



European Union Aviation Safety Agency  
**Explanatory Note to Decision 2020/011/R**

## Regular update of CS-ETSO

### CS-ETSO Amendment 16

RELATED NPA/CRD: 2019-06 — RMT.0457

#### EXECUTIVE SUMMARY

This Decision introduces amendments to CS-ETSO taking into account the principles of efficiency and harmonisation.

It introduces into CS-ETSO new, updated and improved standards for parts and appliances, as follows:

- a number of European Technical Standard Orders (ETSOs) have been modified in order to harmonise them with the corresponding FAA TSOs;
- one new ETSO (Index 1) has been introduced, which is, where possible, technically similar to the existing Federal Aviation Administration (FAA) Technical Standard Order (TSO); and
- some new ETSOs (Index 2) have been introduced, which either do not exist in the FAA TSO series, or which contain significant technical differences from the corresponding FAA TSOs.

These amendments are expected to reduce the regulatory burden for the validation of FAA TSO authorisations by the European Union Aviation Safety Agency (EASA) and vice versa, to increase cost-effectiveness of compliance demonstrations and to reflect in CS-ETSO the technical state of the art.

<b>Action area:</b>	Design and production		
<b>Affected rules:</b>	CS-ETSO		
<b>Affected stakeholders:</b>	Design and production organisations		
<b>Driver:</b>	Efficiency/proportionality	<b>Rulemaking group:</b>	No
<b>Impact assessment:</b>	No	<b>Rulemaking Procedure:</b>	Standard



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## 1. About this Decision

EASA developed ED Decision 2020/011/R in line with Regulation (EU) 2018/1139<sup>1</sup> ('Basic Regulation') and the Rulemaking Procedure<sup>2</sup>.

This rulemaking activity is included in the European Plan for Aviation Safety (EPAS) [2020-2024](#) under Rulemaking Task (RMT).0457. The scope and timescales of the task were defined in the related Terms of Reference<sup>3</sup>.

The draft text of this Decision has been developed by EASA. All the interested parties were consulted through Notice of Proposed Amendment (NPA) 2019-06<sup>4</sup>. 176 comments were received from 17 commentators, including industry, national aviation authorities, bilateral partners and other associations.

EASA reviewed the comments received during the public consultation. The comments received and EASA's responses to them are presented in Comment-Response Document (CRD) 2019-06<sup>5</sup>.

The final text of this Decision, along with the certification specifications (CSs), has been developed by EASA.

The major milestones of this rulemaking activity are presented on the title page.

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<sup>1</sup> 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>).

<sup>2</sup> 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 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by EASA for the issuing of opinions, certification specifications and guidance material (<http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure>).

<sup>3</sup> <https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0457>

<sup>4</sup> In accordance with Article 115 of Regulation (EU) 2018/1139 and Articles 6(3) and 7 of the Rulemaking Procedure.

<sup>5</sup> <https://www.easa.europa.eu/document-library/comment-response-documents>



## 2. In summary — why and what

### 2.1. Why we need to amend the CS

ETSOs are defined by Article 1(2)(g) of Regulation (EU) No 748/2012<sup>6</sup> as detailed airworthiness specifications, issued by EASA to ensure compliance with the requirements of that Regulation as minimum performance standards for specified articles (i.e. parts and appliances to be used in civil aircraft, see Article 1(2)(f) of Regulation (EU) No 748/2012).

Article 4(1)(a) of the Basic Regulation requires the periodical update of EASA's rules by taking into account worldwide aircraft experience in service, and scientific and technical progress. This also applies to CS-ETSO for parts and appliances, which needs to be regularly updated in order to:

- reduce the regulatory burden for the validation of FAA TSO authorisations by EASA and vice versa;
- increase cost-effectiveness of compliance demonstrations; and
- reflect in CS-ETSO the technical state of the art.

### 2.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation. This Decision will contribute to the achievement of the overall objectives by addressing the issues outlined in Section 2.1.

The specific objective of this Decision is to update some existing ETSOs and to propose new ones, taking into account worldwide aircraft experience, as well as scientific and technical progress.

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

To achieve the above objectives, this Decision:

- modifies a number of ETSOs in order to harmonise them with the corresponding FAA TSOs;
- introduces one new ETSO (Index 1) which is, where possible, technically similar to the corresponding FAA TSO<sup>7</sup>; and
- introduces some new ETSOs (Index 2), which do not yet exist in the FAA TSO series, or which contain significant technical differences from the corresponding FAA TSOs.

The basis for the introduction or revision of each ETSO affected by this Decision and the main differences from the current ETSOs are specified hereafter.

Table 1 and Table 2 at the end of this section summarise the proposed amendments.

<sup>6</sup> Commission Regulation (EU) No 748/2012 of 3 August 2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations (OJ L 224, 21.8.2012, p. 1) (<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1591208846477&uri=CELEX:32012R0748>).

<sup>7</sup> FAA TSOs are available at <http://www.airweb.faa.gov>.

## **CS-ETSO Subpart A**

### **2.2 Software**

This section is amended to improve the wording and to delete the link between Subpart A and individual ETSOs.

Additionally, it is also clarified that applicants may request to use means of compliance different from the one proposed in this section. This process will be subject to a deviation request.

### **2.3 Airborne electronic hardware (AEH)**

This section is amended to improve the wording and to introduce AMC 20-152<sup>8</sup>, entitled ‘Development Assurance for Airborne Electronic Hardware’, as the accepted means of compliance for the development of airborne electronic hardware.

Additionally, it is also clarified that applicants may request to use means of compliance different from the one proposed in this section. This process will be subject to a deviation request.

### **2.4 Failure condition classification and development assurance**

This section has been amended to introduce the reference to AMC CS 23.2500 and to improve the wording.

### **2.5 ETSO article using an ETSO-C153a-authorized IMA platform or module**

Following the publication of FAA TSO-C153a on 1 May 2019, which transposes the contents of EASA ETSO-2C153, EASA has decided to rename the latter as ETSO-C153a.

The Subpart A Section 2.5 is amended to reflect this change in the reference of the ETSO mentioned above.

### **2.7 Open problem reports (OPRs)**

This new section is introduced to recognise AMC 20-189<sup>9</sup> ‘Management of Open Problem Reports’ as the accepted process for the management of OPRs in ETSO authorisations for the systems, software, and airborne electronic hardware (AEH) domains.

### **2.8 Embedded batteries**

This new section is introduced to address ETSO articles that embed rechargeable and non-rechargeable batteries, in particular lithium batteries.

## **3 Additional information**

This section has been amended to update the list of organisations issuing standards documents referred to in CS-ETSO.

<sup>8</sup> Refer to NPA 2018-09 ‘Regular update of AMC-20: AMC 20-152 on Airborne Electronic Hardware and AMC 20-189 on Management of Open Problem Reports’ (<https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2018-09>).

<sup>9</sup> Refer to NPA 2018-09 ‘Regular update of AMC-20: AMC 20-152 on Airborne Electronic Hardware and AMC 20-189 on Management of Open Problem Report’ (<https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2018-09>).

## **CS-ETSO Subpart B**

### **Paragraphs 1 and 2:**

The explanations contained in paragraphs 1 and 2 have been amended to better reflect the actual contents of Index 1 and Index 2.

### **Index 1**

#### **ETSO-C10c: Pressure Altimeter System**

This update of ETSO-C10b is based on FAA TSO-C10c, issued on 31 October 2016.

According to this revision, newly designed pressure altimeter systems should meet the minimum performance standard (MPS) qualification and documentation requirements in SAE International's Aerospace Standard AS8009C, Pressure Altimeter Systems, dated 24 May 2016.

In line with the FAA TSO, some modifications to the referenced standards are introduced into the ETSO in Appendix 1.

#### **ETSO-C13g: Life Preservers**

This update of ETSO-C13f is based on FAA TSO-C13g, issued on 2 March 2017.

According to this revision, newly designed life preservers should meet the minimum performance standard (MPS) qualification and documentation requirements in SAE International's Aerospace Standard AS1354, Individual Inflatable Life Preserver, dated 24 February 2016.

In line with the FAA TSO, some modifications to the referenced standards are introduced into the ETSO in Appendices 1 and 2.

#### **ETSO-C20a: Combustion Heaters and Accessories**

This update of ETSO-C20 is based on FAA TSO-C20a, issued on 12 January 2017.

According to this revision, newly designed combustion heaters should meet the minimum performance standard (MPS) qualification and documentation requirements in SAE International's Aerospace Standard AS8040B, Heater, Aircraft, Internal Combustion Heat Exchanger Type, dated 14 February 2013.

In line with the FAA TSO, some modifications to the referenced standards are introduced into the ETSO in Appendices 1 and 2.

#### **ETSO-C27a: Twin Seaplane Floats**

This update of ETSO-C27 is based on FAA TSO-C27a, issued on 31 July 2018.

According to this revision, newly designed twin seaplane floats should meet the minimum performance standard (MPS) qualification and documentation requirements in Aerospace Industries of America, Inc., National Aerospace Standard (NAS) 807, Revision 2, Twin Seaplane Floats, dated 30 June 2017.

#### **ETSO-C43d: Temperature Instruments**

This update of ETSO-C43c is based on FAA TSO-C43d, issued on 20 March 2017.

According to this revision, newly designed temperature instruments should meet the minimum performance standard (MPS) qualification and documentation requirements in SAE International's



Aerospace Standard AS8005, Minimum Performance Standard for Temperature Instruments, Revision A, dated 1 September 1996.

In line with the FAA TSO, some modifications to the referenced standards are introduced into the ETSO in Appendix 1.

#### **ETSO-C113b: Airborne Multipurpose Electronic Displays**

This update of ETSO-C113a is based on FAA TSO-C113b, issued on 17 September 2018.

According to this revision, newly designed airborne multipurpose electronic displays should meet the minimum performance standard (MPS) qualification and documentation requirements provided in SAE International's Aerospace Standard AS8034C, Minimum Performance Standards for Airborne Multipurpose Electronic Displays, dated 30 July 2018, as modified by paragraph 3.1.1.1 of this ETSO.

Additional requirements regarding colours are provided in Appendix 1 to this ETSO.

#### **ETSO-C117b: Airborne Wind Shear Warning and Escape Guidance Systems (Reactive Type) for Transport Aeroplanes**

This update of ETSO-C117a is based on FAA TSO-C117b, issued on 27 March 2018.

According to this revision, newly designed temperature instruments should meet the minimum performance standard (MPS) qualification and documentation requirements provided in Appendix 1 to this ETSO.

#### **ETSO-C126c: Emergency Locator Transmitter**

This update of ETSO-C126b is based on FAA TSO-C126c, issued on 7 March 2019. It amends the minimum performance standards (MPS) in relationship with the guidance material that EASA is developing for compliance with point CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes' of Annex IV (Part-CAT) to Commission Regulation (EU) No 965/2012<sup>10</sup>; see Index 2 below. It also incorporates the clarification introduced by Change 1 to ED-62B 'MOPS for Aircraft Emergency Locator Transmitters 406 MHz' published on 16 June 2020.

#### **ETSO-C142b: Non-Rechargeable Lithium Cells and Batteries**

This update of ETSO-C142a is based on FAA TSO-C142b, issued on 26 March 2018.

According to this revision, newly designed non-rechargeable lithium cells and batteries that are intended to provide power for aircraft equipment should meet the minimum performance standard (MPS) qualification and documentation requirements provided in RTCA document DO-227A, Minimum Operational Performance Standard (MOPS) for Non-Rechargeable Lithium Batteries, issued on 21 September 2017, as amended by Appendix 1 to this ETSO.

#### **ETSO-C145e A1: Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite-Based Augmentation System**

This update of ETSO-C145e is intended to provide applicants with the option to use an ETSO-2C204a SBAS circuit card assembly (CCA) functional sensor as part of their ETSO application, and to correct an

<sup>10</sup> 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/?qid=1591691887660&uri=CELEX:32012R0965>).

unintended difference from Appendix 2 to the published FAA TSO-145e. These changes are in line with FAA TSO-C145e.

No technical changes are introduced for the Minimum Operational Performance Standard (MOPS) in comparison with ETSO-C145e.

#### **ETSO-C146e A1: Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite-Based Augmentation System**

This update of ETSO-C146e is intended to provide applicants with the option to use an ETSO-2C205a class delta circuit card assembly (CCA) functional sensor as part of their ETSO application, and to correct an unintended difference from Appendix 2 to the published FAA TSO-146e. These changes are in line with FAA TSO-C146e.

No technical changes are introduced for the Minimum Operational Performance Standard (MOPS) in comparison with ETSO-C146e.

#### **ETSO-C151d: Terrain Awareness and Warning System (TAWS)**

This update of ETSO-C151c is based on FAA TSO-C151d, issued on 31 August 2017.

According to this revision, newly designed TAWS equipment should meet RTCA document DO-367, Minimum Operational Performance Standards (MOPS) for Terrain Awareness and Warning Systems (TAWS) Airborne Equipment, Section 2, dated 31 May 2017. Requirements for Class A, Class B, and Class C equipment are addressed in RTCA document DO-367, Sections 2.2.1, 2.2.2 and 2.2.3, respectively.

#### **ETSO-C159d: Next Generation Satellite Systems (NGSS) Equipment**

This update of ETSO-C159c is based on FAA TSO-C159d, issued on 31 July 2018.

According to this revision, newly designed NGSS equipment should meet the minimum performance standard (MPS) qualification and documentation requirements provided in EUROCAE ED-243, Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS), dated April 2017.

The content of Appendix 1 is moved to the main body of the ETSO.

Additionally, a clarification on security requirements is added in Section 3.2.1.

#### **ETSO-C160a A1: VDL Mode 2 Communications equipment**

This update of ETSO-C160a introduces the new EUROCAE ED-92C, Minimum Operational Performance Standard (MOPS) for an Airborne VDL Mode-2 System Operating in the Frequency Range 118-136.975 MHz, dated September 2018. The previous version of this standard will be maintained as a MOPS. Applicants for an ETSO authorisation of such an article will have the possibility to select the version of the MOPS to be complied with.

The revision letter of this ETSO is, however, kept in order to ensure synchronisation with the revision letter of the FAA TSO. An amendment number (A1) is added to highlight the update.

#### **ETSO-C165b: Electronic Map Systems for Graphical Depiction of Aircraft Position**

This update of ETSO-C165a is based on FAA TSO-C165b, issued on 28 November 2018.



According to this revision, newly designed electronic map systems for graphical depiction of aircraft position should meet the minimum performance standard (MPS) qualification and documentation requirements provided in RTCA document DO-257B, Minimum Operational Performance Standards for the Depiction of Navigation Information on Electronic Maps, dated 22 March 2018.

The previous Appendix 1 to this ETSO is deleted as part of the new amendment.

#### **ETSO-C168: Aviation Visual Distress Signals**

This new ETSO is based on FAA TSO-C168, issued on 25 March 2004.

According to this amendment, newly designed and manufactured aviation visual distress signals should meet the minimum performance standard (MPS) qualification and documentation requirements for the applicable equipment class defined by this ETSO.

#### **ETSO-C179b: Rechargeable Lithium Cells, Batteries, and Battery Systems**

This update of ETSO-C179a is based on FAA TSO-C179b, issued on 23 March 2018.

According to this revision, newly designed rechargeable lithium batteries and battery systems should meet the minimum performance standard (MPS) qualification and documentation requirements provided in RTCA document DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems, dated 19 December 2017.

#### **ETSO-C196b: Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation**

This update of ETSO-C196a is intended to provide applicants with the option to use an ETSO-2C206 global navigation satellite system (GNSS) circuit card assembly (CCA) as part of their ETSO application. This is in line with FAA TSO-C196b.

No technical changes are introduced to the MOPS in comparison with ETSO-C196a.

#### **ETSO-C199 A1: Traffic Awareness Beacon System (TABS)**

This update of ETSO-C199 is intended to correct some typos.

The existing revision letter is, however, kept to ensure synchronisation with the revision letter of the FAA TSO. This is possible since there are no changes in the technical content. An amendment number is added to highlight the update.

#### **ETSO-C207a: Aeronautical Mobile Airport Communication System (AeroMACS)**

This update of ETSO-C207 is based on FAA TSO-C207a, issued on 18 August 2017.

According to this revision, newly designed temperature instruments should meet the minimum performance standard (MPS) qualification and documentation requirements in EUROCAE ED-223, Minimum Operational Performance Standard (MOPS) for Aeronautical Mobile Airport Communication System (AeroMACS), dated October 2013.

#### **ETSO-C214 A1: Functional ETSO equipment using an ETSO-C153a-authorized IMA platform or module**

This ETSO is updated only to correct the reference to the ETSO-C153a that was formerly named ETSO-2C153.



Table 1 — Summary of changes to Index 1 of CS-ETSO

Changes to Index 1 of CS-ETSO		
New ETSO reference	ETSO title	Corresponding FAA TSO
ETSO-C10c	Pressure Altimeter System	TSO-C10c (from 31.10.2016)
ETSO-C13g	Life Preservers	TSO-C13g (from 03.02.2017)
ETSO-C20a	Combustion Heaters and Accessories	TSO-C20a (from 12.01.2017)
ETSO-C27a	Twin Seaplane Floats	TSO-C20a (from 31.07.2018)
ETSO-C43d	Temperature Instruments	TSO-C43d (from 20.03.2017)
ETSO-C113b	Airborne Multi-purpose Electronic Displays	TSO-C113b (from 17.09.2018)
ETSO-C117b	Airborne Wind Shear Warning and Escape Guidance Systems for Transport Aeroplanes	TSO-C117b (from 27.03.2018)
ETSO-C126c	Emergency Locator Transmitter	TSO-C126c (from 07.03.2019)
ETSO-C142b	Non-Rechargeable Lithium Cells and Batteries	TSO-C142b (from 26.03.2018)
ETSO-C145e A1	Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite-Based Augmentation System	TSO-C145e (from 05.05.2017)
ETSO-C146e A1	Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite-Based Augmentation System	TSO-C146e (from 05.05.2017)
ETSO-C151d	Terrain Awareness and Warning System (TAWS)	TSO-C151d (from 31.08.2017)
ETSO-C153a	Integrated Modular Avionics (IMA) Platform and modules	TSO-C153a (from 01.05.2019)
ETSO-159d	Next Generation Satellite Systems (NGSS) Equipment	TSO-159d (from 31.07.2018)
ETSO-C160a A1	VDL Mode 2 Communications equipment	TSO-C160a (from 27.03.2012)
ETSO-C165b	Electronic Map Systems for Graphical Depiction of Aircraft Position	TSO-C165b (from 28.11.2018)
ETSO-C168	Aviation Visual Distress Signals	TSO-C168 (from 25.03.2004)
ETSO-C179b	Rechargeable Lithium Cells, Batteries and Battery Systems	TSO-C179b (from 23.03.2018)
ETSO-C196b	Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation	TSO-C196b (from 20.12.2013)
ETSO-C199 A1	Traffic Awareness Beacon System	TSO-C199 (from 10.10.2014)

Changes to Index 1 of CS-ETSO		
New ETSO reference	ETSO title	Corresponding FAA TSO
ETSO-C207a	Aeronautical Mobile Airport Communication System (AeroMACS)	TSO-C207a (from 18.08.2017)
ETSO-C214 A1	Functional ETSO equipment using an ETSO-C153a- authorised IMA platform or module	No corresponding TSO

## Index 2

### **ETSO-2C19c A1: Portable Water-Solution Type Hand Fire Extinguishers**

This update of ETSO-2C19c is intended to correct some typos in paragraph 3.1.1. During the previous update of this ETSO, the old MOPS reference was not removed, and only the new MOPS reference was added.

The existing revision letter is, however, kept to ensure synchronisation with the revision letter of the FAA TSO, and an amendment number is added to highlight the change.

### **ETSO-2C123c: Cockpit Voice Recorder Systems**

This update amends the minimum performance standard (MPS) in relationship with the guidance material that EASA is developing for compliance with point CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes' of Annex IV (Part-CAT) to Commission Regulation (EU) No 965/2012; see 'New standards regarding requirements for flight recorders and underwater locating devices in Part-CAT' below.

### **ETSO-2C124c: Flight Data Recorder Systems**

This update amends the minimum performance standards (MPS) in relationship with the guidance material that EASA is developing for compliance with point CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes' of Annex IV (Part-CAT) to Commission Regulation (EU) No 965/2012; see 'New standards regarding requirements for flight recorders and underwater locating devices in Part-CAT' below.

### **ETSO-2C176a: Aircraft Cockpit Image Recorder Systems**

This update amends the minimum performance standard (MPS) in relationship with the guidance material that EASA is developing for compliance with point CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes' of Annex IV (Part-CAT) to Commission Regulation (EU) No 965/2012; see 'New standards regarding requirements for flight recorders and underwater locating devices in Part-CAT' below.

### **ETSO-2C177a: Data Link Recorder Equipment**

This update amends the minimum performance standard (MPS) in relationship with the guidance material that EASA is developing for compliance with point CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes' of Annex IV (Part-CAT) to Commission Regulation (EU) No 965/2012; see 'New standards regarding requirements for flight recorders and underwater locating devices in Part-CAT' below.



**ETSO-2C197 A1: Information Collection and Monitoring Systems**

This update of ETSO-2C197 is intended to clarify that the procedures to retrieve recorded information from a recorder (damaged or undamaged) must be documented, and that any special tools/recovery techniques that are necessary for that purpose shall be made available to the accident investigation authorities on request. Additionally, some typos have been corrected.

**ETSO-2C204a: Circuit Card Assembly (CCA) Functional Sensors using Satellite-Based Augmentation System (SBAS) for Navigation and Non-Navigation Position/Velocity/Time (PVT) Output**

This new ETSO is based on FAA TSO-C204a, issued on 5 September 2017.

This ETSO provides the requirements for circuit card assembly functional sensors that use satellite-based augmentation for navigation and non-navigation position/velocity/time output which are designed and manufactured on or after the date of this ETSO.

To be identified with the applicable ETSO marking, these ETSO articles should meet the requirements provided in RTCA document DO-229E, Minimum Operational Performance Standards for Global Positioning System/Satellite-Based Augmentation System Airborne Equipment, dated 15 December 2016, Section 2, as amended by Appendices 1 and 3 to this ETSO.

Compared with the corresponding FAA TSO, this new ETSO contains additional requirements that are related to partial environmental testing, and the delivery of test procedures for the end user, allowing the possibility of installation in equipment other than C145e equipment. For this reason, this new ETSO has been included in Index 2.

**ETSO-2C205a: Circuit Card Assembly (CCA) Functional Class Delta Equipment Using the Satellite-Based Augmentation System (SBAS) for Navigation Applications**

This new ETSO is based on FAA TSO-C205a, issued on 5 September 2017.

This ETSO provides the requirements for circuit card assembly functional class delta equipment that uses the satellite-based augmentation system for navigation applications, which are designed and manufactured on or after the date of this ETSO.

To be identified with the applicable ETSO marking, these ETSO articles should meet the requirements provided in RTCA document DO-229E, Minimum Operational Performance Standards for Global Positioning System/Satellite-Based Augmentation System Airborne Equipment, dated 15 December 2016, Section 2, as amended by Appendices 1 and 3 to this ETSO.

Compared with the corresponding FAA TSO, this new ETSO contains additional requirements that are related to partial environmental testing, and the delivery of test procedures for the end user, allowing the possibility of installation in equipment other than ETSO-C146e equipment. For this reason, this new ETSO has been included in Index 2.

**ETSO-2C206: Circuit Card Assembly Functional Sensors using Aircraft-Based Augmentation for Navigation and Non-Navigation Position/Velocity/Time (PVT) Output**

This new ETSO is based on FAA TSO-C206, issued on 20 December 2013.

This ETSO provides the requirements for circuit card assembly functional sensors that use aircraft-based augmentation for navigation and non-navigation position/velocity/time output which are designed and manufactured on or after the date of this ETSO.



To be identified with the applicable ETSO marking, these ETSO articles should meet the requirements provided in RTCA document DO-316, Minimum Operational Performance Standards (MOPS) for Global Positioning System/Aircraft Based Augmentation System Airborne Equipment, dated 14 April 2009, Section 2.

Compared with the corresponding FAA TSO, this new ETSO contains additional requirements that are related to partial environmental testing, and the delivery of test procedures for the end user, allowing the possibility of installation in equipment other than ETSO-C196b equipment. For this reason, this new ETSO has been included in Index 2.

#### **ETSO-2C515 A1: Aircraft Halocarbon Clean Agent Hand-Held Fire Extinguisher**

This update of ETSO-2C515 is intended to correct some typos in paragraph 3.1.1. Appendix 2 was not mentioned in paragraph 3.1.1.

The existing revision letter is, however, kept, since the technical content of this ETSO has not been amended.

#### **ETSO-2C517: Automatic Deployable Flight Recorder (ADFR) Systems for Large Aeroplanes**

With this update, the requirements for automatic deployable flight recorders are relocated from ETSO-C123c, ETSO-C124c, ETSO-176a and ETSO-C177a to this new ETSO. Additionally, the MPS is amended to be consistent with the guidance material that EASA is developing for compliance with point CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes' of Annex IV (Part-CAT) to Commission Regulation (EU) No 965/2012; see 'New standards regarding requirements for flight recorders and underwater locating devices in Part-CAT' below.

#### **ETSO-2C518: Runway Overrun Awareness and Alerting Systems**

This new ETSO provides the requirements that runway overrun awareness and alerting systems that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

According to this proposal, newly designed runway overrun awareness and alerting systems must meet the standards provided in EUROCAE ED-250, Minimum Operational Performance Standard for a Runway Overrun Awareness and Alerting System, dated December 2017.

Currently, there is no FAA TSO that corresponds to the proposed ETSO-2C518.

#### **ETSO-2C519: Emergency Breathing Systems (EBSs)**

This new ETSO provides the requirements that an emergency breathing system for operations to or from helidecks located in hostile sea areas must meet in order to be identified with the applicable ETSO marking.

According to this proposal, newly designed EBSs must meet the standards provided in the AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document EN 4856:2018.

Currently, there is no FAA TSO that corresponds to the proposed ETSO-2C519.



## New standards regarding requirements for flight recorders and underwater locating devices in Part-CAT

In 2015, a new air operation requirement was introduced in Part-CAT (CAT.GEN.MPA.210 'Location of an aircraft in distress — Aeroplanes'), which requires some categories of large aeroplanes manufactured after January 2021 to be equipped with 'robust and automatic means to accurately determine, following an accident where the aeroplane is severely damaged, the location of the point of end of flight'. The most mature technologies to meet this requirement are automatic deployable flight recorders (ADFRs), which per EUROCAE ED-112A must each be fitted with an emergency locator transmitter (ELT), and the type of ELT that is automatically triggered in flight upon the detection of a catastrophic situation (also called a 'distress-tracking ELT').

The above changes are introduced to permit the approval of ETSO articles that support the new CAT.GEN.MPA.210 requirement (refer to Regulation (EU) No 965/2012).

As a result, the following existing ETSOs are amended and the new ETSO-2C517 is introduced:

### ETSO-2C123c: Cockpit Voice Recorder System

According to this revision, newly designed cockpit voice recorder (CVR) equipment must meet the standards provided in EUROCAE ED-112A, MOPS for Crash Protected Airborne Recorder Systems, dated September 2013, as amended by the new Appendix 1.

In particular, Appendix 1 extends the duration of the deep-sea pressure and seawater immersion tests to 90 days in accordance with ETSO-C121b 'Underwater Locating Device (Acoustic) (Self-powered)'.

This update clarifies that the procedures to retrieve recorded information from a recorder (damaged or undamaged) must be documented, and that any special tools/recovery techniques that are necessary for that purpose shall be made available to the accident investigation authorities on request.

For deployable recorders, the reference to ED-112A, Section 3, has been replaced by a reference to the newly proposed ETSO-2C517.

### ETSO-2C124c: Flight Data Recorder Equipment

According to this revision, newly designed flight data recorder (FDR) equipment must meet the standards provided in EUROCAE ED-112A, MOPS for Crash Protected Airborne Recorder Systems, dated September 2013, as amended by the new Appendix 1.

In particular, Appendix 1 extends the duration of the deep-sea pressure and seawater immersion tests to 90 days in accordance with ETSO-C121b 'Underwater Locating Device (Acoustic) (Self-powered)'.

This update clarifies that the procedures to retrieve recorded information from a recorder (damaged or undamaged) must be documented, and that any special tools/recovery techniques that are necessary for that purpose shall be made available to the accident investigation authorities on request.

For deployable recorders, the reference to ED-112A, Section 3, has been replaced by a reference to the newly proposed ETSO-2C517.

**ETSO-2C176a: Cockpit Image Recorder Systems**

According to this revision, newly designed cockpit image recorder (CIR) systems must meet the standards provided in EUROCAE ED-112A, MOPS for Crash Protected Airborne Recorder Systems, dated September 2013, as amended by the new Appendix 1.

In particular, Appendix 1 extends the duration of the deep-sea pressure and seawater immersion tests to 90 days in accordance with ETSO-C121b 'Underwater Locating Device (Acoustic) (Self-powered)'.

This update clarifies that the procedures to retrieve recorded information from a recorder (damaged or undamaged) must be documented, and that any special tools/recovery techniques that are necessary for that purpose shall be made available to the accident investigation authorities on request.

For deployable recorders, the reference to ED-112A Section 3 has been replaced by a reference to the newly proposed ETSO-2C517.

**ETSO-2C177a: Data Link Recorder Equipment**

According to this revision, newly designed data link recorder (DLR) equipment must meet the standards provided in EUROCAE ED-112A, MOPS for Crash Protected Airborne Recorder Systems, dated September 2013, as amended by the new Appendix 1.

In particular, Appendix 1 extends the duration of the deep-sea pressure and seawater immersion tests to 90 days in accordance with ETSO-C121b 'Underwater Locating Device (Acoustic) (Self-powered)'.

This update clarifies that the procedures to retrieve recorded information from a recorder (damaged or undamaged) must be documented, and that any special tools/recovery techniques that are necessary for that purpose shall be made available to the accident investigation authorities on request.

For deployable recorders, the reference to ED-112A Section 3 has been replaced by a reference to the newly proposed ETSO-2C517.

**ETSO-2C517: Automatic Deployable Flight Recorder (ADFR) Systems for Large Aeroplanes**

According to this new ETSO, newly designed automatic deployable flight recorder (ADFR) systems must meet the standards provided in EUROCAE ED-112A, MOPS for Crash Protected Airborne Recorder Systems, dated September 2013, as amended by Appendix 1.

Currently, there is no FAA TSO that corresponds to the proposed ETSO-2C517.

**ETSO-C126c: Emergency Locator Transmitter**

According to this revision, newly designed emergency locator transmitters (ELTs) should meet the minimum performance standard (MPS) qualification and documentation standards provided in EUROCAE ED-62B, Minimum Operational Performance Standard for Aircraft Emergency Locator Transmitters 406 MHz, dated December 2018, including the clarifications provided by Change 1 to ED-62B 'MOPS for Aircraft Emergency Locator Transmitters 406 MHz' published on 16 June 2020. This change does not introduce any new technical requirement and permits to maintain a technical equivalence with the FAA TSO-C126c.

**ETSO-2C197 A1: Information Collection and Monitoring Systems**

According to this revision, applicants for newly designed information collection and monitoring systems that record cockpit audio, aircraft data, airborne images, or data link communications should provide all the documents specified in EUROCAE ED-155, Section 2-1,2-1.3.4.

**Table 2 — Summary of changes to Index 2 of CS-ETSO**

Changes to Index 2 of CS-ETSO	
New ETSO reference	ETSO title
ETSO-2C19c A1	Portable Water-Solution Type Hand Fire Extinguishers
ETSO-2C123c	Cockpit Voice Recorder Systems
ETSO-2C124c	Flight Data Recorder Systems
ETSO-2C176a	Aircraft Cockpit Image Recorder Systems
ETSO-2C177a	Data Link Recorder Equipment
ETSO-2C197 A1	Information Collection and Monitoring Systems
ETSO-2C204a	Circuit Card Assembly Functional Sensors Using Satellite-Based Augmentation System (SBAS) for Navigation and Non-Navigation Position/Velocity/Time Output
ETSO-2C205a	Circuit Card Assembly Functional Class Delta Equipment Using the Satellite-Based Augmentation System for Navigation Applications
ETSO-2C206	Circuit Card Assembly Functional Sensors Using Aircraft-Based Augmentation for Navigation and Non-Navigation Position/Velocity/Time Output
ETSO-2C515 A1	Aircraft Halocarbon Clean Agent Hand-Held Fire Extinguishers
ETSO-2C517	Automatic Deployable Flight Recorder (ADFR) Systems
ETSO-2C518	Runway overrun awareness and alerting system
ETSO-2C519	Emergency Breathing Systems (EBSs)

**2.4. What are the stakeholders' views**

The commentators were in general supportive of the proposed amendments to CS-ETSO.

None of the comments was against the proposal or gave rise to significant controversy. The nature of the comments received ranged from specific technical comments, to observations aimed to improve the wording.

In some cases, the commentators focused on the differences between the proposed ETSOs and the corresponding FAA TSO. The majority of these differences have been corrected in consideration of the comments received, and in some cases, the wording proposed through NPA 2019-06 has been improved for clarification purposes.

Hereafter is a summary of the main changes introduced as a result of the consultation; however, it does not represent an exhaustive list.

**SUBPART A — SECTION 2.2 SOFTWARE**

This section identified AMC 20-115 as an accepted means of compliance to demonstrate the acceptability of the software, if any, embedded in one ETSO article.



As proposed by some commentators, this section has been amended in order to allow the usage of alternative means of compliance. This possibility will be subject to a deviation request.

#### **SUBPART A — SECTION 2.3 AIRBORNE ELECTRONIC HARDWARE (AEH)**

As explained above, see the previous point, this section has been amended to allow the use of alternative means of compliance. This possibility will be subject to a deviation request.

#### **ETSO-2C123c COCKPIT VOICE RECORDER SYSTEMS, ETSO-2C124c FLIGHT DATA RECORDER SYSTEMS, ETSO-2C176a AIRCRAFT COCKPIT IMAGE RECORDER SYSTEMS and ETSO-2C177a DATA LINK RECORDER EQUIPMENT**

As the FAA has not transposed these ETSOs into TSOs and has no ongoing rulemaking activity to do so, it has been decided to move these amendments to Index 2.

If there are future amendments of the FAA TSOs, they can use ETSO-C123d / 124d / C176b / C177b without limitation or misalignment between the EASA and FAA revision reference.

#### **ETSO-126c EMERGENCY LOCATOR TRANSMITTER**

COSPAS-SARSAT has updated the GNSS requirements to include the provisions which were initially proposed as Appendix 1 to this ETSO. Therefore, EASA text now aligns with the FAA one, which relies on COSPAS-SARSAT approval.

Nevertheless, EASA has created an Appendix 1 to this ETSO in order to amend some elements of EUROCAE ED-62B that were discussed in RTCA Special Committee 229 – EUROCAE Working Group 98.

#### **ETSO-C142b NON-RECHARGEABLE LITHIUM CELLS, BATTERIES, AND BATTERY SYSTEMS**

Table 1 in Appendix 1 is amended by adding new differences from the DO-227A standard. These additional differences are based on ETSO deviations C142a#2, C142a#3 and C142a#4.

#### **ETSO-C153a INTEGRATED MODULAR AVIONICS (IMA) PLATFORM AND MODULES**

The amendment of this ETSO was not included in NPA 2019-06. On 1 May 2019, the FAA issued TSO-C153a, which is technically identical to the ETSO-2C153 standard. For this reason, EASA has decided to issue a new release of ETSO-2C153 with the purpose of aligning the ETSO index with the published FAA TSO-C153a and reflecting this harmonisation.

As a consequence, this standard is moved from Index 2 to Index 1 of CS-ETSO Subpart B.

Minor editorial changes have been introduced to improve the wording of this ETSO without affecting its technical content.

#### **ETSO-2C197 A1 INFORMATION COLLECTION AND MONITORING SYSTEMS**

As the change introduced into this ETSO is minor, EASA has decided not to change the version reference of this ETSO, which, in this way, remains identical to the corresponding FAA TSO.

Instead of amending the version reference, it has been decided to amend the modification index reflecting only minor changes (e.g. A1).

#### **ETSO-2C516 AIRBORNE SYSTEMS FOR VIDEO/AUDIO SURVEILLANCE OF CABIN AND CARGO AREAS**

On the basis of the comments received, EASA has decided to postpone the issuance of the proposed ETSO for video/audio surveillance system. Before proceeding with its issuance, the proposed standard

will have to be complemented with more specific guidance with respect to the performance requirements, in particular for DO-160 tests. Requirements need to be identified for those DO-160 tests requesting the system to be operating.

Additionally, considering that an applicant might wish to comply with this CS-ETSO only partially, a minimum performance standard needs to be defined for each potential system component.

### **ETSO-2C517 AUTOMATIC DEPLOYABLE FLIGHT RECORDER (ADFR) SYSTEMS FOR LARGE AEROPLANES**

This ETSO has been modified to address the comments from various stakeholders.

The initial ETSO intended that the ADFR manufacturer would provide to the installer the information necessary to demonstrate that, in accidents,

- the deployable package would decelerate to a speed which would be less than the one shown in the impact shock test,
- the deployable package would not collide with the aircraft, and
- that the deployable package would not land in the area where a fire could develop as a result of the impact.

This came from the lower crash qualification requirements contained in EUROCAE ED-112A for deployable recorders compared with those of fixed recorders, and from the even lower survivability of the embedded ELT.

This raised many comments, relative to the ability of the equipment manufacturer to perform such tasks, and to the infinite number of cases to consider.

Following discussions with various stakeholders, EASA acknowledges that the deployable package trajectories required to show the absence of a collision with the airframe have to be computed for the specific airflow of each aircraft. It is a pure installation task, which has been removed from the ETSO. The initial wording of ED-112A 3-1.7. has been reintroduced.

With regard to fire, EASA also understands that the location of the fire is unpredictable and this has also been removed.

For the impact speed, EASA reviewed the data from several accidents. Two types of accidents appeared to exhibit characteristics where the deployable speed could exceed the tested impact speed.

The first one is caused by a loss of control at high altitude, where the aircraft dives to the ground at high speed. The trajectory is close to the vertical and the aircraft is aligned with the speed vector. This type was found to also cover some cases of controlled flights into terrain. Most of those happen at lower speeds or otherwise at speeds not exceeding those of a vertical dive (e.g. MD-83 EC-LTV 24/07/2014). The force of gravity is negligible compared with the aerodynamic and inertial effects. The review showed that most accidents resulted in impact speeds of less than 150 m/s.

The deployable package is released when the deformation of the fuselage (starting from the nose) activates the sensors, but it must reduce its speed from 150 m/s to the tested impact speed (46.33 m/s for the ED-112A impact shock test or higher as declared by the applicant) within the fuselage length (the release mechanism is installed at the aft of the aircraft).

The second type of accident is also caused by a loss of control, but resulting in a deep stall. The trajectory is also close to the vertical, but the aircraft remains slightly pitched-up above the horizon.



The aircraft speed is reduced because the wings act as airbrakes, but the aircraft tail hits the ground first because of the attitude. In this case, the speed is close to the ED-112A impact speed, but the distance between the ground and the release point is in the order of magnitude of the fuselage diameter (e.g. A330 F-GZCP 01/06/2009).

The other types of accidents were found to be less stringent for the survivability of the deployable package.

Taking into account the comments, EASA reduced the trajectories to be considered in those two cases, which have been modelled and simplified in a new Appendix 2 to the ETSO. For those two cases, the applicant now has to compute the distances needed to reduce the speed from the release speed to the tested impact speed, that the applicant can choose to be higher than the initial ED-112A requirement. The distance takes into account the distance flown when remaining captive of the aircraft (time between activation and physical release). These distances have to be less than 70 m (case 1) and 20 m (case 2) to ensure that the ADFR can be installed at least on the largest aircraft.

If the applicant chooses a speed higher than the ED-112A requirement (46.33 m/s), the survivability of the ELT and of the floatable aerofoil may be tested to the ED-112A value of 46.33 m/s only. Indeed, because the availability of crash data is paramount, the crash survivability requirements for the recording medium (e.g. EUROCAE ED-112A, Section 2-4.2.1) have historically been more stringent than those of the means to locate the recorders (SAE AS8045A, Section 6.1) and/or the aircraft (SAE AS6254, Section 6.1). This is possible since the memory chips in the recording medium are passive after the impact whereas the means to locate are required to be operational and active. The same philosophy is retained, and the requirements for the survivability of the floatable aerofoil and of the ELT have been kept to the initial ED-112A levels.

Furthermore, all these considerations and the content of the ED-112A assumes that the deployable package is released from a large aeroplane. For example, the 50 ms release time (Section 3-1.7 f.) would not leave sufficient time to release from a smaller aircraft. Similarly, the release from a hovering helicopter would generate additional challenges. Hence, the scope of the ETSO has been clarified in the title and applicability of the ETSO.

Several comments were related to the release energy of the deployable package. On one hand, some requirements tend to limit it, such as Section 3-1.7.i, which is intended to limit the risk to other aircraft, personnel and passengers when at the gate, as well as to limit the recovery time of the deployable package when unintentionally deployed on the ground. This text has been clarified as to the intent to address deployment from a fixed position on the ground.

On the other hand, ED-112A requires the deployable package to 'incorporate flight characteristics that enable it to rapidly establish a flight trajectory that clears the airframe' and the icing requirement in Table 2, Section 24, requires a minimum energy. EASA eventually left the ice thickness open for a value declared by the applicant. This apparent contradiction should, however, be understood as a continuity of ED-112A, which insists on the 'flight characteristics', i.e. the aerodynamic effect should be favoured over the initial energy.

On a related topic, the labels that were required in Section 3-1.8.3 and in the initial Appendix 2 also raised adverse comments. This was corrected to require the labelling only if the release energy is greater than 44 Joules, which is the energy that can induce an injury rated as 2 in the Abbreviated Injury Scale created by the Association for the Advancement of Automotive Medicine. See Annex 1 to



the Explanatory Note on 'Prototype' Commission Regulation on Unmanned Aircraft Operations for more information. The initial Appendix 2, which was seen as too restrictive on the content of the label, has been removed.

Several comments dealt with deployments caused by immersion. EASA removed the contradiction between different sections such that only hydrostatic sensors are now permitted. EASA better took into account the difference between the depth that the deployable package had to withstand (either because the release was underwater or as a result of a release at speed above water) and the depth at which the hydrostatic sensor would activate the deployment. The tolerance for this latter depth has been reduced, so that the deployment is more predictable, in case for example, the fuselage remains floating immersed just below the surface (e.g. accident of ATR72 TS-LBB 06/08/2005).

In several locations, the review of the comments resulted in the removal of the proposed amendments to the ED-112A text and to the reversion to the original text (lock mechanism – 3-1.7 g., deployment requirements – 3-1.7.).

We also added a missing requirement to ensure that the reception ELT signals would remain successful in all the probable orientations in which the deployable package may lie.

#### **ETSO-2C519 EMERGENCY BREATHING SYSTEMS (EBSs)**

This ETSO is amended to clarify that it contains only the standards applicable to EBSs category A.

EBS category A means an EBS capable of being successfully deployed underwater.

The MPS referred to in this ETSO is defined in the AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document EN4856 that contains requirements for EBS Category 'A' and Category 'B'.

In paragraph 3.1.1, it has been clarified that only the requirements for Category 'A' have to be considered.

### **2.5. What are the benefits and drawbacks**

Technology and its related requirements are continuously changing, and thus new industry standards have been developed, or existing industry standards (to which existing ETSOs refer) have been updated and improved. As a result of this, new ETSOs could be developed and existing ETSOs need to be revised. This will contribute to ensuring that parts to be used on aircraft correspond to the latest (and safest) standards and technological solutions.

This practice is also expected to bring economic benefits to the industry, and no specific drawbacks have been identified.



### 3. How do we monitor and evaluate the rules

EASA has created a specific webpage<sup>11</sup> within the EASA website in order to simplify the identification and the download of the current ETSO articles.

For consultation purposes, EASA has also created a specific webpage<sup>12</sup> listing all (current & historic) ETSOs.

No additional actions are foreseen to support the implementation of the new and amended ETSO articles.

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<sup>11</sup> <https://www.easa.europa.eu/easa-and-you/aircraft-products/etso-authorisations/list-of-current-etso>

<sup>12</sup> <https://www.easa.europa.eu/easa-and-you/aircraft-products/etso-authorisations/list-of-all-etso>



## 4. References

### 4.1. Related regulations

n/a

### 4.2. Related decision

- Decision No. 2003/10/RM of the Executive Director of the Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders ('CS-ETSO')

### 4.3. Other reference documents

n/a



## 5. Related document

CRD to NPA 2019-06 'Regular update of CS-ETSO' (RMT.0457)<sup>13</sup>

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<sup>13</sup> Available at <https://www.easa.europa.eu/document-library/comment-response-documents>.

