avoidance Systems*, Amendment 91

(ii) ICAO Document 9871 *Technical Provisions for Mode S Services and Extended Squitter* Edition 2

(iii) ICAO Document 8168-OPS/611 *Procedures for Air Navigation Services Aircraft Operations — Volume I Flight Procedures*

(iv) ICAO Document 4444-RAC/501 *Procedures for Air Navigation Service, Air Traffic Management*

(4) EUROCAE

(i) ED-73E Minimum Operational Performance Specification for Secondary Surveillance Radar Mode S Transponders

(ii) ED-73F MOPS for Secondary Surveillance Radar Mode S Transponders

(iii) ED-143 Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) version 7.1

(v) ED-221A Minimum Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance

(vi) ED-224 MASPS for Flight Guidance System (FGS) coupled to Traffic Alert and Collision Avoidance System (TCAS)

(iv) ED-256A MOPS for ACAS Xa with ACAS Xo functionality.

## Appendix B — Guidance on classification of failure conditions

(a) A functional hazard assessment (FHA) and system safety assessment (SSA) for the proposed ACAS installation, including all airborne devices contributing to the ACAS function, both for RAs and TAs, should be performed to ensure that the ACAS function is compliant with the following requirements. The safety effect should be assessed at aircraft level.

(b) The FHA / SSA should address the following critical failure conditions:

(1) Loss of system function (annunciated), which is the case where the installed ACAS system is not able to perform its intended function.

(2) Incorrect RA, which is the case where an RA condition exists and an RA is issued but the RA gives incorrect guidance.

(3) Missing RA, which is the case where an RA condition exists but an RA is not issued.

(4) False RA, which is the case where an RA is issued but an RA condition does not exist.

(c) The FHA / SSA should address other ACAS system failure conditions not mentioned in paragraph (b) if they might negatively impact safety.

(d) The failure of the installed ACAS system must not cause adverse effects to any aircraft systems that are essential for continued safe flight and landing (CSFL).

(e) Unless properly substantiated, the classification of failure conditions in the FHA / SSA should be performed as per the following table:

| Failure conditions | Continuity / Integrity | Classification of failure conditions |
|---|---|---|
| 1. Loss of system function (annunciated) | Continuity (Loss) | Minor |
| 2. Incorrect or missing RA aural and visual alert (un-annunciated) | Integrity (Erroneous) | Hazardous<br>(note 1) |
| 3. False RA aural and visual alert (un-annunciated) | Integrity (Erroneous) | Major |

The SSA should provide evidence that the safety objectives associated with the classification of failure conditions are met.

*Note 1: Subject to EASA's agreement, although a failure condition is classified 'hazardous', allowable quantitative objective different from 'Extremely remote' may be accepted.*

*Note 2: In terminal airspace, the frequency of encounters, where another aircraft could be present, may be assumed to be once every 10 hours. In en-route airspace the frequency of encounters, where another aircraft could be present, may be assumed to be once every 200 hours. Different frequencies may be used if supported by operational data.*

(f) The ACAS system should be developed to at least the design assurance level commensurate with the classification of failure condition identified in paragraph (e) of this Appendix.

# Appendix C — Testing guidance for ACAS II initial and follow-on approvals

## 1 General principles

(a) Unless otherwise agreed with EASA, the following inspections and tests defined in this Appendix should be completed for both initial and follow-on approval installations.

(b) Initial approvals are for:

(1) new ACAS on any aircraft type,

(2) new aircraft type designs (including the case where the installation of an ACAS has been previously approved on another aircraft type but not on the aircraft type that is subject to the current ACAS installation), and

(3) unique changes in the ACAS design that would significantly impact the design of the aircraft type.

(c) Follow-on approvals are for changes that do not significantly impact the design but are necessary to ensure proper installation and operation.

(d) Flight testing

(1) The level of flight test required to validate a particular ACAS design and its installation will depend on the type of aircraft, the aircraft system architecture and the credit given from simulations and ground testing and previously certified installations.

(2) The actual requirement for a flight test for each installation should be evaluated.

(i) Credit may be taken from performance flight testing conducted under the European Technical Standard Order Authorisation (ETSOA) if the aircraft installation is similar in performance to the installation of the make and model that is under review for certification.

(ii) Flight testing of an ACAS for follow-on approvals may be necessary to verify that the design and installation perform the intended function under the expected operating conditions.

(iii) Flight testing may not be required for the following cases:

— The approved TCAS II or ACAS Xa equipment has been previously installed in a different aircraft type,

— The change to the defined configuration of a previously approved system installation is not significant.

## 2 Test plan

(a) A test plan should be provided.

(b) For initial approvals:

(1) The test plan will typically include a combination of human factors (HF) compliance inspections, ground testing and flight testing including planned encounters with another ACAS-equipped aircraft.

(2) In the case of new aircraft type where the installation of an ACAS has been previously approved on another aircraft type, which can be demonstrated as being sufficiently similar, the testing may not need to include the encounter flight testing.

(c) For follow-on approvals:

(1) The test plan will typically include a combination of HF compliance inspections, ground testing and flight testing to verify in particular the proper installation with the different interfaces.

(2) In the case of upgrade of an existing approved ACAS installation to a newer ACAS version and the newer version is only a software change that does not affect the functionality of the design, then the applicant may not need to conduct any additional flight testing to obtain a follow-on approval.

**3 Conformity inspection**

(a) For certification testing, a conformity inspection should be performed.

(b) The list of all electronic systems on board the aircraft and control station (if applicable), including part numbers, software versions, should be specified in the type inspection authorisation report. The ACAS installation per installation instructions, including location of controls, displays, and annunciators should be verified.

**4 Human factors airworthiness compliance inspection and on-ground testing**

(a) When ground testing the ACAS system, it is necessary to take precautions to prevent it from being a source of interference to ATC or other ACAS aircraft operating in the area. Both the Mode S and ADS-B In false indications of 'intruder aircraft' could result in unnecessary ATC communications or in ACAS-induced aircraft manoeuvres.

(1) Such testing should be conducted in coordination with ATC.

(2) An antenna shielding (transmission absorption covers or caps) should be used to prevent the system from transmitting test data that could generate false intruder information wherever is possible.

(3) As an alternative to the use of antenna shielding, radiated testing can be used provided that the altitude reported by the traffic system via Mode C, Mode S, and ADS-B Out all provide altitude at ground level.

(b) Human factors general arrangement, access, performance and visibility of information — for initial and follow-on approvals

*Note: For follow-on approvals, the human factors assessment may not be required depending on the extent of the changes.*

(1) A human factors/pilot evaluation of the controls, displays, circuit breakers, placards and annunciators for ACAS should be performed.

(2) Many of these tests can be conducted on board. Some tests may require further evaluation in an engineering simulator cabin, flight test simulator or certified flight deck/control station display arrangement. The evaluation should include the following:

(i) CS 25.1302 'Installed systems and equipment for use by the flight crew', AMC 25-11 'Electronic Flight Deck Displays', and CS 25.1322 'Flight Crew Alerting' for large aeroplanes, or corresponding paragraphs applicable to other aircraft categories and addressing the flight crew alerting system.

(ii) After aircraft power-up, it should be verified that ACAS passes all checks including self-test functions and is ready for operation.

— The result of the test should be heard through the aural speakers.

— Ensure that the use of the self-test function does not change the audio level.

(iii) The aural annunciations found in CS ACNS.D.ACAS.015 should be verified; in particular, the volume levels and intelligibility for acceptability for both low and high cockpit noise levels from the cockpit speakers and/or headsets, as applicable.

(iv) Any ACAS status changes that could result from ACAS mode selections should be verified, in particular the ACAS standby and TA-only mode annunciations with the proper colouring, text, legibility and location.

(v) The display information, pilot controls and inhibits found in CS ACNS.D.ACAS.015 and CS ACNS.D.ACAS.020 should be verified.

— Evaluate the ACAS displays for satisfactory identification, legibility, accessibility, unambiguity, attention-getting properties and visibility during both day and night conditions.

— Whilst on ground, verify the display of ACAS traffic available in the area.

— Check that ACAS automatically switches from RA mode to TA mode when higher-priority alerts occur (e.g. TAWS, windshear, stall warnings).

— Enable operation of other installed systems to check any anomalies, disruptions or clutter that may affect the operation of ACAS or vice versa.

— Check the absence of step overs or overlays on the ACAS display from windshear, TAWS or rotorcraft TAWS (HTAWS), or aural/tactile annunciations from overspeed or stall.

— Demonstrate that the ACAS equipment is electromagnetically compatible with previously installed systems or equipment, that it is not a source of adverse conducted or radiated interference, and that conducted or radiated interference from previously installed systems and equipment does not adversely affect the operation of the ACAS equipment.

(vi) The controls to ensure that no inadvertent pilot actions would disengage ACAS or inhibit ACAS without notification should be verified. *Note: Pay close attention to line select keys, touch screens or cursor-controlled trackballs as these can be susceptible to unintended mode selection resulting from their location in the flight deck (for example, proximity to a footrest or adjacent to a temporary stowage area).*

(3) For follow-on approvals, a change impact analysis should be conducted to determine the level testing required regarding:

(i) any changes to any previously installed aircraft systems (for example, electronic flight instrument system (EFIS), FD, PFD, navigation displays (ND), stand-alone VSI, interface, etc.) as a result of modifications to TCAS II or ACAS Xa;

(ii) any changes to aircraft systems interfacing with TCAS II or ACAS Xa (for example, EFIS, FD, PFD, ND, stand-alone VSI, interfaces, etc.), but with no modifications to TCAS II or ACAS Xa.

(4) The ACAS alerting, failure alerting and alert prioritisation for the installation should be verified. Alerting and alert priorities are found in ACNS.D.ACAS.015 and CS ACNS.D.ACAS.020.

(i) It should be verified that when the transponder is in stand-by mode, the appropriate ACAS annunciation occurs (standby or failed) as described in ACNS.D.ACAS.015.

(ii) It should be verified that, if connected, the altitude alerter is installed per the manufacturer's installation instructions.

(iii) The installation instructions should be checked to verify when ACAS automatically switches to TA mode. There should be an annunciation of the TA mode and/or the unavailability of the RA mode. *Note: Typically this occurs when TAWS or windshear alerts are generated simultaneously with ACAS.*

(iv) Failures of individual sensors, including surveillance sources and position sources and any combination of failures deemed necessary, should be simulated to verify that the resulting system failure state agrees with the predicted results.

(v) The failure modes should be verified including:

— Pressure altitude failure (ACAS should be either failed or in standby),

— Radio altimeter failure (ACAS should be either failed or in standby),

— Transponder failure,

— Own aircraft GNSS failure (for hybrid surveillance).

(c) Interoperability ground testing

The proper installation of the Mode S transponder should be verified. *Note: Further testing may be found in the manufacturer's installation instructions*.

(d) Bearing accuracy/directional antenna performance.

(1) This test is typically conducted for initial approvals.

(2) Bearing accuracy check of intruder. A maximum error of ± 15 degrees in azimuth should be demonstrated for each quadrant. Larger errors may be acceptable in the tail area of the aircraft.

*Note: If there is a second directional antenna on the aircraft, repeat the tests in this section and if installed on the bottom, include allowances for the landing gear and other obstructions.*

(e) Failure of sensors

(1) GNSS disable feature

It should be verified that the ACAS functions are still operational when the GNSS is disabled and when the:

(i) ACAS in the TA/RA mode and Mode S transponder are operating simultaneously.

(ii) ACAS in the TA mode and Mode S transponder are operating simultaneously.

(2) The failure of other sensors which are interfaced to ACAS should be verified to ensure that the effect on ACAS agrees with the predicted results.

**5 Flight tests**

(a) The decision to perform the actual testing should be based on the principles defined in Section 1 of this Appendix.

(b) There should be coordination with EASA to determine which (if any) of the flight tests should be conducted.

(c) Safety considerations

(1) All encounters should be flown in day VMC.

(2) Before any cooperative flight tests at any altitude involving the ACAS-equipped aircraft and another aircraft, fly both aircraft in close formation to ensure matched altimetry readouts. Fly these checks at the speeds and altitudes that are normally used for these tests. Any differences should be noted and accounted for as part of the test.

(3) Both aircraft should remain in continuous radio communication with each other.

(4) At least one aircraft should remain in visual contact with the other during each encounter.

(5) Procedures for loss of visual contact should be decided upon and briefed to all pilots before the flight.

(6) During head-on encounters, the two aircraft should fly opposite heading. Use appropriate reference as cues when performing this test. For example, use opposite sides of a ground cue, i.e. north and south roads as reference in remote areas.

(7) Overtaking and heading encounter profiles include a lateral offset and a vertical offset. The offset should be determined by the range or airspace safety flight planning guidelines.

(8) Suspend flight testing whenever there is the potential for an unplanned encounter with proximate/nearby traffic.

(9) For automated RA testing, ensure that there are procedural mitigations if the aircraft does not respond to the RA command or if the RA command is latent or incorrect.

(d) ATC coordination considerations

(1) When conducting flight testing of ACAS for certification approval, the applicant should prevent the ACAS from being a source of interference to ATC or other ACAS-equipped aircraft operating in the area.

*Note: For example, using a fixed transponder to simulate an intruder aircraft can cause transmission of data which produce false targets for the ground ATC surveillance systems or airborne ACAS-equipped aircraft. These false indications of 'intruder aircraft' could result in unnecessary ATC communications and possibly in ACAS-induced aircraft manoeuvres. Therefore, such testing is to be conducted in coordination with ATC.*

(2) When conducting such tests, add a note in the test procedures, which states:

*Note: The conduct of this test requires cooperation with ATC controllers. Coordination with ATC is important before the flight test for any necessary approval of the flight and agreement with the flight test procedures. During the flight test, the test crew will need to communicate with the controller monitoring the aircraft and reporting transponder performance data.*

(e) In-flight display and performance flight testing — for initial approvals

(1) During all phases of flight, observe and record any mutual interference of ACAS with any other aircraft systems.

(2) Demonstrate that traffic information remains valid and usable when the aircraft is pitched both ±15 degrees and rolled approximately 30 degrees during normal manoeuvres by observing area traffic in the traffic display or use other normal pitch and roll characteristics to ensure that the system is able to track aircraft without any issues on the display.

(3) Evaluate the effective surveillance range of the traffic display, including target azimuth reasonableness and track stability. Use other transponder-/ADS-B-equipped aircraft as targets of opportunity.

(4) Determine that any configuration discretes (changes in logic or function with aircraft configuration, altitude, or speed) associated with the ACAS logic, including inhibits of climb RAs, operate properly (ACAS aural annunciation inhibit and all TCAS II version 7.1 hybrid surveillance system inhibits) unless this has been demonstrated during ground tests.

(5) Perform the additional flight tests in Section 3.4.4 of ED-143, in Section 3.4.4 of ED-256A, Sections 3.2 and 3.3 of ED-221A, as applicable. *Note: There is no need to test against ADS-B Out V0 and V1.*

(6) If the system can perform any automated RA manoeuvres (from either TCAS II or ACAS Xa), evaluate the interaction of this automation with nominal and off-nominal flight plan execution, approach and landing automation, and any other non-traffic-related automation in accordance with ED-224 Sections 3.2 and 3.3.

(7) If all selectable modes of ACAS were not demonstrated or cannot be demonstrated during the ground test, evaluate the rest of the selectable modes of ACAS in flight to determine that they perform their intended function, and that the system clearly and uniquely annunciates the operating mode.

(f) Planned encounter flight tests — for initial and follow-on approvals

(1) The objective of these flight tests is to demonstrate adequate ACAS surveillance and to verify predictable ACAS performance.

(2) Initial approvals

(i) Applicants should demonstrate that the system performs the ACAS function by flying the test aircraft using the following flight test encounter scenarios:

— Intruder overtaking,

— Head-on,

— Horizontal converging,

— Crossing (descend/climb through intruder or vice versa).

(ii) It should be verified that the alerts (audio and visual) are correctly generated when performing each scenario.

*Note: The intruder aircraft must have a previously approved transponder installation capable of Mode A, Mode C, Mode S, ACAS and ADS-B Mode S Extended Squitter if appropriate.*

(3) Follow-on approvals

(i) Applicants may demonstrate operation by observing proximate traffic, at least one TA and at least one RA (non-coordinated).

— It should be verified that the RA and TA alerts (aural and visual) occur correctly and are appropriate for the installation, operation and flight crew procedures.

— For these encounter sets, applicants may use:

— Planned encounters with an intruder aircraft operating a transponder.

— Mode C or Mode S transponders installed at a fixed ground location, which reports an appropriate test altitude. The traffic for this test should be generated using suitable test equipment.

— Aircraft targets of opportunity for TA assessment.

*Note 1: Encounters with aircraft targets of opportunity are not appropriate for generating RAs.*

*Note 2: Tests with RAs should only be conducted on planned encounters or encounters with ground-based transponders.*

(ii) Some follow-on ACAS approvals may need further flight testing due to changes in the installation or performance assumptions from the existing ACAS approved design, such as a new flight deck display, controls or avionics platform installation.

Note: There should be coordination with EASA to determine which (if any) of the flight tests should occur from the encounter flight testing set in (f).

(g) RA information downlink

For initial approvals, and possibly follow-on approvals, it should be verified that the correct RA data is downlinked to the ground ATC centre.

# Appendix D — Aircraft flight manual for ACAS

## 1 Introduction

This Appendix provides guidance for the aircraft flight manual.

The aircraft flight manual should include at least the following sections:

— normal operating procedures,

— limitations,

— emergency procedures, and

— abnormal procedures.

## 2 Normal operating procedures

For normal operating procedures, the following should be considered:

— Avoidance manoeuvres based on RAs,

— TA mode selection, TA response and traffic information,

— RA autopilot features,

— Ignoring RA (nuisance/false RA) based on visual acquisition of traffic,

— TCAS II version 7.1 hybrid surveillance mute feature (for rotorcraft),

— Failure modes.

*Note for rotorcraft: ACAS developed under all the revisions of ED-143, ED-221A and ED-256 A have not been designed for rotorcraft installations, so the ACAS operating envelope may not suit all rotorcraft. Pilots should be aware of these ACAS operating limitations including altitude restrictions and exposure to high-vibration operating environments. Certain installations may require the pilot to disable ACAS when flying between different altitudes or above a certain altitude, or when performing certain tasks that would not jeopardise the safe operation of the aircraft.*

(a) Avoidance manoeuvres based on RA.

(1) Deviation from the ATC-assigned altitude is authorised only to the extent necessary to comply with the ACAS RA.

(2) When an RA occurs, the pilot flying (PF) should respond immediately by directing attention to the RA displays and manoeuvre as indicated, unless doing so would jeopardise the safe operation of the aircraft.

(3) In certain cases, ACAS RAs may command manoeuvres that significantly reduce stall margins or result in stall warning. Stall warnings have a higher priority. When the RA manoeuvre is initiated and results in a stall warning or stall, the pilot should follow the stall warning procedures or stall recovery procedures.

(4) When responding to an RA, the PF should limit evasive manoeuvring to the minimum required to comply with the RA.

(5) For rotorcraft: Pilots should not use autorotative descent for 'increase descent' RAs. Use normal descent rates as directed by the FD or operating instructions.

(b) TA mode selection, TA response and traffic information

(1) Respond to TAs by attempting to establish visual contact with the intruder aircraft and other aircraft which may be in the vicinity. Coordinate to the degree possible with other crew members to assist in searching for traffic. Do not deviate from an assigned clearance based only on TA information. For any traffic acquired visually, continue to maintain safe separation in accordance with current regulations and good operating practices.

*Note: Only the traffic with operable transponders or qualified ADS-B Out systems is displayed.*

(2) The selection of TA-only mode operations should be addressed in the AFM.

(3) For fixed wing aircraft: During windshear and/or GPWS/TAWS warnings, ACAS switches automatically into a TA-only mode and inhibits aural annunciation. In this mode, the system does not issue RAs, and the current RAs become TAs. The system remains in TA-only mode for 10 seconds after removal of the windshear or GPWS/TAWS warning. ACAS re-enables aural annunciations immediately following the removal of the windshear or GPWS/TAWS warning aural annunciation.

(4) For fixed wing aircraft: ACAS Xa includes an optional feature that displays ADS-B Only Traffic Advisories Only (AOTO). RAs are never issued against this traffic. This traffic will be displayed using a unique symbol to differentiate from normal TAs, since these TAs will never progress to RAs. TCAS II version 7.1 with hybrid surveillance does not have this feature and will not trigger a TA on ADS-B only targets. When an AOTO is issued, follow the procedures in Section 2(b)(1) of this Appendix.

(c) RA autopilot features

(1) If applicable, any limitation of the use of the autopilot/FD TCAS RA mode should be included.

(2) The ACAS flight procedures should address the following:

(i) For a non-crossing RA, to avoid negating the effectiveness of a coordinated manoeuvre by the intruder aircraft, advice that vertical speed should be accurately monitored to comply with the RA.

(ii) For a crossing RA, a warning that non-compliance by one aircraft can result in reduced vertical separation with the need to achieve safe horizontal separation by visual means.

(iii) Caution that, under certain conditions, commanded manoeuvres may significantly reduce stall margins. The expected crew procedure in such situation should be defined, including the need for pilot intervention to respect the stall warning where this may occur.

(iv) When a climb RA is given with the aircraft in landing configuration, a normal go-around procedure should be considered.

*Note: If aircraft of the same type can be operated with or without autopilot/FD ACAS RA mode, an operational procedure should make the crew aware whether the* *autopilot/FD ACAS RA mode is installed or not. Some aircraft may be fitted with the autopilot/FD TCAS RA mode and some not.*

(3) ACAS RA coupled to the autopilot/FD may be implemented differently on each aircraft type. Examples of two different FM procedures from two different implementations:

(i) When the autopilot/FD TCAS RA mode is engaged and the pilot determines that the RA selection is incorrect/unnecessary, the pilot can disengage the auto RA mode without affecting other autopilot/FD modes.

(ii) When the autopilot/FD TCAS RA mode is engaged and the pilot determines that the RA selection is incorrect/unnecessary, the pilot can disengage the auto RA mode, but it will also disengage autopilot/FD modes on the aircraft. Pilots should then prepare to fly the aircraft in manual mode.

(4) Manufacturers should address procedures for flight crew after the auto RA has completed its function and the flight crew receives a 'Clear of Conflict' message.

(d) Ignoring RA (nuisance/false RA) based on visual acquisition of traffic

(1) When an RA occurs and the PF does not respond or chooses a different response, the flight crew is effectively taking responsibility for achieving safe separation. In choosing this action, the PF should be aware of the following:

(i) The traffic acquired by ACAS may also be equipped with an ACAS and it may manoeuvre in response to an RA coordinated with own aircraft ACAS.

(ii) The traffic acquired visually may not be the same traffic causing the RA.

(iii) The visual perception of the encounter may be misleading. Unless it is unequivocally clear that the traffic acquired visually is the one generating the RA, and there are no complicating circumstances, the pilot's instinctive reaction should always be to respond to the RAs in the direction and to the degree displayed.

(iv) ATC may not be providing separation service or be communicating with the traffic causing the RA.

(v) Disregarding an RA during a coordinated encounter with another ACAS-equipped aircraft can result in a loss of safe separation.

(e) For rotorcraft: TCAS II version 7.1 with hybrid surveillance mute feature

For installations with mute feature, pilots should follow the instructions of its use in the operating procedures provided by the operator/manufacturer.

(f) Failure modes

(1) ACAS operation requires an operable transponder and radar altimeter to provide own aircraft altitude information. In the event of transponder or radar altimeter failure, ACAS will also fail.

(2) With an own aircraft ADS-B failure or own aircraft GNSS failure, ACAS will still issue TAs and RAs against operable transponder-equipped aircraft.

## 3 Limitations

Include any limitations affecting ACAS.

## 4 Emergency procedures

Include any emergency procedures affecting ACAS.

## 5 Abnormal procedures

Include any abnormal procedures affecting ACAS.

## 6 Example of flight manual supplement for ACAS

Note: The text in *italics* requires the applicant to provide suitable information.

This Flight Manual is EASA-approved under Approval Number P-EASA.xxxxx

Flight Manual [*or POH as appropriate*] Reference ________

***(Company Name)***

**FLIGHT MANUAL SUPPLEMENT**

Aircraft model: _______

Serial number: ____

**Airborne collision avoidance system**

Modification number ___________

***The limitations and information contained herein either supplement or, in the case of conflict, override those in the flight manual.***

GENERAL

The installed ACAS is fully compliant with the requirements of CS ACNS.D.ACAS (Airborne Collision Avoidance System). A detailed description of the ACAS operation can be found in the _____________________, P/N ___________________, Rev. ____ or subsequent revisions.

NORMAL PROCEDURES

Normal ACAS operating procedures are described in the _______________, P/N ____________________, Rev. _____ or subsequent revisions.

(a) Avoidance manoeuvres based on RAs

(1) Deviation from the ATC-assigned altitude is authorised only to the extent necessary to comply with the ACAS Resolution Advisory (RA).

(2) When an RA occurs, the pilot flying (PF) should respond immediately by directing attention to the RA displays and manoeuvre as indicated, unless doing so would jeopardise the safe operation of the aircraft.

(3) In certain cases, ACAS RAs may command manoeuvres that significantly reduce stall margins or result in stall warning. Stall warnings have a higher priority. When the RA manoeuvre is initiated and results in a stall warning or stall, the pilot should follow the stall warning procedures or stall recovery procedures.

(4) When responding to an RA, the PF should limit evasive manoeuvring to the minimum required to comply with the RA.

*(5)* *For rotorcraft:* Pilots should not use autorotative descent for 'Increase Descent' RAs. Use normal descent rates as directed by the flight director (FD) or operating instructions.

(b) TA mode selection, TA response and traffic Information

(1) Respond to TAs by attempting to establish visual contact with the intruder aircraft and other aircraft which may be in the vicinity. Coordinate to the degree possible with other crew members to assist in searching for traffic. Do not deviate from an assigned clearance based only on TA information. For any traffic acquired visually, continue to maintain safe separation in accordance with current regulations and good operating practices.

Note: Only the traffic with operable transponders or qualified ADS-B Out systems is displayed.

(2) *The selection of TA-only mode operations should be addressed in the AFM.*

(c) RA autopilot features (*if installed*)

(1) Normal RA autopilot operating procedures are described in the _______________, P/N ____________________, Rev. _____ or subsequent revisions.

(2) *Any limitation of the use of the autopilot/FD TCAS RA mode should be included.*

(3) *The ACAS flight procedures should address the following:*

(i) For a non-crossing RA, to avoid negating the effectiveness of a coordinated manoeuvre by the intruder aircraft, advice that vertical speed should be accurately monitored to comply with the RA.

(ii) For a crossing RA, a warning that non-compliance by one aircraft can result in reduced vertical separation with the need to achieve safe horizontal separation by visual means.

(iii) Caution that, under certain conditions, commanded manoeuvres may significantly reduce stall margins. The expected crew procedure in such situation should be defined, including the need to respect the stall warning where this may occur.

(iv) When a climb RA is given with the aircraft in landing configuration, a normal go-around procedure should be considered.

(d) Ignoring RA (nuisance/false RA) based on visual acquisition of traffic

(1) When an RA occurs and the PF does not respond or chooses a different response, the flight crew is effectively taking responsibility for achieving safe separation. In choosing this action, the PF should be aware of the following:

(i) The traffic acquired by ACAS may also be equipped with an ACAS and it may manoeuvre in response to an RA coordinated with own aircraft ACAS.

(ii) The traffic acquired visually may not be the same traffic causing the RA

(iii) The visual perception of the encounter may be misleading. Unless it is unequivocally clear that the traffic acquired visually is the one generating the RA, and there are no complicating circumstances, the pilot's instinctive reaction should always be to respond to the RAs in the direction and to the degree displayed.

(iv) ATC may not be providing separation service or be communicating with traffic causing the RA.

(v) Disregarding an RA during a coordinated encounter with another ACAS-equipped aircraft can result in a loss of safe separation.

<u>LIMITATIONS</u>

*Include any limitations affecting ACAS.*

<u>EMERGENCY PROCEDURES</u>

*Include any emergency procedures affecting ACAS.*

<u>ABNORMAL PROCEDURES</u>

*Include any abnormal procedures affecting ACAS.*

<u>PERFORMANCE</u>

*Include any aircraft performance characteristics affecting ACAS.*

| | | |
|---|---|---|
| ***To be inserted in the flight manual. Record sheet to be amended accordingly.*** | | |
| **Page (__) of (__)** | **Authority/DOA approval:___________________Date:__________** | |
| **Issue:______** | **Signature:_________________________________** | |

## 3.6. Draft amendment to Certification Specifications for European Technical Standard Orders (CS-ETSO)

~~*ED Decision 2022/018/R*~~

*ED Decision 20../../.*

### SUBPART B – LIST OF ETSOs

[...]

**Index 1 of CS-ETSO**

| EASA ETSO ref. | Title | Last amended by |
|---|---|---|
| ETSO-C1e | Cargo Compartment Fire Detection Instruments | CS-ETSO/13 |
| ETSO-C2d | Airspeed Instruments | CS-ETSO/Initial Issue |
| ETSO-C3e | Turn and Slip Instruments | CS-ETSO/11 |
| ETSO-C4c | Bank and Pitch Instruments | CS-ETSO/Initial Issue |
| ETSO-C5f | Direction Instrument, Non-Magnetic (Gyroscopically Stabilized) | CS-ETSO/11 |
| ETSO-C6e | Direction Instrument, Magnetic (Gyroscopically Stabilized) | CS-ETSO/6 |
| ETSO-C7d | Direction Instrument, Magnetic Non-Stabilized Type (Magnetic Compass) | CS-ETSO/Initial Issue |
| ETSO-C8e | Vertical Velocity Instrument (Rate-of-Climb) | CS-ETSO/6 |
| ETSO-C10c | Pressure Altimeter System | CS-ETSO/16 |
| ETSO-C13g | Life preservers | CS-ETSO/16 |
| ETSO-C14b | Aircraft Fabric, Intermediate Grade; External Covering Material | CS-ETSO/Initial Issue |
| ETSO-C15d | Aircraft Fabric, Grade A; External Covering Material | CS-ETSO/Initial Issue |
| ETSO-C16b | Electrically Heated Pitot and Pitot-Static Tubes | CS-ETSO/13 |
| ETSO-C20a | Combustion Heaters and Accessories | CS-ETSO/16 |
| ETSO-C21b | Aircraft Turnbuckle Assemblies and/or Turnbuckle Safetying Devices | CS-ETSO/Initial Issue |
| ETSO-C22g | Safety Belts | CS-ETSO/Initial Issue |
| ETSO-C23f | Personal Parachute Assemblies and Components | CS-ETSO/13 |
| ETSO-C25a | Aircraft Seats and Berths (Type I Transport 6g Forward Load) | CS-ETSO/Initial Issue |

| EASA ETSO ref. | Title | Last amended by |
|---|---|---|
| ETSO-C26d | Aircraft Wheels and Wheel-Brake Assemblies (CS-23, 27 and 29 aircraft) | CS-ETSO/12 |
| ETSO-C27a | Twin Seaplane Floats | CS-ETSO/16 |
| ETSO-C28 | Aircraft Skis | CS-ETSO/Initial Issue |
| ETSO-C30d | Aircraft Position Lights | CS-ETSO/13 |
| ETSO-C39c | Aircraft Seats and Berths Certified by Static Testing only | CS-ETSO/6 |
| ETSO-C42 | Propeller Feathering Hose Assemblies | CS-ETSO/Initial Issue |
| ETSO-C43d | Temperature Instruments | CS-ETSO/16 |
| ETS0-C44c A1 | Fuel Flowmeters | CS-ETSO/8 |
| ETS0-C45b A1 | Manifold Pressure Instruments | CS-ETSO/8 |
| ETSO-C46a | Maximum Allowable Airspeed Indicator System | CS-ETSO/Initial Issue |
| ETS0-C47a A1 | Pressure Instruments — Fuel, Oil, and Hydraulic (Reciprocating Engine-Powered Aircraft) | CS-ETSO/8 |
| ETSO-C49b | Electric Tachometer: Magnetic Drag (Indicator and Generator) | CS-ETSO/Initial Issue |
| ETSO-C53a | Fuel and Engine Oil System Hose Assemblies | CS-ETSO/Initial Issue |
| ETSO-C54 | Stall Warning Instruments | CS-ETSO/Initial Issue |
| ETSO-C55a A1 | Fuel and Oil Quantity Instruments | CS-ETSO/17 |
| ETS0-C56b A1 | Engine-Driven Direct Current Generators/Starter Generators | CS-ETSO/8 |
| ETSO-C59b | Airborne Selective Calling Equipment | CS-ETSO/13 |
| ETSO-C62e | Aircraft Tyres | CS-ETSO/7 |
| ETSO-C63f | Airborne Weather Radar Equipment | CS-ETSO/17 |
| ETSO-C64b | Oxygen Mask Assembly, Continuous Flow, Passenger | CS-ETSO/12 |
| ETSO-C69c | Emergency Evacuation Slides, Ramps and Slide/Rafts Combinations | CS-ETSO/Initial Issue |
| ETSO-C70b | Life Rafts | CS-ETSO/11 |
| ETSO-C71 | Airborne Static ('DC to DC') Electrical Power Converter (for Air Carrier Aircraft) | CS-ETSO/Initial Issue |
| ETSO-C72c | Individual Flotation Devices | CS-ETSO/Initial Issue |

| EASA ETSO ref. | Title | Last amended by |
|---|---|---|
| ETSO-C73 | Static Electrical Power Inverter | CS-ETSO/Initial Issue |
| ETSO-C76b | Fuel Drain Valves | CS-ETSO/11 |
| ETSO-C78a | Crewmember Demand Oxygen Mask | CS-ETSO/13 |
| ETSO-C79 | Fire Detectors (Radiation Sensing Types) | CS-ETSO/Initial Issue |
| ETSO-C80 | Flexible Fuel and Oil Cell Material | CS-ETSO/Initial Issue |
| ETSO-C85b | Survivor Locator Lights | CS-ETSO/12 |
| ETSO-C87a | Airborne Low-Range Radio Altimeter | CS-ETSO/8 |
| ETSO-C88b | Automatic Pressure Altitude Reporting Code Generating Equipment | CS-ETSO/11 |
| ETSO-C89a | Crew Member Oxygen Regulators, Demand | CS-ETSO/11 |
| ETSO-C90d A1 | Cargo Pallets, Nets and Containers | CS-ETSO/11 |
| ETSO-C92c | Ground Proximity Warning, Glide Slope Deviation Alerting Equipment | CS-ETSO/Initial Issue |
| ETSO-C95a | Mach Meters | CS-ETSO/7 |
| ETSO-C96c | Anticollision Light Systems | CS-ETSO/17 |
| ETSO-C99a | Flight Deck (Sedentary) Crew Member Protective Breathing Equipment | CS-ETSO/11 |
| ETSO-C100c | Aviation Child Safety Device (ACDS) | CS-ETSO/11 |
| ETSO-C101 | Overspeed Warning Instruments | CS-ETSO/Initial Issue |
| ETSO-C102 | Airborne Radar Approach and Beacon Systems for Helicopters | CS-ETSO/Initial Issue |
| ETSO-C103 | Continuous Flow Oxygen Mask Assembly (for Non-Transport Category Aircraft) | CS-ETSO/Initial Issue |
| ETSO-C105 | Optional Display Equipment for Weather and Ground Mapping Radar Indicators | CS-ETSO/Initial Issue |
| ETSO-C106a | Air Data Computer | CS-ETSO/17 |
| ETSO-C109 | Airborne Navigation Data Storage System | CS-ETSO/Initial Issue |
| ETSO-C110a | Airborne Passive Thunderstorm Detection Systems | CS-ETSO/Initial Issue |
| ETSO-C112e | Secondary Surveillance Radar Mode S Transponder | CS-ETSO/11 |
| ETSO-C113b | Airborne Multipurpose Electronic Displays | CS-ETSO/16 |

| EASA ETSO ref. | Title | Last amended by |
|---|---|---|
| ETSO-C114 A1 | Torso Restraint Systems | CS-ETSO/8 |
| ETSO-C115d | Required Navigation Performance (RNP) Equipment using Multi-Sensor Inputs | CS-ETSO/13 |
| ETSO-C116a | Crew Member Portable Protective Breathing Equipment | CS-ETSO/11 |
| ETSO-C117b | Airborne Wind Shear Warning and Escape Guidance Systems (Reactive Type) for Transport Aeroplanes | CS-ETSO/16 |
| ETSO-C118a | Traffic Alert and Collision Avoidance System I (TCAS I) | CS-ETSO/13 |
| ETSO-C119e | Airborne Collision Avoidance System II (ACAS II) Version 7.1 with Hybrid Surveillance | CS-ETSO/17 |
| ETSO-C121b | Underwater Locating Device | CS-ETSO/8 |
| ETSO-C126c | Emergency Locator Transmitter | CS-ETSO/16 |
| ETSO-C127c | Rotorcraft, Transport Aeroplane, and Small Aeroplane Seating Systems | CS-ETSO/17 |
| ETSO-C132a | Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment | CS-ETSO/12 |
| ETSO-C135a | Large Aeroplane Wheels, and Wheels and Brake Assemblies | CS-ETSO/6 |
| ETSO-C137a | Aircraft Portable Megaphones | CS-ETSO/17 |
| ETSO-C139a A1 | Aircraft Audio Systems and Equipment | CS-ETSO/17 |
| ETSO-C141 | Aircraft Fluorescent Lighting Ballast/Fixture Equipment | CS-ETSO/Initial Issue |
| ETSO-C142b | Non-Rechargeable Lithium Cells and Batteries | CS-ETSO/16 |
| ETSO-C144a | Passive Airborne Global Navigation Satellite System (GNSS) Antenna | CS-ETSO/6 |
| ETSO-C145e A1 | Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite-Based Augmentation System | CS-ETSO/16 |
| ETSO-C146e A1 | Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite-Based Augmentation System | CS-ETSO/16 |
| ETSO-C147a | Traffic Advisory System (TAS) Airborne Equipment | CS-ETSO/12 |
| ETSO-C151d | Terrain Awareness and Warning System (TAWS) | CS-ETSO/16 |
| ETSO-C153a | Integrated Modular Avionics (IMA) Platform and Modules | CS-ETSO/16 |

| EASA ETSO ref. | Title | Last amended by |
|---|---|---|
| ETSO-C154c | Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment | CS-ETSO/7 |
| ETSO-C155b | Recorder Independent Power Supply | CS-ETSO/13 |
| ETSO-C157c | Flight Information Services-Broadcast (FIS-B) Equipment | CS-ETSO/17 |
| ETSO-C158 | Aeronautical Mobile High Frequency Data Link (HFDL) Equipment | CS-ETSO/7 |
| ETSO-C159d | Next Generation Satellite Systems (NGSS) Equipment | CS-ETSO/16 |
| ETSO-C160a A1 | VDL Mode 2 Communications Equipment | CS-ETSO/16 |
| ETS0-C161b | Ground-Based Augmentation System Positioning and Navigation Equipment | CS-ETSO/17 |
| ETSO-C162b | Ground-Based Augmentation System Very High Frequency Data Broadcast Equipment | CS-ETSO/17 |
| ETSO-C165b | Electronic Map Systems for Graphical Depiction of Aircraft Position | CS-ETSO/16 |
| ETS0-C166b A3 | Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz) | CS-ETSO/13 |
| ETSO-C170 | High-Frequency (HF) Radio Communication Transceiver Equipment Operating Within the Radio Frequency 1.5 to 30 Megahertz | CS-ETSO/7 |
| ETSO-C172a | Cargo Restraint Strap Assemblies | CS-ETSO/12 |
| ETSO-C173a | Nickel-Cadmium, Nickel Metal-Hydride, and Lead-Acid Batteries | CS-ETSO/11 |
| ETS0-C174 A1 | Battery-Based Emergency Power Unit (BEPU) | CS-ETSO/8 |
| ETSO-C175 | Galley Cart, Containers and Associated Components | CS-ETSO/3 |
| ETSO-C178a | Aircraft Circuit Breakers | CS-ETSO/17 |
| ETSO-C179b | Rechargeable Lithium Cells, Batteries, and Battery Systems | CS-ETSO/16 |
| ETSO-C184 | Galley Equipment | CS-ETSO/7 |
| ETSO-C190 | Active Airborne Global Navigation Satellite System (GNSS) Antenna | CS-ETSO/6 |
| ETSO-C194 | Helicopter Terrain Awareness and Warning System (HTAWS) | CS-ETSO/7 |
| ETSO-C195b | Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance | CS-ETSO/12 |
| ETSO-C196b | Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation | CS-ETSO/16 |

| EASA ETSO ref. | Title | Last amended by |
|---|---|---|
| ETSO-C198 | Automatic Flight Guidance and Control System (AFGCS) Equipment | CS-ETSO/8 |
| ETSO-C199 A1 | Traffic Awareness Beacon System (TABS) | CS-ETSO/16 |
| ETSO-C200a | Low-Frequency Underwater Locating Device (ULD) | CS-ETSO/12 |
| ETSO-C201 | Attitude and Heading Reference Systems (AHRS) | CS-ETSO/11 |
| ETSO-C202 | Cargo Stopper Devices | CS-ETSO/11 |
| ETSO-C203 A1 | Fire containment covers (FCC) | CS-ETSO/13 |
| ETSO-C207a | Aeronautical Mobile Airport Communication System (AeroMACS) | CS-ETSO/16 |
| ETSO-C209 | Electronic Flight Instrument System (EFIS) Display | CS-ETSO/13 |
| ETSO-C210 | Airborne Head-Up Display | CS-ETSO/13 |
| ETSO-C214 A1 | Functional ETSO equipment using an ETSO-C153a-authorised IMA platform or module | CS-ETSO/16 |
| ETSO-C219a | Airborne Collision Avoidance System (ACAS) Xa/Xo | CS-ETSO/18 |

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[Amdt ETSO/8]
[Amdt ETSO/9]
[Amdt ETSO/10]
[Amdt ETSO/11]
[Amdt ETSO/12]
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[Amdt ETSO/17]
[Amdt ETSO/18]

INDEX 1

# ETSO-C219a

~~*ED Decision 2020/011/R (applicable from 25/7/2020)*~~

*ED Decision 20../../.*

# European Technical Standard Order

Subject: AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS) Xa/Xo

## 1 Applicability

This ETSO provides the requirements which ACAS X equipment that is designed and manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

'ACAS X' in this ETSO refers to an ACAS Xa/Xo system and not to any other ACAS X variant.

## 2 Procedures

### 2.1 General

Applicable procedures are detailed in CS-ETSO, Subpart A.

### 2.2 Specific

None

## 3 Technical conditions

### 3.1 Basic

#### 3.1.1 Minimum performance standard

Standards set forth in EUROCAE ED-256 Rev. A, Minimum Operational Performance Standards for Airborne Collision Avoidance System X (ACAS Xa and ACAS Xo), dated XXXXXX 2023.

#### 3.1.2 Environmental standard

See CS-ETSO, Subpart A, paragraph 2.1 and EUROCAE ED-256 Rev A Section 2.3.

#### 3.1.3 Software

See CS-ETSO, Subpart A, paragraph 2.2.

#### 3.1.4 Airborne electronic hardware

See CS-ETSO, Subpart A, paragraph 2.3.

### 3.2 Specific

#### 3.2.1 Failure condition classification

See CS-ETSO, Subpart A, paragraph 2.4.

**3.2.1.1** Failure of the function defined in paragraph 3.1.1 of this ETSO resulting in misleading information is:

(a) a hazardous failure condition for un-annunciated failures that could either generate an incorrect resolution advisory or result in a missing resolution advisory.

(b) a major failure condition for un-annunciated failures that could generate a false resolution advisory.

**3.2.1.2** Failure of the function defined in paragraph 3.1.1 of this ETSO resulting in loss of the function (annunciated) is a minor failure condition.

Additional guidance on the failure conditions classifications is provided in CS ACNS Subpart D Section 5.

*Note: As used in this paragraph:*

— *Incorrect resolution advisory is the case where a resolution advisory condition exists and a resolution advisory is issued but the resolution advisory provides incorrect guidance.*

— *Missing resolution advisory is the case where a resolution advisory condition exists but a resolution advisory is not issued.*

— *False resolution advisory is the case where a resolution advisory is issued but a resolution advisory condition does not exist.*

**4 Marking**

**4.1 General**

Marking as detailed in CS-ETSO, Subpart A, paragraph 1.2.

**4.2 Specific**

The marking shall also include the equipment class and the ACAS X article name as defined in Section 1.1.3.1 of EUROCAE ED-256 Rev A.

**5 Availability of Referenced Documents**

See CS-ETSO, Subpart A, paragraph 3.

### 3.7. Draft amendments to Regulation (EU) 2018/1048 and related AMC & GM to AUR

## *Article 5 — Exclusive use of PBN*

1. Providers of ATM/ANS shall not provide their services using conventional navigation procedures, or using performance-based navigation which is not in accordance with the requirements of point AUR.PBN.2005 of the Annex.

2. Paragraph 1 shall be without prejudice to Article 6 and to the possibility of providers of ATM/ANS to provide their services using landing systems enabling CAT II~~, CAT IIIA or CAT IIIB~~ or CAT III operations within the meaning of ~~points 14, 15 and 16, respectively,~~ point (120e) of Annex I to Regulation (EU) No 965/2012.

## ANNEX — SUBPART PBN — PERFORMANCE-BASED NAVIGATION

## AUR.PBN.2005 Routes and procedures

[…]

(5) By way of derogation from point (4), where providers of ATM/ANS have established SID routes or STAR routes and where higher performance requirements than those referred to in that point are required in order to maintain air traffic capacity and safety in environments with high traffic density, traffic complexity or terrain features, they shall

implement those routes in accordance with the requirements of the RNP 1 specification~~,~~. Additionally, where the operational scenario so requires, the routes shall ~~including~~ consider one or more of the following ~~additional~~ navigation functionalities:

(a) operations along a vertical path and between two fixes and with the use of:

(i) an 'AT' altitude constraint;

(ii) an 'AT OR ABOVE' altitude constraint;

(iii) an 'AT OR BELOW' altitude constraint;

(iv) a 'WINDOW' constraint;

(b) the radius to fix (RF) leg.

(6) Where providers of ATM/ANS have established ATS routes for en route operations, they shall implement those routes in accordance with the requirements of the RNAV 5 specification.

(7) By way of derogation from points (4) and (6), where providers of ATM/ANS have established ATS routes, SID routes or STAR routes for rotorcraft operations, they shall implement those routes in accordance with the requirements of the RNP 0.3, RNAV 1 or RNP 1 specifications. In that case, they shall be entitled to decide which of those three sets of requirements they comply with.

(8) By way of derogation from point (6), where providers of ATM/ANS have established ATS routes in oceanic or remote continental airspace, they shall implement those routes in accordance with the requirements of the RNAV 10 or the RNP 4 specifications.

## GM2 Article 4 Transitional measures

**RELEVANT ASPECTS OF THE TRANSITION PLAN**

In implementing the required routes and procedures, there is an opportunity to optimise the overall safety, capacity and efficiency of flight operations. The transition plan needs to take due account of the complexity of the airspace structures and traffic flows as well as the specificities of the traffic operating at the affected aerodromes. In addition, it is suggested that a transition plan address, at least, the following aspects:

[…]

(d) the need to consider CAT II/III ground facilities (ILS, MLS) to supplement RNP APCH procedures where operations below CAT I minima are required due to local conditions~~, as well as the existing and planned GLS facilities that currently provide guidance during CAT I approach and landing operations, but which are anticipated to support CAT II/III operations in the future~~; and

[…]

## GM1 Article 5 Exclusive use of PBN

[…]

Article 5 precludes the use of instrument approach procedures, other than those predicated on PBN, as per AUR.PBN.2005. As regards CAT I approaches predicated on ILS and MLS, they may in many cases be replaced by SBAS approaches that can be operated down to CAT I precision approach minima. There could be locations at which SBAS approaches cannot offer CAT I minima, so existing instrument approach procedures based on ILS, ~~GLS~~ or MLS may be retained and used in normal conditions until the deadline defined in Article 7(2)(a).

[…]

## GM1 Article 7 Entry into force and application

The following table provides a summary of the implementation timing:

| **Implementation by 3 December 2020** | **AUR.PBN.2005 points** |
|---|---|
| RNP APCH or RNP AR to all IREs without PA, except at those airports listed in point 1.2.1 of the Annex to the PCP Regulation[18], and, where required, RF legs | (1) + (2) + (3) |
| RNAV 5 for all ATS routes at or above FL150 | (6) |
| RNAV 10 or RNP 4 for all ATS routes in support of oceanic and remote continental operations at or above FL150 | (8) |
| **Implementation by 25 January 2024** | |
| RNP APCH or RNP AR to all IREs, and, where required, RF legs | (1) + (2) + (3) |
| For all IREs, RNAV 1 or RNP 1(+) for at least one established SID/STAR | (4) + (5) |
| For all IREs, RNP 0.3 or RNP 1 or RNAV 1 for at least one established SID/STAR for rotorcraft operations | (7) |
| RNAV 5 for ATS routes established below FL150 | (6) |
| RNP 0.3 or RNP 1 or RNAV 1 for ATS routes established below FL150 for rotorcraft operations | (7) |
| **Implementation by 6 June 2030** | |
| RNAV 1 or RNP 1(+) applicable to all SIDs/STARs when established | (4) + (5) |
| RNP 0.3 or RNP 1 or RNAV 1 applicable to all SIDs/STARs for rotorcraft operations when established | (7) |
| IRE: instrument runway end<br>PA: precision approach<br>RNP 1(+): RNP 1 specification including RF and/or vertical paths defined by constraints<br>SID: standard instrument departure<br>STAR: standard instrument arrival<br>RF: radius to fix<br>RNAV X & RNP X: navigation specifications | |

[18] Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan

# 4. Impact Assessment (IA)

## 4.1. What is the issue

This impact assessment refers to the introduction of aircraft equipped with ACAS Xa avionics into the SES airspace, an objective described in Section 2.2.1.

Commission Regulation (EU) No 1332/2011 requires aeroplanes with a maximum certificated take-off mass exceeding 5 700 kg or authorised to carry more than 19 passengers to be equipped with an ACAS II version 7.1. With the industry furnishing a new technology to provide airborne collision avoidance safety nets that further reduce the risk of a mid-air collision[19], there is a need to assess the use of ACAS Xa as an alternative option to TCAS II version 7.1.

Note: No ACAS Xo operations have been assessed or are within the scope of this impact assessment.

### 4.1.1. ICAO background information on ACAS Xa

In April 2020, the Surveillance Panel of ICAO proposed the introduction of provisions for the newly developed airborne collision avoidance system (ACAS X), as well as an amendment to reduce false alerts for aircraft equipped with TCAS II with hybrid surveillance capability. The proposal was for an amendment to the SARPs of Annex 10 *Aeronautical Telecommunications* — Volume IV *Surveillance and Collision Avoidance Systems*, with an applicability date as of 3 November 2022. The adoption of the proposal as Amendment 91 of the ICAO Annex 10 Volume IV was presented to the 225th session of the Council for approval and the publication of the corresponding State Letter (SL) Ref: AN 7/66.2.2-22/27 occurred on 29 March 2022.

ICAO Annex 10, Volume IV, Amendment 91 introduces ACAS X including provisions for ACAS Xa — active surveillance — and for ACAS Xo which is operation-specific. The evaluations performed by ICAO in support of the proposal indicated that the deployment of ACAS Xa would reduce the probability of a near mid-air collision (NMAC) (as indicated in the ICAO SL AN 7/1.3.105-20/42[20] ) and optimise the number of resolution advisories (RAs) compared to TCAS II. The proposal stated that since ACAS Xa works with the same hardware and displays traffic advisories (TAs) and RAs in the same manner as existing ACAS II[21] systems, no change of ICAO PANS-OPS (Doc 8168) are envisaged. Furthermore, the introduction of ACAS Xa supports the Global Air Navigation Plan (GANP) (Doc 9750), specifically ASBU Block ACAS-B2/1.

### 4.1.2. Analysis of ACAS Xa advantages

The relative benefits (of collisions prevented) are calculated based on the logic risk ratios[22], using simulation. The logic risk ratio of a TCAS II version 7.1 is of 4.9 %, while this risk is reduced to 4 % in the case of ACAS Xa. Such improvement is however relative to an existing very low risk of NMAC.

[19] If the collision avoidance system diagnoses a risk of impending collision it issues a resolution advisory (RA) to the flight crew which directs the pilots how best to regulate or adjust their vertical rate so as to avoid a collision.

[20] Section 1.3 of Attachment A to ICAO SL AN 7/1.3.105-20/42.

[21] TCAS II version 7.1 and ACAS Xa systems are considered to be an ACAS II.

[22] The logic risk ratio is defined in ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual, as follows: ‘The term “logic risk ratio” limits the consideration to the effect of the CAS logic, omitting other factors, e.g. surveillance performance, that could affect the safety of the end to end ACAS system’.

Furthermore, such improvement may only be achieved if pilots follow the RAs in a timely manner and the results depend on the fleet being ACAS Xa-equipped.

#### 4.1.3. European assessment of ACAS Xa

A European assessment was undertaken within the framework of SESAR project PJ.11-A1, on a unit compliant with the specifications defined in the *EUROCAE ED-256 'Minimum Operational Performance Standards (MOPS) for airborne collision avoidance system X (ACAS X) (ACAS Xa and ACAS Xo)'* dated October 2018, which is the standard referenced as a means of compliance in Amendment 91 to ICAO Annex 10, Volume IV. The project demonstrated that ACAS Xa performs nominally better than TCAS II within the SES airspace, thus confirming the ICAO assessment. However, with respect to the operational suitability within the SES airspace, several deficiencies were identified that required improvements in the algorithm. The resulting changes developed to address these deficiencies were verified and validated in 2022 and showed that the resulting algorithm was suitable for the SES airspace. These changes are to be included in EUROCAE standard ED-256 Rev. A.

#### 4.1.4. Who is affected

The introduction of ACAS Xa would affect manufacturers of large aeroplanes or aeroplanes authorised to carry more than 19 passengers, suppliers of ACAS Xa systems and aircraft operators where they choose to supply or implement ACAS Xa. Additionally, air navigation service providers (ANSPs) and monitoring services will have to update their systems to cope with a mix of TCAS II and ACAS Xa equipage.

#### 4.1.5. Baseline scenario

Continued operation in SES airspace using only TCAS II will be permitted. Therefore, operators of aircraft equipped with ACAS Xa will not be able to access the SES airspace.

#### 4.1.6. What we want to achieve

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation.

EASA intends to provide the regulatory enablers, promotion and implementation support material, to enable the safe, efficient, interoperable and timely deployment of the operational improvements based on SESAR solutions stemming from the European ATM Master Plan.

It is also intended to address the implementation needs stemming from the ICAO Aviation System Block Upgrades (ASBUs) to support global operations.

One of these regulatory enablers refers to the use of ACAS X. Therefore, the specific objective of this task is to enable the use of ACAS Xa as an alternative to TCAS II in the SES airspace and globally.

### 4.2. How it could be achieved — options

#### 4.2.1. Overview of the options

Three options have been identified for achievement of the objective.

Option 0, the baseline scenario, considers the impacts of a 'do nothing' option, i.e. no change to the regulatory framework.

Option 1 foresees a change to the regulatory framework to enable the voluntary carriage and operation of ACAS Xa as an alternative to the current TCAS II.

Option 2 envisages a change to the regulatory framework which would mandate the carriage and operation of ACAS Xa.

**Table 1: Proposed policy options**

| *Option No* | *Short title* | **Description** |
|---|---|---|
| 0 | | No policy change (no change to the rules) |
| 1 | | ACAS Xa voluntary implementation |
| 2 | | ACAS Xa mandatory implementation |

#### 4.2.2. Discarded option

Option 2 would imply a complete retrofit of the whole fleet; however, the high retrofit cost would not be justified by the minor safety benefit. Furthermore, Option 2 would not be aligned with the latest ICAO SARPs which allow the use of both ACAS Xa and TCAS II version 7.1.

Option 2 has therefore not been retained.

#### 4.2.3. Methodological approach to assess the options

The voluntary nature of Option 1 makes it very difficult to quantify the impact of the option for all the impact assessment criteria (safety, environment, social and economic). The assessment is performed with a quantitative approach for the safety impacts and a qualitative approach for the economic impacts on aircraft operators and ANSPs.

#### 4.2.4. Safety impact

**Option 0**

With Option 0, the safety risks of the current aviation system would be unchanged.

**Option 1**

The validation study, undertaken by EUROCONTROL, ('European Airborne Collision Avoidance System (ACAS) Xa Change Proposal (CP)1 Validation Report')[23] using simulations based on observed European traffic, addresses the overall safety and operational benefits of ACAS Xa, and includes its interoperability with TCAS II version 7.1 when operating with the current and foreseen traffic patterns and densities within the SES airspace. The main conclusions of this study are:

Overall, there are several safety and operational performance benefits from ACAS Xa compared to TCAS II version 7.1.

— When aircraft follow their RAs, the performance of ACAS Xa in comparison with the performance of TCAS II version 7.1 in preventing NMAC has improved in general. However, such improvement is to an existing risk of NMAC that is already very low. Furthermore, although in

[23] https://skybrary.aero/sites/default/files/bookshelf/33311.pdf

some areas the ACAS Xa performance compared to that of TCAS II version 7.1 has improved, in other areas TCAS II version 7.1 was assessed as performing better.

— ACAS Xa optimises the overall number of RAs, leading to an RA reduction, therefore improving regularity of flight and increasing ATM efficiency.

In summary, ACAS Xa brings limited safety and operational benefits when compared with TCAS II version 7.1.

It should be noted that ACAS Xa also contributes to a reduction in 1030/1090 MHz congestion due to a reduction in ACAS interrogations (primarily when compared with TCAS II version 7.1 with no hybrid surveillance capability).

#### 4.2.5. Environmental impact

There are no identified impacts on aircraft noise or engine emissions due to the operation of ACAS Xa in the SES airspace.

#### 4.2.6. Social impact

##### 4.2.6.1 Option 0

For Option 0 there is no change and therefore no social impact.

##### 4.2.6.2 Option 1

For Option 1, ACAS Xa has been designed as a replacement of existing TCAS II version 7.1 systems, performing the same operational safety net function.

Flight crew

While the displays and alerts will be familiar to flight crews, the number, timing and type of alerts generated by ACAS Xa may be different from those issued by TCAS II version 7.1 in similar circumstances. Therefore, as recommended by the ICAO ACAS Manual (Doc 9863), flight crews should be made aware that the behaviour of ACAS Xa may be different from TCAS II version 7.1. This will be addressed as part of the normal recurrent training.

Air traffic controllers

The need for additional training with respect to the potential differences in the resolution guidance between ACAS Xa and TCAS II version 7.1 was assessed. ACAS II training for air traffic controllers has a different focus than that for flight crew training, as specified in the ICAO ACAS Manual (Doc 9863). The objective of the controller training is to enable them to manage situations in which RAs occur, by understanding how collision avoidance systems work and how they interact with ATC, and by understanding the responsibilities of flight crew and air traffic controllers during an ACAS event. These aspects are already covered in the existing initial and recurrent training courses. The existing material will only need to be updated to provide a general description of the ACAS Xa concept and regulatory update status, so that the controllers are aware that there are two compatible collision avoidance systems operating in parallel. This will be addressed as part of the normal recurrent training.

Therefore, no social impact is expected.

### 4.2.7. Economic impact

#### 4.2.7.1 Option 0

Currently there is no fleet equipped with ACAS Xa, but it is anticipated that in the future, new aircraft will be delivered with ACAS Xa. Thus, operators of aircraft equipped only with ACAS Xa will not be able to access the SES airspace. This will have significant operational economic impacts for these operators.

#### 4.2.7.2 Option 1

##### 4.2.7.2.1 Airspace users

Airborne implementation

The limited information received shows that the implementation costs of an ACAS Xa system on new aircraft design (new type certificate (TC)) and in production aircraft (existing TC) are of the same order of magnitude as TCAS II version 7.1 costs.

Flight crew training

Training can be achieved as a part of the recurrent flight crew classroom / simulator training. The update of training material is minor and can be done as a part of a regular maintenance of training material. Therefore, the impact on flight crew training can be considered neutral.

##### 4.2.7.2.2 ANSPs

A mixed fleet of aircraft operating with ACAS Xa and TCAS II version 7.1 needs to be accommodated by the ground systems. The impact of such a mix on the ANSPs was assessed and the outcomes are minor one-off implementation costs on three aspects.

Monitoring system

For those ANSPs that monitor ACAS[24], they would need to update these monitoring systems to take into account the new ACAS Xa systems. The amount of effort required to update the system is estimated to be 40 – 80 manhours per ANSP.

Operational use of RAs

ANSPs that use the RA downlink for display on the controller working position (CWP) will have to verify the potential impact on their systems. Depending on how the RA information is displayed on the CWP, they may or may not need to adapt the RA report decoding depending on which detailed RA report information is displayed. The same data as for TCAS II version 7.1 will be extracted by the surveillance sensors, however the decoding of the content for presentation on the CWP will need to be updated.

More than 12 ANSPs have a system displaying RA information on the CWP. 5 of them use detailed information provided in RA reports. For these 5 ANSPs, their system will need to be checked and adapted. The baseline of these systems will need to be updated by the supplier and the new versions will need to be installed and tested in the relevant control centres. A rough estimate of the required effort is of a magnitude of 400-800 manhours for each ANSP.

[24] See ICAO Doc 9863, Airborne Collision Avoidance System (ACAS) Manual, Chapter 9.

There is no requirement to use RA downlink and display on the CWP as that is an individual decision of each ANSP. If they are unable or unwilling to update their system to accommodate ACAS Xa, the RA downlink functionality would have to be turned off by the ANSP.

Considering the estimated number of manhours provided above, the overall impact on ANSPs can be considered minor.

Air traffic controller training

Training can be achieved as a part of the recurrent flight crew classroom / simulator training. The update of training material is minor and can be done as a part of a regular maintenance of training material. Therefore, the impact on air traffic controller training can be considered neutral.

#### 4.2.8. Impact on the Network Manager

Regulation (EU) 2019/123[25] tasks the Network Manager (NM) to monitor the performance of ACAS systems.

The additional effort for the NM to update the monitoring systems to include ACAS Xa were assessed to be in the range of 480 manhours including all activities related to the monitoring service. Therefore, the impact on the NM can be considered minor.

### 4.3. Conclusion

Overall, from the safety and operational perspective, the benefits of ACAS Xa introduction are:

— improved performance of ACAS Xa in comparison with TCAS II version 7.1 in preventing NMACs;

— optimisation of the overall number of RAs.

Option 1 ‘ACAS Xa Voluntary implementation’ will allow any operators using ACAS Xa to operate in the SES airspace.

In addition, the cost of implementing ACAS Xa versus TCAS II version 7.1 for airspace users is deemed to be insignificant, as ACAS Xa is proposed as an option, and the cost of ACAS Xa is of the same order of magnitude as the cost of TCAS II version 7.1.

A limited number of ANSPs who monitor ACAS operations, will have to adapt their ACAS monitoring systems, however the one-off implementation cost impact is considered minor.

A limited number of ANSPs will have to adapt their operational systems to ensure that the RA information displayed to the controller is updated to support ACAS Xa. However, the implementation cost impact is considered minor.

The overall conclusion is that **Option 1 ‘ACAS Xa Voluntary implementation’ is the preferred option**.

[25] Commission Implementing Regulation (EU) 2019/123 of 24 January 2019 laying down detailed rules for the implementation of air traffic management (ATM) network functions and repealing Commission Regulation (EU) No 677/2011(OJ L 28, 31.1.2019, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0123).

# 5. Proposed actions to support implementation

With regard to ACAS Xa, EASA intends to:

— identify implementation issues, and propose the required mitigating actions in coordination with the European Commission and EUROCONTROL as required;

— consider safety promotion activities to promote the ACAS Xa equipage;

— provide support to stakeholders implementing ACAS Xa and stakeholders making use of the additional information provided by ACAS Xa.

In 2021, EASA commenced ongoing monitoring and support to implementation activities in relation to the PBN Regulation. This project will remain active until the implementation of the required ATS routes and approach procedures by 6 June 2030. EASA intends to:

— review and analyse the PBN transition plans to verify consistency with the regulatory requirements;

— monitor and report on the status of the implementation, in consistency with the regulatory deadlines and the PBN transition plans;

— monitor aircraft equipage rates;

— identify implementation issues, and maintain a close coordination with EUROCONTROL and the European Commission for the definition of supporting actions, as required;

— provide support to stakeholders implementing the PBN Regulation.

# 6. References

## 6.1. Related EU regulations

— Commission Regulation (EU) No 1332/2011 of 16 September 2011 laying down common airspace usage requirements and operating procedures for airborne collision avoidance (OJ L 336 20.12.2011, p. 20)

— Commission Implementing Regulation (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulation (EC) No 482/2008, Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377 and amending Regulation (EU) No 677/2011 (OJ L 62, 8.3.2017, p. 1)

— Commission Implementing Regulation (EU) 2018/1048 of 18 July 2018 laying down airspace usage requirements and operating procedures concerning performance-based navigation (OJ L 189, 26.7.2018, p. 3)

— Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296 25.10.2012, p. 1)

## 6.2. Related EASA decisions

— ED Decision 2018/013/R of 21 November 2018 issuing Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 1332/2011 and Commission Implementing Regulation (EU) 2018/1048 and repealing Decision 2012/002/R of the Executive Director of the Agency of 8 March 2012 — Acceptable Means of Compliance and Guidance Material on common airspace usage requirements and operating procedures ‘AMC & GM to AUR’

— ED Decision 2012/018/R of 24th October 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council — Acceptable Means of Compliance and Guidance Material to Part-CAT

— ED Decision 2013/021/R of 23 August 2013 on adopting Acceptable Means of Compliance and Guidance Material for Non-commercial operations with complex motor-powered aircraft (Part-NCC)

— ED Decision 2014/018/R of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-SPO of Regulation (EU) No 965/2012 ‘AMC and GM to Part-SPO’

— ED Decision 2011/001/R of 23 March 2011 Amending Decision 2003/12/RM on The Executive Director of The Agency of 05 November 2003 on General Acceptable Means of Compliance For Airworthiness Of Products, Parts And Appliances « AMC-20 »

— ED Decision 2022/008/R of 22 March 2022 issuing Issue 4 of the Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance ‘CS-ACNS – Issue 4’

— ED Decision 2022/018/R of 31 August 2022 issuing 'CS-ETSO — Amendment 17'

## 6.3. Other references

— ICAO Annex 10 *Aeronautical Telecommunications* — Volume IV *Surveillance and Collision Avoidance Systems*, Amendment 91

— ICAO Document 9871 *Technical Provisions for Mode S Services and Extended Squitter* Edition 2 (data formats for transponder registers)

— ICAO Document 7030 *ICAO Regional Supplementary Procedures*, Fifth Edition — 2008, Amendment 9

— ICAO Document 8168-OPS/611 *Procedures for Air Navigation Services* — Volume I *Flight Procedures*

— ICAO Document Doc 4444-RAC/501 *Procedures for Air Navigation Service, Air Traffic Management*

— ICAO State Letter Ref: AN 7/66.2.2-22/27 issued by ICAO on 29 March 2022 — *Adoption of Amendment 91 to Annex 10 Volume IV to the Convention on International Civil Aviation*

— ED-73E *Minimum Operational Performance Specification for Secondary Surveillance Radar Mode S Transponders*, May 2011

— ED-73F *MOPS for Secondary Surveillance Radar Mode S Transponders*, December 2020

— ED-143 *Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) version 7.1*

— ED-221A *Minimum Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance*, December 2015

— ED-224 *MASPS for Flight Guidance System (FGS) coupled to Traffic Alert and Collision Avoidance System (TCAS)*, March 2014

— EUROCAE ED-256A *MOPS for ACAS Xa with ACAS Xo functionality*, xxxx 2023

# 7. Appendix 1 – PBN Oceanic Routes

## 1. Analysis

The ICAO PBN Manual[26] describes navigation specifications that have been specifically designed to support operations in oceanic (and remote continental) airspace, namely RNAV 10, RNP 4 and RNP 2. However, none of them are recognised and accepted by the PBN Regulation, which requires instead the implementation of RNAV 5 routes for all the SES en-route operations.

If the PBN Regulation is not amended, ATM/ANS service providers are obliged to remove the existing routes from the respective aeronautical information publications (AIPs) and replace them by routes based on the RNAV 5 specification.

The objective of this Appendix is to elaborate on the issue analysis introduced in Chapter 2 and explain why the PBN Regulation should be amended to allow the use one or more of the PBN specifications intended for oceanic operations.

At EASA ATM/ANS TeB #3-2021, EASA requested information from Member States about the present use of oceanic routes in the SES airspace. With the information available so far, only Spain and France have confirmed the existence of oceanic routes in the airspace targeted by the PBN Regulation. In both cases, their transition plans include routes based on the RNAV 10 (RNP 10) specification; for the time being and waiting for this proposal that seeks to permit the use of oceanic specifications, neither Spain nor France have planned the replacement of such routes by RNAV 5 routes.

France's PBN transition plan indicates that overseas territories may use navigation specifications other than RNAV 5 for oceanic en-route operations, in consistency with ICAO regional navigation plans. More specifically, concerning Mayotte and La Réunion Island, UN 307 (Dzaoudzi), UN 304 (Saint-Denis/Mogadishu) and UG 661 (APLEM/NIBIS section) are published as RNAV 10 routes from FL245 to FL460 in the AIP of ASECNA (Agency for Air Navigation Safety in Africa and Madagascar).

On its part, Spain's transition plan foresees the use of PBN oceanic/remote continental specifications, such as RNAV 10 / RNP 4, in the oceanic sector of the Canarias' FIR/UIR Canarias (GCCC). In this regard, the Spanish oceanic routes are described in detail in Section 3 of this Appendix; there are five (5) Spanish routes that make use of the RNAV 10 specification, and they are mostly contained within the so-called oceanic sector (GCCCOCE) of GCCC. The below paragraphs analyse the issue based on those routes and other data provided by ENAIRE (the Spanish service provider responsible for GCCCOCE) and describe the operational environment.

The situation in the oceanic sector (GCCCOCE) of GCCC presents the following operational specificities, which are commonly associated with oceanic airspace, in particular:

— procedural control, whereby procedural separations are provided by air traffic control (ATC);

— lack or very limited coverage of ground navigation aids (NAVAIDs);

— satellite-based controller-pilot data link communications (CPDLC), satellite-based air traffic services (ATS) ACARS (D-ATIS/D-VOLMET), and high-frequency (HF) radio communications (very limited VHF communications, except when close to the islands);

[26] Performance-based Navigation (PBN) Manual (ICAO Doc 9613, 4th Edition).

— Inexistent or very limited primary surveillance radar (PSR) and/or secondary surveillance radar (SSR) coverage and use of satellite-based automatic dependent surveillance — contract (ADS-C) for position monitoring purposes only.

Note 1: There is no ADS-B information available to ATC in GCCCOCE sector.

Note 2: FANS 1/A satellite-based ADS-C information is available to ATC, but it has not currently been approved as a means for establishing reduced lateral aircraft separation values; hence, it is used for position monitoring only.

Therefore, communication, navigation and surveillance (CNS), as well as separation services, are 'degraded' in comparison with the services offered over continental airspace or in the vicinity of the Canary Islands, where VHF communications are possible, there is sufficient radar and NAVAID coverage, and procedural control is not necessary.

ENAIRE has provided data on (see Section 3 of this Appendix):

— the PSR and/or SSR radar coverage in GCCC; and

— VHF coverage available at both FL100 and FL245).

Some oceanic routes in GCCCOCE connect with airspace that is beyond the limits of the SES. In this regard, it should be noted that the implementation of oceanic routes may require regional or multi-regional agreements to ensure seamless operations and maximise operational benefits.

When it comes to aircraft's navigation performance, the navigation system is to be designed to provide a level of integrity and continuity that supports the intended operation, i.e. oceanic operations within airspace where, typically, a degraded CNS infrastructure exists. In this regard, the ICAO PBN Manual considers that the loss of navigation function (continuity failure) and the malfunctions providing erroneous data (integrity failure) are both major failure conditions for oceanic operations supported by RNAV 10, RNP 4, and RNP 2. However, most aircraft certified for RNAV 5 operations do not meet such a requirement, as the loss of the navigation function is usually considered to be a minor failure condition.

Note: As far as RNAV 10 and RNP 4 are concerned, ICAO considers that the continuity requirement is satisfied by the carriage of dual independent long-range navigation systems (LRNSs). The RNP 2 specification considers different continuity requirements for oceanic/remote and continental operations. Aircraft intended to fly on oceanic and remote continental routes must meet a higher continuity requirement than aircraft wishing to operate on continental routes. In consequence of this, some RNP 2-capable aircraft will meet the higher continuity requirement, while other RNP 2-capable aircraft just meet a lower continuity requirement, which limits the operations of the latter aircraft to continental routes.

As for aircraft capabilities to perform enroute operations, the data corresponding to the second half of 2021[27] that the Network Manager has made available to EASA shows the following:

[27] These data consider en-route capabilities declared in flight plans (FP). The related flights took place within flight information regions (FIRs) of EASA Member States, including overflights.

**Table B: 'aircraft's capabilities'**

| Capabilities[28] | Number of aircraft capable | % of the fleet (22 893 ACFT) | Number of flights capable | % of flights (3 554 244 OPS) |
|---|---|---|---|---|
| RNAV 5 (any sensor) | 21 380 | 93.39 % | 3 476 802 | 97.82 % |
| RNAV 10 (RNP 10) | 15 713 | 68.64 % | 2 592 728 | 72.95 % |
| RNP 4 | 10 342 | 45.18 % | 1 400 626 | 39.41 % |

The data above proves that almost the totality of the fleet is ready to fly RNAV 5, regardless of the supporting navigation infrastructure (GNSS, VOR/DME, etc.). When it comes to navigation specifications specifically designed for oceanic operations, RNAV 10 capabilities are more common than RNP 4 capabilities at present time.

On the other hand, modern aircraft are usually equipped with GNSS receivers and the data available to EASA on new navigation systems indicates that RNP systems are considered in most certification projects; hence, EASA certification requirements for PBN, i.e. CS-ACNS, have been specifically developed to certify RNP systems; in other words, the EASA certification basis for PBN allows to verify compliance with the RNP navigation specifications like RNP 4, while compliance with basic EASA certification requirements in CS-ACNS automatically ensures compliance with RNAV specifications (indirectly), including RNAV 5 and RNAV 1, which are considered in the PBN Regulation. As for RNAV 10, CS-ACNS additionally requires dual navigation systems, which is in line with the ICAO PBN Manual.

In general, greater longitudinal and lateral separations are provided in oceanic airspace, as ATC supporting services (SUR & COM) are not comparable to continental airspace in the event of route deviations. For example:

the RNAV 10 specification was developed to support 50 NM lateral and the 50 NM longitudinal distance-based separation minima; and

RNP 4 was originally developed to support 30 NM lateral and the 30 NM longitudinal distance-based separation minima.

Note: oceanic route spacings are also published in Chapter 5 of ICAO PANS-ATM (Doc 4444).

In general, an evaluation of the communication and surveillance means is important to determine to what extent these services can contribute to support ATC with the mitigation of navigation errors and the definition of a safe route spacing.

The operational scenario in the oceanic sector of Canarias FIR/UIR seems to have all the ingredients that justify the provision of procedural separations due to the characteristics of the CNS infrastructure,

[28] Note that the ICAO 2012 flight plan (FP) does not expressly require the reporting of RNP 2 capabilities. Other navigation equipment capabilities that are not usually specified by default could be described in Item 18 of the ICAO FP, but operators are not likely to inform about this capability, unless RNP 2 capabilities are required to operate on the routes and the competent authority expressly requires that the RNP 2 capability is indicated. Moreover, not all RNP 2-capable aircraft meet the higher continuity requirement that oceanic operations necessitate, so information taken from the flight plan about RNP 2 capabilities is anyway incomplete if not supplemented by information about the continuity requirements being met. Since no detailed information about RNP 2-capable aircraft exists, RNP 2 data have been excluded.

which require aircraft to ensure higher continuity requirements, particularly, by meeting the RNAV 10 specification.

In addition, according to Article 1(2)(b) of the PBN Regulation, the Regulation applies in 'any other airspace where Member States are responsible for the provision of air navigation services in accordance with Article 1(3) of Regulation (EC) No 551/2004 of the European Parliament and of the Council'. In this regard, Article 1(3) of Regulation (EC) No 551/2004[29] stipulates that the airspace Regulation shall apply to the airspace within the ICAO EUR and AFI regions where Member States are responsible for the provision of air traffic services in accordance with the service provision Regulation[30]. However, this article potentially foresees a wider scope of application and continues to state the following: Member States may also apply this Regulation to airspace under their responsibility within other ICAO regions, on condition that they inform the Commission and the other Member States thereof.'

Some EASA Member States are responsible for the provision of ANS, in particular ATS, in the ICAO NAT Region, where there is significant oceanic airspace. According to North Atlantic (NAT) Regional Supplementary Procedures in ICAO SUPP (Doc 7030), from 1 January 2015, RNAV 10 and RNP 4 are the only navigation specifications that can support operations in the NAT Region.

## 2. CONCLUSIONS OF THE ANALYSIS

The scenario described above is possibly representative of other oceanic airspace, which will, in all cases, differ from continental airspace. In oceanic operations:

— the availability of NAVAIDs, communications and ATS surveillance is often limited in comparison with continental airspace. Higher navigation performance is then to be ensured, which is not usually compatible with the RNAV 5 classification of failure conditions for continuity (usually minor).

— it is fairly common to find communications based on HF, SATCOM and/or CPDLC, while surveillance may depend on automatic dependent surveillance – contract (ADS-C). This limits ATC capabilities to monitor the traffic and ensure separation, thus resulting in procedural separations being applied.

In general, aircraft's performance requirements (the navigation specification) must be consistent with the intended operations.

The Regulation should be amended to enable the use of navigation specifications designed for oceanic operations, where necessary. EASA recommends that the use of RNAV 10 and RNP 4 is permitted, discarding RNP 2, as existing RNP 2-capable aircraft may not meet the required continuity requirements (not all RNP 2-capable aircraft may meet the higher continuity requirements necessary for oceanic operations). In addition, RNP 4 and RNAV 10 were developed for airspace without a ground-based NAVAID infrastructure.

[29] Regulation (EC) No 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the single European sky (the airspace Regulation) - Commission statement (OJ L 96, 31.3.2004, p. 20) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32004R0551&qid=1682592671234).

[30] Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation) (OJ L 96, 31.3.2004, p. 10) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32004R0550&qid=1682592830719).

Nowadays, more aircraft and more operations are performed by RNAV 10-capable aircraft, while the number of RNP 4-capable aircraft is expected to increase in the coming years due to the EASA certification basis.

Allowing to keep RNAV 10 eliminates any impact on the existing routes, which can remain unchanged; thus, no investment is necessary in routes predicated on a different navigation specification. Moreover, the operational scenario would remain safe, with aircraft's performance being commensurate with the ATS and CNS services available.

Flexibility to use RNP 4 and RNAV 10 is, therefore, the preferred option.

## 3. Supporting data

Note 1: The segments of the routes contained in GCCC that are based on the RNAV 10 specification are described below. Information shown in the tables has been obtained from the replies to an EASA questionnaire that sought to better define the oceanic route characteristics and operational context.

Note 2: The description of the Spanish RNAV 10 routes can be found in Subsection ENR 3.3 of Spain's AIP. Charts for Canarias upper airspace can be consulted online (https://aip.enaire.es/AIP/CartasInsigniaImpresas-es.html).

| ROUTE DESIGNATION: **UN741** | |
|---|---|
| Navigation specification | RNAV 10 between ROSTA and EDUMO (full route in GCCC, both inside and outside GCCCOCE) |
| Does the route continue to a non-EU/AFI FIR? | Continues to the south to FIR/UIR GVSC (Cape Verde), which belongs to the ICAO AFI region but not to an EASA State. |
| FIR name | Canarias (GCCC) |
| Airspace class | Airspace Class C |
| Flight level(s) | FL195 - FL660 |
| Communication requirements that apply on the route (type of COM available, e.g. VHF, HF, CPDLC) | • Satellite-based CPDLC (FANS 1/A) — full availability in the GCCCOCE sector.<br>• Satellite-based ATS ACARS (D-ATIS/D-VOLMET) — full availability in the GCCCOCE sector.<br>• HF — full availability in the GCCCOCE sector.<br>• VHF — no or very limited availability (only in route segments close to the Canary Islands). See below the VHF radio horizon map in Figure 2. |
| Separation monitoring (ATS SUR means / procedural control) | • Procedural control in the vast majority of the GCCCOCE sector.<br>• No or very limited PSR and/or SSR coverage. See below the PSR/SSR coverage map in Figure 1.<br>• Satellite-based ADS-C (FANS 1/A) fully available in the GCCCOCE sector, although it can only be used for position monitoring — not to establish reduced longitudinal separation values between aircraft. |
| Is the route totally or partially within an RVSM transition area? | Yes (between FL290-FL410) |

| ROUTE DESIGNATION: **UN866** | |
|---|---|
| Navigation specification | RNAV 10 between TENPA and ORVEK (inside GCCCOCE only), while the remaining segments are RNAV 5 |
| Does the route continue to a non-EU/AFI FIR? | This is a northbound-only airway. Aircraft arrive from FIR/UIR GVSC (which belongs to the ICAO AFI Region, but not to an EASA State) and continue North to FIR Casablanca (belongs to the ICAO EUR Region but not to an EASA State). |
| FIR name | Canarias (GCCC) |
| Airspace class | Airspace Class C |
| Flight level(s) | FL195 - FL660 |
| Communication requirements that apply on the route (type of COM available, e.g. VHF, HF, CPDLC) | • Satellite-based CPDLC (FANS 1/A) — full availability in the GCCCOCE sector.<br>• Satellite-based ATS ACARS (D-ATIS/D-VOLMET) — full availability in the GCCCOCE sector.<br>• HF — full availability in the GCCCOCE sector.<br>• VHF — no or very limited availability (only in route segments close to the Canary Islands). See below the VHF radio horizon map in Figure 2. |
| Separation monitoring (ATS SUR means / procedural control) | • Procedural control in the vast majority of the GCCCOCE sector.<br>• No or very limited PSR and/or SSR coverage. See below the PSR/SSR coverage map in Figure 1.<br>• Satellite-based ADS-C (FANS 1/A) fully available in the GCCCOCE sector, although it can only be used for position monitoring — not to establish reduced longitudinal separation values between aircraft. |
| Is the route totally or partially within an RVSM transition area? | Yes (between FL290-FL410) |

| ROUTE DESIGNATION: **UN873** | |
|---|---|
| Navigation specification | RNAV 10 between IPERA and ISOKA (inside GCCCOCE only), while the remaining segments are RNAV 5 |
| Does the route continue to a non-EU/AFI FIR? | Continues to the south to FIR/UIR GVSC, which belongs to the ICAO AFI Region, but not to an EASA State. |
| FIR name | Canarias (GCCC) |
| Airspace class | Airspace Class C |
| Flight level(s) | FL145 - FL660 |
| Communication requirements that apply on the route (type of COM available, e.g. VHF, HF, CPDLC) | • Satellite-based CPDLC (FANS 1/A) — full availability in the GCCCOCE sector.<br>• Satellite-based ATS ACARS (D-ATIS/D-VOLMET) — full availability in the GCCCOCE sector.<br>• HF — full availability in the GCCCOCE sector.<br>• VHF — no or very limited availability (only in route segments close to the Canary Islands). See below the VHF radio horizon map in Figure 2. |
| Separation monitoring (ATS SUR means / procedural control) | • Procedural control in the vast majority of the GCCCOCE sector.<br>• No or very limited PSR and/or SSR coverage. See below the PSR/SSR coverage map in Figure 1.<br>• Satellite-based ADS-C (FANS 1/A) fully available in the GCCCOCE sector, although it can only be used for position monitoring — not to establish reduced longitudinal separation values between aircraft. |
| Is the route totally or partially within an RVSM transition area? | Yes (between FL290-FL410) |

| ROUTE DESIGNATION: **UN857** | |
|---|---|
| Navigation specification | RNAV 10 between BIPET and GUNET (inside GCCCOCE only), while the remaining segments are RNAV 5 |
| Does the route continue to a non-EU/AFI FIR? | Continues to the south to FIR/UIR GOOO (then, after a very short segment within GOOO (Dakar Oceanic), to FIR/UIR GVSC (Cape Verde). Both FIRs belong to the ICAO AFI Region, but not to EASA States. |
| FIR name | Canarias (GCCC) |
| Airspace class | Airspace Class C |
| Flight level(s) | FL145 - FL660 |
| Communication requirements that apply on the route (type of COM available, e.g. VHF, HF, CPDLC) | • Satellite-based CPDLC (FANS 1/A) — full availability in the GCCCOCE sector.<br>• Satellite-based ATS ACARS (D-ATIS/D-VOLMET) — full availability in the GCCCOCE sector.<br>• HF — full availability in the GCCCOCE sector.<br>• VHF — no or very limited availability (only in route segments close to the Canary Islands). See below the VHF radio horizon map in Figure 2. |
| Separation monitoring (ATS SUR means / procedural control) | • Procedural control in the vast majority of the GCCCOCE sector.<br>• No or very limited PSR and/or SSR coverage. See PSR/SSR coverage map in Figure 1.<br>• Satellite-based ADS-C (FANS 1/A) fully available in the GCCCOCE sector, although it can only be used for position monitoring — not to establish reduced longitudinal separation values between aircraft. |
| Is the route totally or partially within an RVSM transition area? | Yes (between FL290-FL410) |

| ROUTE DESIGNATION: **UN871** | |
|---|---|
| Navigation specification | RNAV 10 between APASO and PUCLO (inside GCCCOCE only), while the remaining segments are RNAV 5 |
| Does the route continue to a non-EU/AFI FIR? | No. This PUCLO-APASO oceanic route segment is fully contained inside GCCC. Southwards, it continues by following the RNAV 10 UN866 route. |
| FIR name | Canarias (GCCC) |
| Airspace class | Airspace Class C |
| Flight level(s) | FL195 - FL660 |
| Communication requirements that apply on the route (type of COM available, e.g. VHF, HF, CPDLC) | • Satellite-based CPDLC (FANS 1/A) — full availability in the GCCCOCE sector.<br>• Satellite-based ATS ACARS (D-ATIS/D-VOLMET) — full availability in the GCCCOCE sector.<br>• HF — full availability in the GCCCOCE sector, although it is not normally needed, as full VHF coverage is available too.<br>• VHF — full availability. |
| Separation monitoring (ATS SUR means / procedural control) | • Procedural control applied.<br>• Limited PSR and/or SSR coverage. See PSR/SSR coverage map in Figure 1. This lack of radar coverage is the only reason for which oceanic specifications are still considered applicable to this UN871 AWY segment.<br>• Satellite-based ADS-C (FANS 1/A) fully available in the GCCCOCE sector, although it can only be used for position monitoring — not to establish reduced longitudinal separation values between aircraft. |
| Is the route within an RVSM transition area? | No |

Note 3: Figure 1 depicts PSR and/or SSR radar coverage in GCCC FIR/UIR, taken from the ENAIRE INSIGNIA application on 4 March 2022. The map also considers the coverage of non-Spanish radars thanks to service agreements that have been established by ENAIRE, e.g. with Porto Santo (Nav Portugal).

Note 4: Figure 2 illustrates VHF direct controller-to-pilot voice communications by depicting radio the horizons of available ENAIRE transmitters at both FL100 (green) and FL245 (brown).

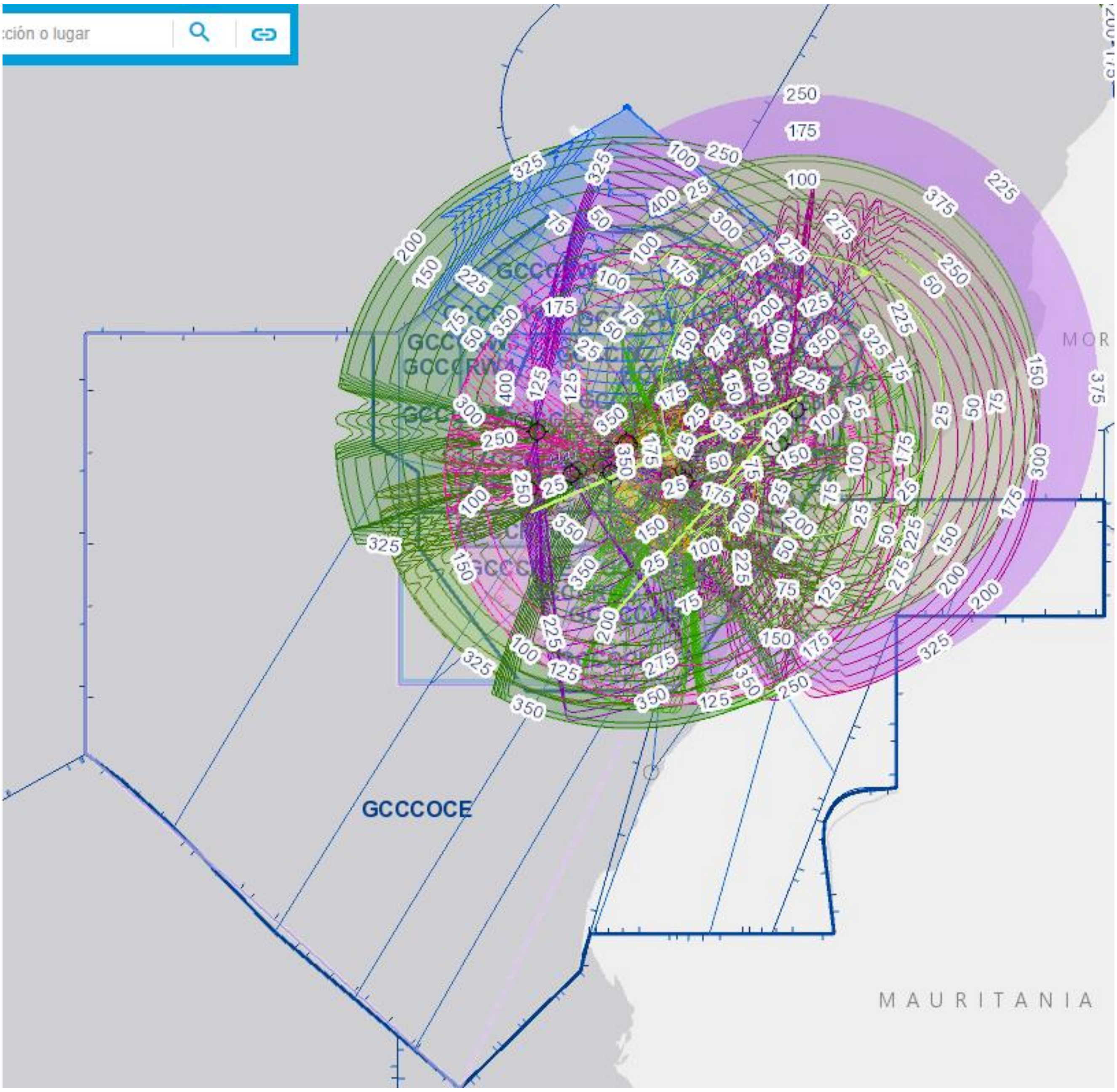


Figure 1

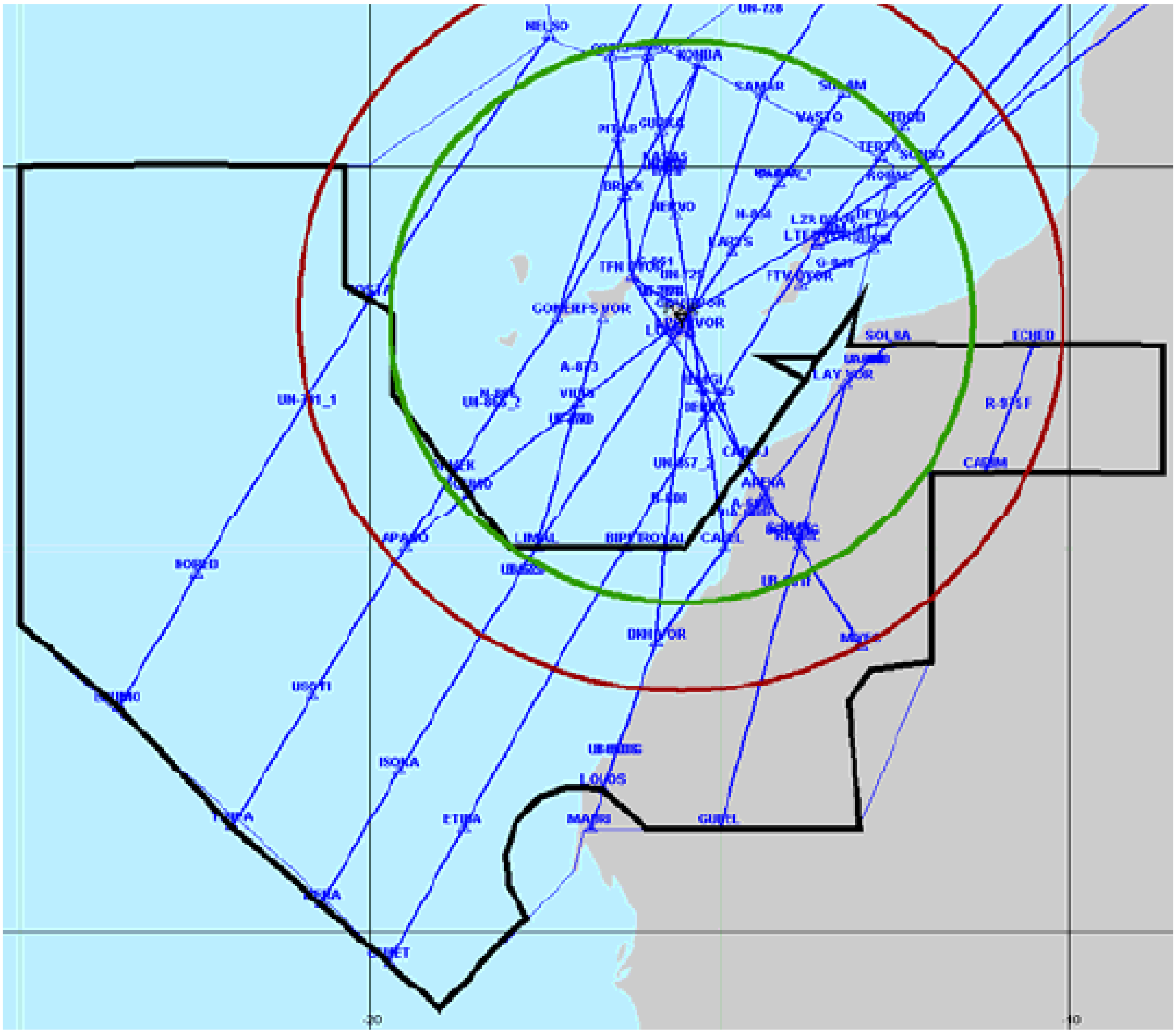
NELSO
KONBA
SAMAR
VASTO
TERTO
BRICK
TFN VOR
GOMERFS VOR
LPAVOR
A-873
UN-741_1
APARO
LIMAL
BIPEROYAL
ARENA
SOLBA
ECHED
LAY VOR
R-975F
CADIM
FTV VOR
LTE
DRK VOR
ISONA
ETIBA
LOLOS
MAGRI
GUREL
USOTI
BORED
KUMBO
TABA
RENA
OBET
-20
-10

Figure 2

# 8. Quality of the NPA

To continuously improve the quality of its documents, EASA welcomes your feedback on the quality of this NPA with regard to the following aspects:

## 8.1. The regulatory proposal is of technically good/high quality

*Please choose one of the options below and place it as a comment in CRT; if you disagree or strongly disagree, please provide a brief justification.*
Fully agree / Agree / Neutral / Disagree / Strongly disagree

## 8.2. The text is clear, readable and understandable

*Please choose one of the options below and place it as a comment in CRT; if you disagree or strongly disagree, please provide a brief justification.*
Fully agree / Agree / Neutral / Disagree / Strongly disagree

## 8.3. The regulatory proposal is well substantiated

*Please choose one of the options below and place it as a comment in CRT; if you disagree or strongly disagree, please provide a brief justification.*
Fully agree / Agree / Neutral / Disagree / Strongly disagree

## 8.4. The regulatory proposal is fit for purpose (capable of achieving the objectives set)

*Please choose one of the options below and place it as a comment in CRT; if you disagree or strongly disagree, please provide a brief justification.*
Fully agree / Agree / Neutral / Disagree / Strongly disagree

## 8.5. The impact assessment (IA), as well as its qualitative and quantitative data, is of high quality

*Please choose one of the options below and place it as a comment in CRT; if you disagree or strongly disagree, please provide a brief justification.*
Fully agree / Agree / Neutral / Disagree / Strongly disagree

## 8.6. The regulatory proposal applies the 'better regulation' principles[1]

*Please choose one of the options below and place it as a comment in CRT; if you disagree or strongly disagree, please provide a brief justification*.
Fully agree / Agree / Neutral / Disagree / Strongly disagree

## 8.7. Any other comments on the quality of this NPA (please specify)

*Note:* Your comments on Chapter 8 will be considered for internal quality assurance and management purposes only and will not be published in the related CRD.

[1] For information and guidance, see:
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how_en
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en