European Union Aviation Safety Agency

Comment-Response Document 2019-06

RELATED NPA: 2019-06 — RMT.0457 — 24.7.2020

Table of contents

1. Summary of the outcome of the consultation

176 comments were received from 17 stakeholders. The following Table 1 shows the number of comments received by each commentator:

COMMENTATORS	# OF COMMENTS
AIRBUS	2
Airbus Helicopters	16
Airbus-Regulations-SRg	25
Blake van den Heuvel	5
Brad Miller, FAA AIR-131	1
CMC Electronics	1
Curtiss Wright	4
DGAC France	1
European Cockpit Association	1
FAA	16
Garmin International	61
General Aviation Manufacturers Association	9
L3Harris	15
Luftfahrt-Bundesamt	2
Prof. Filippo Tomasello	1
THALES-Avionics	15
UK CAA	1
	Total 176

Table 1

The subjects that received the more significant comments are listed in the following Table 2:

NPA 2019-06 SEGMENT	# OF COMMENTS
General comments	7
Introduction and explanatory notes	17
Draft Subpart A	7
Draft Subpart B	1
Draft ETSO-C10c	4
Draft ETSO-C13g	4
Draft ETSO-C43d	1
Draft ETSO-C113b	7
Draft ETSO-C117b	13
Draft ETSO-C123d	4
Draft ETSO-C124d	7
Draft ETSO-C142b	5

NPA 2019-06 SEGMENT	# OF COMMENTS
Draft ETSO-C145e A1	6
ETSO-C146e A1	10
ETSO-C151d	4
ETSO-C159d	5
ETSO-C165b	6
ETSO-C168	1
ETSO-C176b	3
ETSO-C177b	2
ETSO-C179b	1
ETSO-C196b	1
ETSO-C199 A1	4
ETSO-2C197a	1
ETSO-2C204a	6
ETSO-2C205a	4
ETSO-2C516	12
ETSO-2C517	30
ETSO-2C518	1
ETSO-2C519	2
	Total 176

Table 2

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 at improving the wording.

In some cases, the commentators focused on the differences between the proposed ETSOs and the corresponding FAA TSO.

The majority of these misalignments have been corrected in considering the comments received, and in some cases, the wording proposed by NPA 2019-06 has been improved for clarification purposes.

The majority of the comments submitted were either accepted or partially accepted, as shown in the following Table 3:

	ACCEPTED	PARTIALLY ACCEPTED	NOTED	NOT ACCEPTED	Σ
# of occurrences	70	38	34	34	*176*
percentage	40 %	22 %	19 %	19 %	*100 %*

Table 3

The individual comments and the responses to them are contained in Chapter 2 of this comment-response document (CRD).

A summary of the changes made compared with the text proposed in NPA 2019-06 is provided in the Explanatory Note of the Decision on 'CS-ETSO — Amendment 16'.

2. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

(a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — EASA either partially agrees with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — EASA acknowledges the comment, but no change to the existing text is considered to be necessary.

(d) **Not accepted** — The comment or proposed amendment is not agreed by EASA.

2.1. CRD table of comments and responses

(General Comments)	-

comment	*1* comment by: *DGAC France* Please note that DGAC France has no specific comments on this NPA.
response	Noted.

comment	*15* comment by: *FAA* TSO-C126C Appendix 1: Recommend EASA solicit standards setting organizations with expertise in GNSS requirements to validate ELT (DT) GNSS requirements.
response	Accepted. COSPAS-SARSAT has updated the GNSS requirements. The EASA text is now aligned with the FAA text, which relies on COSPAS-SARSAT approval.

comment	*26* comment by: *UK CAA* Thank you for the opportunity to comment on this NPA 2019-06. Please be advised that there are no comments from the UK CAA.
response	Noted.

comment	*43* comment by: *General Aviation Manufacturers Association* GAMA Reference: GAMA19-48 The current revision of the EASA-FAA Bilateral Agreement and supporting Technical Implementation Procedures (TIP) revision 6.1, reflect the mutual recognition of ETSO / TSO. Does the introduction of the additional ETSO requirements identified in NPA

2019-06, Index 1 e.g. ETSO-C126c, ETSO-C151d etc. preserve the reciprocity of this agreement? Has EASA discussed the introduction of the additional ETSO requirements with FAA to understand the impact on the corresponding FAA TSO?
Further, to ensure that these requirements are highlighted as technical differences, the affected ETSO should be moved to Index 2. This action would then enable a US TSO applicant to highlight the additional EASA requirements to the FAA, using the provisions in 14 CFR 21.8(d) to obtain FAA approval and negate any impact to the EASA validation.

response

Not Accepted.
The introduction of differences in requirements or ultimately having an ETSO classified 2C do not affect mutual recognition.

Mutual recognition implies that it is not required to have a validation of the TSO, and any difference from the TC/STC certification basis will be assessed at aircraft installation.

Differences between TSOs that refer to the same MOPS standards (meaning they are in the C series) but that have different hardware, software or environmental testing DO-160 requirements, have existed for many years, before TiP Rev 5; and these TSOs are classified in the C series even though they contain significant differences.

For the ETSO standards that have some differences, but which do not justify them being in the 2C category, applicants are invited to assess those differences and elect to comply with the appropriate standards, to ease installation. TSO and ETSO applicants should be aware that ETSOs under Index 1 may need further investigations in view of the final installation, even if these ETSOs are very similar to the corresponding FAA ones. It is up to the FAA to decide the conditions of use of 14 CFR 21.8(d) as recognised in TIP Rev 6.

comment

52 comment by: *Garmin International*

General:

With the EASA/FAA bilateral agreement that requires the importing Authority (in this case EASA) to accept the exporting Authority's (in this case FAA) TSO, all effort should be made to make the ETSOs within Index 1 as technical similar as possible with the TSOs because US companies may commonly assume that ETSOs under Index 1 need no further investigation.

Below are some examples of ETSOs that NPA 2019-06 amended to include additional requirements when compared to the corresponding FAA TSOs:

ETSO-C113b
ETSO-C126c
ETSO-C145e A1
ETSO-C146e A1
ETSO-C151d

To make sure there are no issues during installation of imported TSOA articles, EASA should consider doing one of the following:

- Remove the additional requirements from any Index 1 ETSOs,
- Clarify that the additional ETSO requirements are not required for imported articles with the corresponding FAA TSO, or
- Move these ETSOs to Index 2 to highlight the technical differences.

If ETSOs are moved to Index 2, a US company that expects to validate with EASA should know to perform a difference analysis and to obtain FAA approval for the additional ETSO requirements using the provisions of 14 CFR section 21.8(d).

response

Not accepted.

ETSO-C113b, ETSO-C145e A1, ETSO-C146e A1 are considered technically similar to the equivalent FAA TSOs. The slight differences provide more clarifications for C113b, for which we liaised and sought the FAA interpretations. We concur on the same overall MOPS, and EASA considered and agreed on the need for adding those clarifications.

For C145eA1 and c146e A1, the changes are related to the consideration of ETSO-C204 and ETSO-C205, and do not change any final MOPS requirement for the C145e or C146e functions. In terms of performance, these two ETSOs should be equivalent to the FAA ones.

Differences between TSOs that refer to the same MOPS standards but have different hardware, software or DO-160 environmental testing requirements have existed for many years. Applicants are invited to assess those differences and elect to comply with the appropriate standards, to ease installation. TSO and ETSO applicants should be aware that ETSOs under Index 1 may need further investigations in view of the final installation, even though these ETSOs are very similar to the corresponding FAA ones.

comment

65 comment by: *THALES-Avionics*

Thales fully supports this recurrent and usefull rulemaking task.
Regarding US-EU bilateral and TIP implementation of mutual recognition, this rulemaking task is important to fill the gap between EU and US as we understand that there is no possibility to get a LODA in case of difference of revision between ETSO and TSO or in case of ETSO /TSO not technically equivalent.
Increasing the frequency and reducing the elongation of these rulemaking tasks would be an answer, together with the possibility to improve bilateral in order to be able to get credit at ETSO level (and not TC level as per new TIP) of both ETSO and TSO when different.

response

Noted.
With this EDD, the gap between the FAA TSOs and EASA ETSOs is almost filled. EASA is already working on the next NPA that will address the remaining differences.
See also the responses to comments #43 and #52.

comment

144 comment by: *European Cockpit Association*

	ECA welcomes the proposed changes to the Certification Specifications for European Technical Standard Orders (CS-ETSO) as detailed in NPA 2019-06. Especially the new standards regarding requirements for flight recorders and underwater locating devices should provide an important step forward with regard to flight recorder recoverability and analysis.
response	Noted.

EXECUTIVE SUMMARY p. 1-2

comment	*6* comment by: *Prof. Filippo Tomasello* FAA has already published since a while TSOs C211, C212 and C 213. Transposition of these TSOs into the Agency's CS-ETSO in not proposed by this NPA. Possibly the Agency has good reasons forthis missing transposition, but the justification is not made visible to stakeholders through this NPA. May one expect that the justification would be spelled out in the Explanatory Note accompanying the Decision which will follow this NPA?
response	Noted. EASA is working on new ETSOs intended to support the certification of unmanned aircraft systems (drones). As this is a specific field, the NPA will be issued as part of the related rulemaking task (RMT.0230).

comment	*131* comment by: *Airbus-EIAIX-SRg* The Document NPA 2019-06 provided through the CRT contains 381 pages. By this it is different to that NPA document which is provided through the EASA Homepage for NPA 2019-06. This version of the NPA contains only 372 pages. The comments provided by AIRBUS are related to the version published on EASA homepage (containing 372 pages). Airbus would be pleased if EASA could confirm that only editorial changes in the CRT version are the cause for that difference in pages and that no difference in content exist (e.g. no further changed ETSO numbers). Thank You.
response	Noted. EASA confirms that the technical content of the NPA is exactly the same.

comment	*136* comment by: *Airbus-EIAIX-SRg* In this CRT document of NPA 2019-06 the ETSO-C126 at issue C is not released for comments. As AIRBUS would like to also comment that change, please find our comment on ETSO-C126c below.

Page 152 of 372 [156 of 381]
ETSO-C126c, Chapter 3.1.1, Airbus request:

This ETSO-C126c shall clarify that the requirement 2.9.5.2.1 e) in the corresponding ED-62b shall be
replaced by the following modified one:

Continuously monitor the triggering command communications connection between the automatic triggering system
and ELT unit. If that connection is lost while the ELT is armed the ELT ~~shall~~ ***may*** *be activated until the communication*
connection is restored and the ELT receives an indication that a triggering command is not active, in which case a
cancellation message is sent by the ELT, and the ELT returns to the armed mode.

Rationale:
This ED-62b requirement (2.9.5.2.1 e) was introduced when ELT-DTs were **not** intended to be crash survivable, but now with the introduction of crash survivable and crash detectable ELT-DTs, there is no longer a mandatory need (shall àmay) to trigger when the communication is lost.
Especially keeping in mind that the internal / integral crash detection means will activate the distress signal automatically anyhow in a crash scenario.

response

Partially accepted.
Crash-survivable ELTs are designed to survive a limited impact, where at least some occupants of the aircraft may survive the crash. They are not designed, in contrast to flight recorders, to withstand the constraints found in non-survivable crashes. However, ELT(DT)s are installed to detect the position of the end of flight (CAT.GEN.MPA.210), which encompasses non-survivable crashes. The ELT should permit an alert to be sent when the conditions that cause the accident disable the command sent by the aircraft. It is recognised that the probability of loss of the communication connection may be higher than the permitted rate of nuisance alerts. An amendment of the ED-62B wording is therefore introduced, affecting 2.9.5.1, 2.9.5.2.1 e).

1. About this NPA p. 3

comment *73* comment by: *THALES-Avionics*

TSO C153a has been published in US end of June. This TSO being technically equivalent to existing 2C153, Thales would recommend to move ETSO 2C153 into TSO C153a, in the scope of this NPA without additionnal public consultation.

response

Accepted
ETSO-2C153 has been renamed as ETSO-C153a and included in the EDD.

This new release has the purpose to align the ETSO index with the published FAA TSO-C153a to reflect harmonisation. As a consequence, this standard is moved from Index 2 to Index 1 of CS-ETSO Subpart B.

comment	*74* comment by: *THALES-Avionics* Regarding Circuit Card Assembly (CCA) ETSO for GPS equipment, we have understood the interest of introducing the US TSO in CS-ETSO index 2 as 2C20x, as far as the ETSOA will be granded for the board itself with no limitation requiring the end-use manufacturer to receive an ETSO. These NPA contains CCA ETSO: 2C204, 2C205, 2C206 relatively respectively to ETSO C145e, C146e, and C196a. Thales would request to add a new ETSO 2C20x relatively to ETSO C161a Ground-Based Augmentation System Positioning and Navigation Equipment, based on the model of the 3 other ones, in the scope of this rulemaking task.
response	Noted This request has been recorded and will be considered during future amendments to CS-ETSO.

2. In summary — why and what | 2.3. How we want to achieve it — overview of the proposals p. 4-18

comment	*17* comment by: *FAA* Page 16, ETSO-C126c section says “Currently, the FAA TSO that corresponds to ETSO-C126c is at Revision b.” However, revision C of the FAA TSO is current. (TSO-C126c)
response	Accepted. Sentence deleted.

comment	*33* comment by: *Airbus Helicopters* **Comment** “Currently, the FAA TSO that corresponds to ETSO-C123d is at Revision b.” rev b of TSO-C123 is relative to ED-112 and not ED-112A. So please confirm it should be rev c for FAA equivalence. **Rationale for Comment** ED-112A is granted on equipment via FAA TSO-C123c. **Recommendation** please confirm it should be rev c for FAA equivalence. **Classification** MINOR
response	Accepted. Text amended as suggested.

comment	*34* comment by: *Airbus Helicopters* **Comment** TSO-C123d, ETSO-C124d, ETSO-C176b and ETSO-C177b: what will be the corresponding EASA ETSO for non-deployable combi recorder equipment which are already granted by FAA TSO-C123c, TSO-C124c, TSO-C176a and TSO-C177a for ED-112A application?

Rationale for Comment
Those new ETSO introduce compliance to the new CAT.GEN.MPA.210 but limited to aeroplanes.
Recommendation
Can EASA accept as equivalence for non-deployable combi recorder in helicopter use case those new ETSO wrt the FAA TSO (TSO-C123c, TSO-C124c, TSO-C176a and TSO-C177a for ED-112A) as discrepancies are linked to CAT.GEN.MPA.210 compliance limited to aeroplane and ADFR only?
Classification
MAJOR

response

Noted.
The question relates to the acceptability of parts approved by the FAA according to an earlier standard, which is not affected by the update of CS-ETSO.

comment *35* comment by: *Airbus Helicopters*

Comment
Seems a copy paste error in ETSO-C124d is “Currently, the FAA TSO that corresponds to ETSO-C123d is at Revision b.”
Rationale for Comment
-
Recommendation
should be C124 and not C123.
Classification
FORMAL

response

Accepted.
Text amended as suggested.

comment *36* comment by: *Airbus Helicopters*

Comment
“Currently, the FAA TSO that corresponds to ETSO-C124d is at Revision b.” rev b of TSO-C124 is relative to ED-112 and not ED-112A. So please confirm it should be rev c for FAA equivalence.
Rationale for Comment
ED-112A is granted on equipment via FAA TSO-C124c.
Recommendation
please confirm it should be rev c for FAA equivalence.
Classification
MINOR

response

Accepted.
Text amended as suggested.

comment *37* comment by: *Airbus Helicopters*

Comment
“Currently, the FAA TSO that corresponds to ETSO-C176b is at Revision a.” It is notified in Table A1 of page 10&11 there is no corresponding FAA TSO for this part.

Rationale for Comment
-
Recommendation
Indicate in Tabla A1 the corresponding FAA TSO is TSO-C176a instead of "no corresponding FAA TSO revision"
Classification
MINOR

response

Partially accepted.
EASA appreciates that the proposed amendment to ETSO-C176a refers to the same MOPS as the existing TSO-C176a. Nevertheless, the amendment proposed by EASA introduces new requirements (see Appendix 1), therefore it has been decided to rename the new version of the ETSO and to move it into Index 2.

comment

38 comment by: *Airbus Helicopters*

Comment
"Currently, the FAA TSO that corresponds to ETSO-C177b is at Revision a." It is notified in Table A1 of page 10&11 there is no corresponding FAA TSO for this part.
Rationale for Comment
-
Recommendation
Indicate in Tabla A1 the corresponding FAA TSO is TSO-C177a instead of "no corresponding FAA TSO revision"
Classification
MINOR

response

Partially accepted.
EASA appreciates that the proposed amendment to ETSO-C177a refers to the same MOPS as the existing TSO-C177a. Nevertheless, the amendment proposed by EASA introduces new requirements (see Appendix 1), therefore it has been decided to rename the new version of the ETSO and to move it into Index 2.

comment

122 comment by: *Garmin International*

CS-ETSO Subpart A Sections 2.2 and 2.3 - Page 19-20:

1. The wording in the first paragraph of both sections is inconsistent, awkward to read, and implies the referenced AMC is "The" only acceptable means for development assurance, which is contrary to what is stated in the EASA CS-25 SEI List for Panel 10.

2. The wording of the section 2.3 first paragraph implies that AMC 20-152 must be followed even for DAL D. This is inconsistent with the applicability proposed in NPA 2018-09 per AMC 20-152A section 2:

"This [AMC]/[AC] is applicable to airborne electronic hardware that contributes to functions with a hardware development assurance level (DAL) A, DAL B, or DAL C. … demonstration of compliance with the objectives described in this [AMC]/[AC] is not required for … airborne electronic hardware contributing to functions with

a hardware DAL D. [Appendix]/[AC 00-72, Best Practices for Airborne Electronic Hardware Design Assurance Using EUROCAE ED-80( ) and RTCA DO-254( )] provides some clarifications that may be used to ensure that the DAL D hardware performs its intended function".

3. The section 2.3 second paragraph uses the term “design assurance” when “development assurance” is the currently accepted term. Further, AMC 20-152A uses the term “hardware development assurance” rather than “airborne electronic hardware development assurance” since AMC 20-152A also covers complex COTS devices.

4. In the second paragraph of both sections, the use of “below” in the phrase referencing “Section 2.4 of this document” is unnecessary.

5. Other editorial inconsistencies.

Suggest revising the wording as follows:

2.2 Software

If the ETSO article includes software, the software shall be developed with development assurance. An acceptable means of compliance for airborne software development assurance is outlined in the latest revision of AMC 20-115, entitled ‘Airborne Software Development Assurance using EUROCAE ED-12 and RTCA DO-178’.

The software development assurance level (DAL), also known as the ‘item development assurance level (IDAL)’, may be determined by using the guidance proposed in Section 2.4 of this document. The applicant must declare the software DAL(s) to which the software has been developed and verified.

Note: Proposals for use of other airborne software development assurance means of compliance should be coordinated with EASA and may require a deviation from the requested ETSO.

2.3 Airborne electronic hardware (AEH)

If the ETSO article includes airborne electronic hardware, the airborne electronic hardware shall be developed with development assurance. An acceptable means of compliance for airborne electronic hardware development assurance is outlined in the latest revision of AMC 20-152, entitled ‘Development Assurance for Airborne Electronic Hardware’ for hardware development assurance levels (DAL) A, DAL B, and DAL C.

The hardware DAL, also known as the ‘item development assurance level (IDAL)’, may be determined by using the guidance proposed in Section 2.4 of this document. The applicant must declare the hardware DAL(s) to which it has been developed and verified.

Note: Proposals for use of other airborne electronic hardware development assurance means of compliance should be coordinated with EASA and may require a deviation from the requested ETSO.

Note: AMC 20-152A Appendix 'Best Practices for Airborne Electronic Hardware Design Assurance Using EUROCAE ED-80( ) and RTCA DO-254( )' provides some clarifications that may be used to ensure that the DAL D hardware performs its intended function.

response

Partially accepted.

1. Partially accepted.
Different from type certificates as well as from the CS-25 context, there are no possible CRIs in the ETSO context. Alternatives to traditional development are therefore not accompanied by possible additional guidance on the means of compliance for granting an ETSOA. The ETSO path is optional. If the applicant wishes to use alternative means of compliance - in the ETSO context -, a deviation shall be requested.
Text added to use another means of compliance.

2. Not accepted.
EASA does not concur with the interpretation of the comment on AMC 20-152A applicability. The CS-ETSO does not refer to a given applicability to the DAL on purpose; this applicability to DAL is clearly indicated in the AMC 20-152A, which is referred to as a whole in CS-ETSO Subpart A.

3. Accepted.
The text now refers to the hardware development assurance level, in line with AMC 20-152A.

4. Accepted.
'below' is removed.

5. Noted.
DAL is used in the text.
Section 2.2 is kept unchanged from the NPA. AMC 20-115D refers to Software levels, as in DO-178.

comment

167 comment by: *AIRBUS*

ETSO-2C518: Runway Overrun Awareness And Alerting System

Page 14, please change:

"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."

by:

	"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, **or an existing means of compliance already agreed with the agency."** **Justification:** Airbus has already developed and certified ROOAS on most of the fleet according to an EASA CRI. It is therefore requested to explicitly authorize the use of another means of compliance already agreed with the agency, to not unduly penalize Manufacturers who voluntarily adopt the technology in advance to regulation application.
response	Not accepted. An ETSO authorisation is granted when the equipment is compliant with a minimum performance standard that is published and available to the public, but the use of CRIs for ETSOs is not permitted by Part 21. The ETSO process is an optional path, and does not constitute an installation approval. It permits EASA to approve an equipment manufacturer's part independently of a specific installation. The installer may then use the ETSOA as a means of compliance for installation of the ETSO article, but this is not the only means. The creation of ETSO-2C518 does not invalidate the installations granted on Airbus aircraft.

2. In summary — why and what | 2.4. What are the expected benefits and drawbacks of the proposals p. 18

comment	*22* comment by: *FAA* Page 18 Referenced Text: CS-ETSO, Subpart A, Paragraph 2.2. If the ETSO article includes software, the software shall be developed with development assurance. Acceptable means of compliance for the development assurance of the airborne software is outlined in the latest revision of AMC 20-115. entitled Airborne Software Development Assurance using EUROCAE ED-12 and RTCA DO-178 Comment: The sentence "Acceptable means of compliance for the development assurance of the airborne software is outlined in the latest revision of AMC 20- 115 ... " is ambiguous. It is not clear if use of AMC 20- 115 is mandatory or optional. Proposed Resolution: According to EASA, AMCs are an Acceptable Means of Compliance (AMC). AMCs are not mandatory, and therefore the text should clearly state "An acceptable means of compliance for the development assurance of the airborne software is outlined in the latest revision of AMC 20-115 ... ".
response	Partially accepted. The sentence referring to acceptable means of compliance is clarified. For the context of an ETSO, it is mandatory to comply with the latest version of AMC 20-115. As a consequence, if an applicant wishes to use an alternate MoC, a deviation should be requested as foreseen by the ETSO process.

comment	*44* comment by: *General Aviation Manufacturers Association* 1. The wording in the first paragraph of both sections is inconsistent and difficult to read; further it implies that the referenced AMC is "the" only acceptable means for development assurance, which is contrary to what is stated in the EASA CS-25 SEI List for Panel 10. 2. The statement within section 2.3 first paragraph implies that AMC 20-152 must be followed even for DAL D. This is inconsistent and contrary to the applicability statement proposed in NPA 2018-09, AMC 20-152A section 2.
response	Partially accepted. See the answer to comment #122.

3. Proposed amendments p. 19

comment	*45* comment by: *General Aviation Manufacturers Association* 1. The wording in the first paragraph of both sections is inconsistent and difficult to read; further it implies that the referenced AMC is "the" only acceptable means for development assurance, which is contrary to what is stated in the EASA CS-25 SEI List for Panel 10. 2. The statement within section 2.3 first paragraph implies that AMC 20-152 must be followed even for DAL D. This is inconsistent and contrary to the applicability statement proposed in NPA 2018-09, AMC 20-152A section 2.
response	Partially accepted. See the answer to comment #122.

SUBPART A—GENERAL | 2. STANDARDS TO MEET TECHNICAL CONDITIONS p. 19-21

comment	*7* comment by: *Luftfahrt-Bundesamt* In Point 2.7 it is required, that non-rechargeable litium batteries must comply with the UN transport regulation. For rechargeble lithium batteries it is not required. Should it?
response	Accepted. Compliance with the UN regulation has been added as a requirement for rechargeable lithium batteries.

comment	*23* comment by: *FAA* Page 19 Referenced Text: CS-ETSO, Subpart A, paragraph 2. 3. If the ETSO article includes airborne electronic hardware, the airborne electronic hardware shall be developed with development assurance. The acceptable means of compliance for the

development of airborne electronic hardware is outlined in the latest revision of AMC 20- 152, entitled 'Development Assurance for Airborne Electronic Hardware'.

Comment: The sentence "The acceptable means of compliance for the development of airborne electronic hardware is outlined in the latest revision of AMC 20-152 ... " implies that AMC 20-152 is the only means of compliance.

Proposed Resolution:
According to EASA, AMCs are an Acceptable Means of Compliance (AMC). AMCs are not mandatory, and therefore the text should state:
"An acceptable means of compliance for the development of airborne electronic hardware is outlined in the latest revision of AMC 20-152 ... "

response

Partially accepted.
See the answer to comment #122.

comment *24* comment by: *FAA*

Page 20
CS-ETSO Subpart A, paragraph 2.6 Problem reports that are related to ETSO articles that contain software or airborne electronic hardware shall be identified and managed. Acceptable means of compliance for the management of OPRs are outlined in the latest revision of AMC 20-189 'Management of Open Problem Reports'.

Comment: The sentence "Acceptable means of compliance for the management of OPRs are outlined in the latest revision of AMC 20-189 'Management of Open Problem Reports' " is ambiguous. It is not clear if use of AMC 20-189 is mandatory or optional.

Proposed Resolution: According to EASA, AMCs are an Acceptable Means of Compliance (AMC). AMCs are not mandatory, and therefore the text should clearly state "An acceptable means of compliance for the management of OPRs is outlined in the latest revision of AMC 20-189 ... "

response

Partially accepted.
See the answer to comment #22.

comment *46* comment by: *General Aviation Manufacturers Association*

1. The statement implies AMC 20-189 is “the” only acceptable means of compliance for Open Problem Report (OPR) management.
2. The statement implies that for ETSO articles with minor or no safety effect failure conditions, AMC 20-189 should be followed - this is inconsistent and contrary to the applicability statement proposed in NPA 2018-09 per AMC 20-189 section 2.

response

Partially accepted.
1- Partially accepted, see the answer to comment #24.
2- Not accepted.

	EASA does not concur with the interpretation of the comment on AMC 20-189 applicability. CS-ETSO does not refer to a given failure condition; this applicability is indicated in AMC 20-189, which is referred to as a whole in CS-ETSO Subpart A.

comment	*66* comment by: *THALES-Avionics* In Subpart A § 2.3 Airborne electronic hardware (AEH), replace « The acceptable means of compliance for the development of airborne electronic hardware is outlined in the latest revision of AMC 20-152, ..." by "Acceptable means of compliance for the development of airborne electronic hardware is outlined in the latest revision of AMC 20-152, ..." This would be coherent with § 2.2 Software paragraph, and AMC 20-152 is an acceptable means of compliance but may not be the only one.
response	Not accepted. See the answer to comment #22.

comment	*100* comment by: *THALES-Avionics* 2.4 Failure condition classification and development assurance 1/ ETSO is a requirement at equipment level not at aircraft level therefore it is to the equipment manufacturer to decide and declare for what level of failure condition he wants to design its equipment. Replace "….development assurance level that is appropriate to the failure condition classifications that are expected for the intended installation" by development assurance level that is appropriate to the failure condition classifications envisionned by the applicant" 2/ Safety analysis being done at system or aircraft level, at equipment level, failure classification may only be declarative. Therefore, the sentence "the applicant should develop an assumption for the failure classification", should be clarified by replacing "develop an assumption" by "make an assumption" or "declare its assumed failure classification".
response	Partially accepted. 1- Not accepted. EASA considers the sentence equivalent. At the ETSO level, the intended installation is equivalent to the envisioned installation. 2- Accepted. The sentence has been clarified.

comment	*123* comment by: *Garmin International* **CS-ETSO Subpart A Section 2.6 - Page 21:** 1. The wording implies AMC 20-189 is "The" only acceptable means for open problem report management.

2. The wording implies that AMC 20-189 should be followed for ETSO articles with minor or no safety effect failure conditions.This is inconsistent with the applicability proposed in NPA 2018-09 per AMC 20-189 section 2:

"… This [AMC]/[AC] applies to all airborne electronic systems and equipment, software and AEH embedded in those systems, which could cause or contribute to Catastrophic, Hazardous, or Major failure conditions. This [AMC]/[AC] is not applicable to electronic equipment embedded in airborne systems which could cause or contribute only to Minor failure conditions or to failure conditions having No Safety Effect. This [AMC]/[AC] is also not applicable to component partitions which could cause or contribute only to Minor failure conditions or to failure conditions having No Safety Effect".

Other editorial inconsistencies.

Suggest revising the wording as follows:

2.6 Open Problem Reports (OPRs)

Problem reports that are related to ETSO articles that contain software or airborne electronic hardware shall be identified and managed. An acceptable means of compliance for the management of OPRs is outlined in the latest revision of AMC 20-189, entitled 'Management of Open Problem Reports' for articles that could cause or contribute to Catastrophic, Hazardous, or Major failure conditions.

Note: See AMC 20-189 Section 2 for additional information related to its Applicability to airborne systems with embedded electronic equipment and component partitions which could cause or contribute only to Minor failure conditions or to failure conditions having No Safety Effect.

Note: Proposals for use of other problem report management means of compliance should be coordinated with EASA and may require a deviation from the requested ETSO.

response

Partially accepted.
See the answer to comment #46.

SUBPART B — LIST OF ETSOs (INDEX 1 AND INDEX 2) p. 23-30

comment *42* comment by: *Airbus Helicopters*

Comment
ETSO-C194 should be revised to specify what corresponds to HTAWS class A.

Rationale for Comment
EU 965/2012 regulation SPA.HOFO.160 (c) requires TAWS that meets the requirements for class A equipment as specified in an acceptable standard.
Recommendation
Update ETSO-C194 to acceptable standards for HTAWS class A.

This should not mean that ETSO -C151d proposed updates should be carried over. Indeed the Rationale behind the required capability to trigger two kinds of aural alerts for caution level FLTA is not clear. No additional technical requirement for HTAWS with reference to current systems/implementations should be introduced pending EASA rulemaking task RMT.708 CFIT outcomes are delivered.

Classification
MAJOR

response

Noted.
EASA will consider the amendment of this ETSO as part of the next regular update of CS-ETSO.

ETSO-C10c p. 31-33

comment

68 comment by: *THALES-Avionics*

ETSO C10c - App 1 / 3.11
Symbol 40 is not directly linked to scale notion in ARP4102/7. This is why we propose to modify the text as follows :
*"Instruments that use a tape-type display or present altitude with a digital readout are permitted to use tic marks every 100 feet with a more prominent mark every 500 feet in agreement with SAE ARP4102/7, Appendix A, Symbols 39 and**/or** 40. "*

response

Accepted.
Text modified as suggested

comment

75 comment by: *THALES-Avionics*

ETSO C10c - App 1 / New line for 5.10
In AS8009C, § 5.10 Monitoring Functions (for Altimeters with External Power or Excitation Inputs), it is written:

With nominal input power applied to the UUT and all interfaces connected and operating normally, there shall be no failure flags or failure indicators in view. Failure signal outputs shall not be indicating any failures.
Remove or interrupt the UUT primary power and verify that within one second a positive inidcation of loss of input power is clearly visible in the form of a failure flag or failure indicator within the viewing area of the instrument display. If applicable, failure signal outputs shall be verified to indicate the failure condition.
Reapply the power and verfiy the failure flag, indicator and any output signal is removed or cleared within 1 second."

Comment: the test case condition is too stringent for power up situation and should take into account different type of design, including the case of displays where failure indicator can be a black screen and where an image is displayed after a power up phase that can last more than one second.

	Recommendation to update Appendix 1 table with new section 5.10, to clarify MPS and add a note indicating that duration may be one second or nominal start-up phase duration.
response	Partially accepted. A new line for 5.10 has been added, but referring to AS8034C as an alternative means of compliance.

comment	*76* comment by: *THALES-Avionics* ETSO C10c - App 1 / 5.11 and 6.29 AS8034C is now available. Proposal to reference both AS8034B and C.
response	Accepted. Text modified as suggested

comment	*124* comment by: *Garmin International* **ETSO-C10c - Page 33:** In SAE Appendix 1 Section 3.4, the ETSO text reads “may be omitted from the dial of instruments”, while the TSO-C10c text reads “may be omitted for instruments”. Suggest removing ‘from the dial’ to be consistent with the TSO.
response	Accepted. Text modified as suggested

ETSO-C13g	p. 34-56

comment	*18* comment by: *FAA* Page 46. Referenced Text: Page 6, subsection 2.3 applies as written, except the replacement of the definition of the following terms as follows: Replace with: Page 6, subsection 2.3, apply as written, except replace the definition of the following terms with the new text.
response	Accepted Text amended as suggested.

comment	*19* comment by: *FAA* Page 47. Referenced Text: Appendix 1 Section 3, 3.9 For the child and infant-small child category, it shall be demonstrated that at least 60% ... starting with the *packaged* life I preserver.

	Comment: In TSO-C13g, itallics are used to indicate a change in text from AS1354. In ETSO-C13g, usually the italics were removed, but here they are not - *packaged*. Rationale - Be consistent. Either keep the original italisized text, or useplain text.
response	Accepted. Plain text was kept consistently through the document.

comment	*20* comment by: *FAA* Page 48 Reference Text Appendix 1 Section 3, 3.10 and various other paragraphs. The infant-small child category life preserver shall remain inflated and undamaged, ... an adult and *tested in accordance with 5.4 3* Comment: In TSO-C13g, itallics are used to indicate a change in text from AS1354. In ETSO-C13g, usually the italics were removed, but here they are not - *tested in accordance with 5.4 3*. Rationale - Be consistent. Either keep the original italisized text, or use plain text.
response	Accepted. Plain text was kept consistently through the document.

comment	*21* comment by: *FAA* Page 50 Referenced Text: Appendix 1 Section 5, 5.3.1. Child donning tests shall be performed by a minimum of 5 adult test subjects of both sexes between the ages of 20 and 40. Tests shall be performed using a child weighing between 35 and 90 pounds (15.88 and 40.91 kg}. Comment: This text should be in a separate paragraph.
response	Accepted. Text modified as suggested

ETSO-C43d	p. 65-67

comment	*69* comment by: *THALES-Avionics* ETSO C43 - Appendix 1 To be consistent with the removal of section 4.3, a new modification to SAE AS8005A should be introduced related to friction error to state that in section 4.8 of SAE AS8005Ato remove the part "or vibrated" from the sentence "the instrument reading shall be noted before and after the instrument is lightly tapped or vibrated. ”
response	Not accepted.

	The fact that EASA does not allow the vibration of the article to be used to show compliance does not mean that EASA is not interested in the values displayed before and after the vibration, if vibration is applied. Only the value before vibration can be used for compliance demonstration.

ETSO-C113b p. 68-71

comment	*27* comment by: *Airbus Helicopters* **Comment**: The referred AS8034B conflicts the reference AS8034C addressed overall with ETSO-C113b. **Recommendation:** Correct the AS8034 reference on page 70 **Classification:** Formal
response	Accepted. Text modified as suggested

comment	*47* comment by: *General Aviation Manufacturers Association* The proposed modifications to AS8034C section 5 and 5.1 introduce additional tests not referenced within FAA TSO-C113b. To ensure technical equivalency and preserve EASA-FAA reciprocity under the current TIP, this modification should be discussed with FAA, to ensure all TSOA applicants are compliant with the EASA standard.
response	Not accepted. EASA has added the text for clearer guidance. This text has been discussed with the FAA and both authorities concluded that the EASA text was not controversial, but adds more precision (see the answer to comment 57-2.). The TSO and ETSO for this C113b standard are considered sufficiently similar to have ETSO-C113b under Index 1. There are no controversial points regarding TSO-C113b. Finally, EASA-FAA reciprocal acceptance under the current TIP is not affected by differences between the ETSO and TSO.

comment	*57* comment by: *Garmin International* **ETSO-C113b - Page 68:** Section 3.1.1.1 includes Modifications to AS8034C Section 5 and Section 5.1 which are not found in TSO-C113b. These modifications require additional tests not called out by FAA TSO-C113b. For technical equivalency, these modifications should not be made without coordination with the FAA as some TSOA applicants would not be compliant with the EASA standard. If the comment in the prior paragraph does not result in removing the proposed Modifications, then the following comments/suggestions should be considered:

1. The proposed modification to Section 5, second bullet is ambiguous as to whether the intent is that the last sentence in AS8034C is to be retained or not; i.e., “Software simulation cannot be used in lieu of physical activation.” If the intent of EASA’s modification is to allow the same flexibility for other tests (e.g., 5.4 Temperature and Altitude Tests, 5.6 Humidity Test, etc.) as it is for the 5.5 Temperature Variation and 5.20 RF Susceptibility Tests, then consideration should be given to striking this sentence. In any case, the ETSO-C113b text should make the extent of the intended modification obvious.
2. The proposed modification to Section 5.1 to reference a new Section 5.1.7 requiring testing of latency and accuracy during all environmental tests is problematic even with the proposed modification to Section 5. The SAE committee that produced AS8034C spent hours discussing how to word Section 5 to prevent unrealistic expectations that would require an applicant to determine how to interact with a touch screen during tests where the unit is inaccessible. Even with the proposed Section 5, second bullet, the concern about the ability to “prove that the touch screen” meets the 4.7.1 Latency and 4.7.3 Touch Screen Selection Accuracy characteristics remains. Consequently, it is recommended to delete this modification.
3. Change any remaining “touchscreen” references within ETSO-C113b to “touch screen” (with appropriate capitalization for the context) to be consist with the term used in AS8034C.

response

Partially accepted.

Introduction sentence:
Not accepted. See the answer to comment 47.
1. Accepted.
The remaining text, unchanged, has been added for clarity, responding to the comment raised.
2. Not accepted.
The modification to AS8024C is found essential to test touchscreen functionality over some specific environmental conditions. AS8034C allows the exclusion of any physical test from the touchscreen functions, and the modification brought by EASA in ETSO-C113b results in a request to test the touchscreen functionality under the Temperature and Altitude Tests (Section 4.0, DO-160G/ED-14G) but excluding overpressure tests, and under the Temperature Variation Test (Section 5.0, DO-160G/ED-14G). After inquiry following this comment, this approach is found quite reasonable and realistic.
3. Accepted.

comment

60 comment by: *Garmin International*

ETSO-C113b - Page 70:

Item 2 does not include wording present in TSO-C113b: “however, the color selected should not impair the use of the overlaid information elements. Labels, display-based controls, menus, symbols, and graphics should all remain identifiable and distinguishable.”

	For consistency with TSO-C113b, it is suggested to add the text into ETSO-C113b.
response	Accepted. Text amended as suggested.

comment	*84* comment by: *Garmin International* **ETSO-C113b - Page 69:** SAE AS8034B reference in Appendix 1 is outdated and should be updated to SAE AS8034C
response	Accepted. See the answer to comment #27.

comment	*85* comment by: *Garmin International* **ETSO-C113b - Page 70:** In Table A1, 'non-normal sources' has been moved to a different row, and that row's colours have been expanded with a note 'as appropriate'. Suggest that Table A1 and its notes should stay consistent with the FAA TSO and rely on certification authority to determine proposals that don't fall under the accepted colours.
response	Noted. See the answer to comment #47.

comment	*87* comment by: *Garmin International* **ETSO-C113b - Page 71:** Item 4 from TSO-C113b is not included: "A red 'X' can be used to denote a failure of the display or parameters." For consistency with TSO-C113b, it is suggested to add the text into ETSO-C113b.
response	Not accepted. This feature is not found to conform to the equivalent aircraft level requirements related to colours of annunciations (e.g. CS 25.1322). The red colour should be only associated with warnings. EASA has decided that the annunciation of a given parameter on the display should be consistent with this CS 25.1322 requirement.

ETSO-C117b	p. 72-147

comment	*80* comment by: *Garmin International* **ETSO-C117b Section Page 106:**

	Appendix 1, page 106, paragraph after Note 3, it states 'for both increasing and decreasing wind shear' whereas on previous similar worded note (Page 105) it read 'for both performance increasing and performance decreasing wind shear'.
response	Accepted. EASA agrees with the commenter. The change was inadvertently introduced and it has been corrected.

comment	*81* comment by: *Garmin International* **ETSO-C117b Page 105:** Appendix 1, the Tables at the top of Pages 105 and 106 are missing units (seconds) in the middle column.
response	Accepted. Text amended as suggested.

comment	*82* comment by: *Garmin International* ETSO-C117b - Page 100: Appendix 1, Table 1, appears to be missing entries for Sections 24-Icing, 25-Electrostatic Discharge, and 26-Fire, Flammability. These sections are included in TSO-C117b.
response	Accepted. Text amended as suggested.

comment	*83* comment by: *Garmin International* **ETSO-C117b Page 95:** Appendix 1, Section 4.a.16.ii ends with '(reserved)' whereas TSO-C117b includes '(1 x 10-3 or less per flight hour for systems installed in out-of-production aircraft as defined in 14 CFR § 121.358)'.
response	Noted. The (reserved) is used by purpose to indicate that the flexibility provision allowed by the FAA is not included in ETSO-C117b. This was already the case for the previous revision of this ETSO.

comment	*117* comment by: *Garmin International* **ETSO-C117b - Page 130:** Appendix 4, Page 130 references 'paragraphs (e)(7)(ii), (e)(7)(iii), (e)(8)(ii), and (e)(8)(iii) of this ETSO'. Those references do not appear to exist. Suggest a possible change to 'paragraphs 4(d)(7)(ii), 4(d)(7)(iii), 4(d)(8)(ii), and 4(d)(8)(iii) of Appendix 1 of this ETSO'.

response	Accepted. Text amended as suggested.

comment	*118* comment by: *Garmin International* **ETSO-C117b - Page 132:** Appendix 5, Page 129 for W h did not appear to edit the units to read (ft/s) instead of (ft/sec) as was done for other instances.
response	Accepted. Text amended as suggested.

comment	*119* comment by: *Garmin International* **ETSO-C117b - Page 134:** Appendix 6, Page 134, second paragraph has two occurrences of 'alpha_command' yet they do not match in that one uses the underscore and one does not. Also, in the fourth paragraph and numbered paragraphs 2 and 3, there are some alpha_command terms with an underscore and some without. In TSO-C117b, all occurrences have the underscore.
response	Accepted. Text amended as suggested.

comment	*120* comment by: *Garmin International* **ETSO-C117b - Page 134:** Appendix 6, Page 134, Numbered paragraph 4 states 'during the wind shear encounter at menu a time.' it is unclear what 'at menu a time' means.
response	Accepted. EASA concurs with the commenter; the wording was improved.

comment	*121* comment by: *Garmin International* **ETSO-C117b Page 126-129:** Appendix 3, Pages 126-129 it is unclear which figures are being deleted and which remain. Just a note to ensure any figures that remain are numbered appropriately as it appears the remaining figure is labelled Figure 6.
response	Accepted. All the figures have been removed from Appendix 3, as they were all moved to Appendix 2.

comment	*148* comment by: *Garmin International*

ETSO-C117b Page 108:

Appendix 1, page 106, paragraph (10) there is a reference to '(d)(3)' which might need to be '4(d)(3)'.

response
Accepted.
All three occurrences of '(d)(3)' shall be changed to '4(d)(3). In addition, 'Section 4(d)(3)' shall be replaced with 'paragraph 4(d)(3)'.

comment *149* comment by: *Garmin International*

ETSO-C117b - Page 111:

Appendix 2, page 108 references paragraph '4(d)(19) of this ETSO'. There does not appear to be a paragraph with that number. Perhaps it should be '4(d)(10) of Appendix 1 of this ETSO'. That is the way the reference is worded in TSO-C117b.

response
Accepted.
EASA agrees with the commentator, so the reference has been corrected.

comment *150* comment by: *Garmin International*

ETSO-C117b -Page 114:

Appendix 2, page 111, Equations (3a) and (3b) have the equation labels towards the left side of the page instead of the far right as in the other equations.

response
Accepted.
EASA agrees with the commentator, so the formatting has been corrected.

comment *151* comment by: *Garmin International*

ETSO-C117b Page 118:

Appendix 2, page 115, last paragraph states 'also listed in the Appendix'. It is somewhat unclear which Appendix is being referred to here. In TSO-C117b it's worded 'also listed in this Appendix'.

response
Accepted.
EASA agrees with the commentator, so the formatting has been corrected.

ETSO-C123d p. 148-150

comment *2* comment by: *Curtiss Wright*

Sections 2-4.2.7a and 2-4.2.7b are part of the same test sequence within ED-112A. Therefore, with the change to the wording, the same unit would undergo a 90 day deep sea pressure test and a 90 day seawater immersion test. This is 180 days in seawater altogether which seems unreasonable considering the underwater locator beacon is only expected to work for 90 days. Furthermore, requiring the completion

of a six month test to verify the performance of a recorder is likely to obstruct innovation and the adoption of new technologies and inhibit the implementation of incremental improvements. Hence, recorder capability will suffer in the long term.

A better solution would be to require only one of the tests to be 90 days. Curtiss Wright propose that the deep sea pressure test be reduced to 24 hours without the need to justify the statement "*the methods and materials used to protect the recording medium have been shown to be unaffected by the deep-sea pressure test"* as long as the same sea water is subsequently used for a 90 day sea water immersion test. In other words, the recording medium is not removed from the sea water between tests.

The rationale being that 24 hours at deep sea pressure would be sufficient time to test the protective armour against collapse and to ensure that the sea water ingress into the unit is complete. The subsequent 90 day test in the warm sea water at 3m depth will then better test the corrosion effects of the unit under test.

At the very least, it should be made possible to allow the two tests to be carried out in parallel.

In 2-4.2.7b, the phrase "nominal temperature of at least" is ambiguous. The definition of nominal in ED-112A implies a minimum and a maximum. It would be better to remove the word "nominal".

response

Partially accepted.
It is acknowledged that the 180 days resulting from the sequencing of both 2-4.2.7 a. & b. is excessive. The retained solution is, as suggested, to replace the substantiation of the 24h by a repetition of the deep sea pressure test after the 90-day sea water immersion test to make sure that the effect of the corrosion does not affect the result. The condition 'provided the test is repeated after the sea water immersion test in 2-4.2.7 b' replaces the former substantiation. Furthermore, additional text is introduced in 2-1.16.2 a. iii. to permit testing in parallel of the deep sea water test and of the sea water immersion test, when this latter is kept at 90 days.
Accepted for the removal of 'nominal'.

comment

115 comment by: *Garmin International*

ETSO-C123d - Page 149:

In Table 1, the only occurrence of Section 3 has been struck out for deployable recorders, yet the Note still references Section 3 as being required for the given example. ED-112A, Section 3 is specific to deployable recorders. Add Section 3 back into the table or remove from all Notes and other references in ETSO-C123d.

response

Accepted.
The reference to Section 3 is replaced by ETSO-2C517 in the note.

comment

132 comment by: *Airbus-EIAIX-SRg*

Page 147 of 372 pages [150/381]:

	ETSO-C123 at issue d, Table 1 - Modification of EUROCAE ED-112A for ADFR systems. (Location 2-4.2.7a & 2-4.2.7b) Airbus request: The deep sea pressure test shall remain at a duration of 30 days for the recorder, to ensure that the recently updated recorders (updated with 90 days beacon) are still serviceable. Rationale: 90 days deep sea pressure test will result in new more stringent qualification test level. Consequently current recorders may not meet this requirement without considering significant cost and interchangeability impacts.
response	Not accepted. The introduction of this standard does not affect existing approvals. The authorisation of the recorders that have been recently upgraded with a 90-day ULB is unaffected.

comment	*170* comment by: *Blake van den Heuvel* 3.1.3 - Is DO-178C an acceptable SW standard, equivalent to AMC 20-115? Table 1 - 2-4.2.7a - can a deployable recorder be exempt from 60 MPA pressure test given that it floats and would never be immersed to more than 5 m depth? Table 1 2-4.2.7b; Is there an option for accelerated testing at higher temperatures?
response	Partially accepted. 3.1.3: The use of DO-178C is addressed within AMC 20-115. Table 1 - 2-4.2.7a: The text has been modified to exclude deployable recorders. Table 2 - 2-4.2.7b: No accelerated testing is permitted by the standard.

ETSO-C124d	p. 151-155

comment	*3* comment by: *Curtiss Wright* Sections 2-4.2.7a and 2-4.2.7b are part of the same test sequence within ED-112A. Therefore, with the change to the wording, the same unit would undergo a 90 day deep sea pressure test and a 90 day seawater immersion test. This is 180 days in seawater altogether which seems unreasonable considering the underwater locator beacon is only expected to work for 90 days. Furthermore, requiring the completion of a six month test to verify the performance of a recorder is likely to obstruct innovation and the adoption of new technologies and inhibit the implementation of incremental improvements. Hence, recorder capability will suffer in the long term.

	A better solution would be to require only one of the tests to be 90 days. Curtiss Wright propose that the deep sea pressure test be reduced to 24 hours without the need to justify the statement "*the methods and materials used to protect the recording medium have been shown to be unaffected by the deep-sea pressure test"* as long as the same sea water is subsequently used for a 90 day sea water immersion test. In other words, the recording medium is not removed from the sea water between tests. The rationale being that 24 hours at deep sea pressure would be sufficient time to test the protective armour against collapse and to ensure that the sea water ingress into the unit is complete. The subsequent 90 day test in the warm sea water at 3m depth will then better test the corrosion effects of the unit under test. At the very least, it should be made possible to allow the two tests to be carried out in parallel. In 2-4.2.7b, the phrase "nominal temperature of at least" is ambiguous. The definition of nominal in ED-112A implies a minimum and a maximum. It would be better to remove the word "nominal".
response	Partially accepted. See the response to comment #2

comment	*16* comment by: *FAA* TSO-C126C Appendix 1: Recommend EASA solicit standards setting organizations with expertise in GNSS requirements to validate ELT (DT) GNSS requirements.
response	Partially accepted. See the response to comment #15.

comment	*51* comment by: *General Aviation Manufacturers Association* ETSO-C126c, Page 154: The proposed performance requirements outlined in Appendix 1 are not referenced within FAA TSO-C126c. To ensure technical equivalency and preserve EASA-FAA reciprocity under the current TIP, this modification should be discussed with FAA, to ensure all TSOA applicants are compliant with the EASA standard.
response	Partially accepted. See the responses to comments 15 and 126.

comment	*114* comment by: *Garmin International* **ETSO-C124d - Page 153:** In Table 1, the only occurrence of Section 3 has been struck out for deployable recorders, yet the Note still references Section 3 as being required for the given example. ED-112A, Section 3 is specific to deployable recorders. Add Section 3 back into the table or remove from all Notes and other references in ETSO-C124d.

response	Accepted. The reference to Section 3 is replaced by ETSO-2C517 in the note.

comment	*133* comment by: *Airbus-EIAIX-SRg* Page 151 of 372 pages [155/381]: ETSO-C124 at issue d, Table 1 - Modification of EUROCAE ED-112A for ADFR systems. (Location 2-4.2.7a & 2-4.2.7b) Airbus request: The deep sea pressure test shall remain at a duration of 30 days for the recorder, to ensure that the recently updated recorders (updated with 90 days beacon) are still serviceable. Rationale: 90 days deep sea pressure test will result in new more stringent qualification test level. Consequently current recorders may not meet this requirement without considering significant cost and interchangeability impacts.
response	Not accepted. See the response to comment #132.

comment	*171* comment by: *Blake van den Heuvel* 3.1.3 Is DO-178C an acceptable SW standard in place of AMC 20-115 Table 1, 2-4.2.7a; can deployable recorders be exempt from this test given that they float and will never be immersed to more than 5m? Table 1, 2-4.2.7b; Is acclerated testing possible at higher temperatures?
response	Partially accepted. 3.1.3: Use of DO-178C is addressed within AMC 20-115. Table 1 - 2-4.2.7a: The text has been modified to exclude deployable recorders. Table 2 - 2-4.2.7b: No accelerated testing is permitted by the standard.

comment	*172* comment by: *Blake van den Heuvel* For ETSO C126b; 3.1.2, in case of conflict between ED-62b and DO-160, ED-62b shall apply. 3.1.3 Computer SW -- DO-178C is an acceptable substitute for AMC 20-115. Appendix 1: Pass criteria -- occasional loss of signal lock during high dynamic manouevers is acceptable if final reported position is within 6 NM of crash site. attached ECEF_trajectory....csv file is ureadable.
response	Partially accepted.

3.1.2: ED-62B specifies the use of DO-160 when appropriate. The text has been modified to refer to ED-62B, and to Subpart A only for categories that are not specified in ED-62B. 3.1.3: The use of DO-178C is addressed within AMC 20-115. Appendix 1: See comment 15.

ETSO-C142b p. 160-168

comment	*160* comment by: *Garmin International* **ETSO-C126c - Page 157:** **(Note: This comment is for ETSO 126c. I am unable to enter any comment in that section as it states that it is not a commentable segment.)** Section 4.2 references EUROCAE ED-62 instead of EUROCAE ED-62B
response	Accepted. Text modified as suggested.

comment	*161* comment by: *Garmin International* **ETSO-C126c - Page 158:** **(Note: This comment is for ETSO 126c. I am unable to enter any comment in that section as it states that it is not a commentable segment.)** Appendix 1 is not part of TSO-C126c. These modifications require additional performance requirements not called out by FAA TSO-C126c. For technical equivalency, this modification should not be made without coordination with the FAA as some TSOA applicants would not be compliant with the EASA standard.
response	Partially accepted. See the responses to comments #15 and #126.

comment	*162* comment by: *Garmin International* **ETSO-C126c - Page 158:** **(Note: This comment is for ETSO 126c. I am unable to enter any comment in that section as it states that it is not a commentable segment.)** Appendix 1 incorporates requirements and a test procedure taken from C/S T.007 and C/S T.021. It includes the bulk of the GNSS simulator scenario description but omits two notes present in the C/S references. In particular, Note a) from C/S documents specifies that the simulator scenario shall include/exclude satellite signals based on the attitude of the aircraft antenna during the specified maneuvers. Neglecting this detail can result in a simulator scenario that does not verify GNSS receiver requirements that are dependent on the attitude of the receiving antenna.

Recommend either:

- Delete the scenario description entirely and only include references to the test procedures in C.S T/007 (Issue 5 – Rev. 3) Annex K and CS T.021 Annex D (Preliminary Issue B) section D.3. Note that the Issue/Revision of these documents must be included in the reference to be meaningful; OR
- Alternatively, include the following text extracted from the C/S procedures:

"Note - the above trajectory and aircraft attitude shall be implemented such that:

1. The satellites used at the start of the simulation shall be those that are above 5 degrees elevation at the location of the simulation based upon its start time. As the aircraft direction and attitude changes during the simulation (i.e. climbs, banks, descends etc) the horizon shall be considered to change with the aircraft movement, such that the satellites in view change accordingly. For example if the aircraft was heading due north and climbing at an angle of 30 degrees, then any satellites to the North below 35 degrees elevation would be excluded from the simulation, while satellites due South should take into account the earth's horizon, and satellites at other points around the compass would be included or excluded accordingly on the same basis.
2. Discontinuities between the various phases of the trajectory are limited to a maximum acceleration of 100 m/s2. Apart from the final transition phase, which in effect simulates the aircraft crashing, where the change in instantaneous acceleration shall be infinite".

response

Partially accepted.
See the responses to comments #15 and #126.

comment

163 comment by: *Garmin International*

ETSO-C126c Page 159:

(Note: This comment is for ETSO 126c. I am unable to enter any comment in that section as it states that it is not a commentable segment.)

Appendix 1 ends with an 'Attached File' which is just a picture, no way to access the actual file.

response

Noted.
The actual file is available in the EASA website at the following address: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2019-06

comment

173 comment by: *Blake van den Heuvel*

	In DO-227A, para 2.2.3.2.2, Thermal Runaway(TR) containment, It is not clear if a single cell TR is adequate, or if all cells must be in TR simultaneously or sequentially. Cell heating intiation method for TR given in 2.4.3.2.2 is inadquate for TR initiation for large batteries and for Li thionyl chloride chemistry.
response	Not accepted. As explained in DO-227A, Section 2.4.3.2.2, the objective is to verify that the thermal runaway resulting from heating one cell is contained. It is not required that several cells should go into thermal runaway simultaneously, but in all cases, the thermal runaway should be contained.

ETSO-C145e A1 p. 169-182

comment	*25* comment by: *CMC Electronics* At page 172, section 4.2, the declaration of design and performance should be abbreviated DDP and not DPP.
response	Accepted. Text modified as suggested.

comment	*50* comment by: *General Aviation Manufacturers Association* The performance requirements outlined in Appendix 4 are not referenced within FAA TSO- C145e. To ensure technical equivalency and preserve EASA-FAA reciprocity under the current TIP, this modification should be discussed with FAA, to ensure all TSOA applicants are compliant with the EASA standard.
response	Noted. The topic has been discussed with the FAA. EASA-FAA reciprocal acceptance under the current TIP is not affected by differences between ETSOs and TSOs. See also the response to comment #113.

comment	*111* comment by: *Garmin International* **ETSO-C145e A1 - Page 180:** Appendix 2 Section 1.8.3 Paragraph 6 is missing this content from TSO-C145e: “Additionally, aircraft manufacturers should consider establishing appropriate procedures for aircraft operators to maintain security protection of the equipment during the life of the equipment installation in the aircraft".
response	Not accepted. This text highlighted in the comment is not for the ETSO applicant. What is applicable to the ETSO applicant is covered by the ETSO standard itself. Any requirement related to what aircraft manufacturers should do is not appropriate inside an ETSO standard.

comment	*112* comment by: *Garmin International* **ETSO-C145e A1 - Page 180:** Typo. Appendix 2 Section 1.8.3 Final Paragraph references "(DO-160E Section 16.5.2 and 16.6.2)" where is should be "(DO-160E Sections 16.5.2 and 16.6.2)
response	Accepted. Text modified as suggested.

comment	*113* comment by: *Garmin International* **ETSO-C145e A1 - Page 182:** Appendix 4 is not found in TSO-C145e. While ETSO-C145d added Appendix 4 and it is unmodified in ETSO-C145e A1, Appendix 4 creates additional requirements not called out by FAA TSO-C145e. For technical equivalency, this modification should not be made without coordination with the FAA as some TSOA applicants would not be compliant with the EASA standard.
response	Not accepted. Appendix 4 is a technical difference in order to ensure a proper link between ETSO-2C204a and this ETSO. Appendix 4 does not, as such, change the MOPS of C145eA1, and as a consequence, this difference is not sufficient to declare the two standards as different. In addition, there have been for years some differences between the ETSO standards from Index 1 (C category) and the FAA standards, such as the DO-160 revision, and the software and the hardware requirements, which also count when assessing technical equivalency between the ETSO and TSO standards. (E)TSO applicants should evaluate these differences when intending to meet the 2 standards. It is also worth noting that EASA coordinated with the FAA before the publication of the NPA.

comment	*152* comment by: *Garmin International* **ETSO-C145e A1 Page 179:** Appendix 2 Section 1.8.3 Paragraph 2 is missing this content from TSO-C145e, Appendix 2, page 2-1: "RTCA/DO-326A and ED-202A along with RTCA/DO-355 and ED-204 may also be useful to assess vulnerabilities and identify mitigations".
response	Noted. The references to guidance for security are not adopted, in the ETSO context, because EASA considers they should not be specific to this ETSO standard. Security aspects for ETSO are handled through Rulemaking Task RMT.0720, and a dedicated ETSO update may be needed to accommodate them.

ETSO-C146e A1	p. 183-200

comment	*49* comment by: *General Aviation Manufacturers Association* The performance requirements outlined in Appendix 4 are not referenced within FAA TSO- C146e. To ensure technical equivalency and preserve EASA-FAA reciprocity under the current TIP, this modification should be discussed with FAA, to ensure all TSOA applicants are compliant with the EASA standard.
response	Not accepted. See the response to comment #113.

comment	*109* comment by: *Garmin International* **ETSO-C146e A1 Page 184:** Section 3.1.1 first two paragraphs reference “Delta” equipment class, while TSO-C146e references “Delta-4” equipment class in the same section. Should they all be “Delta-4” references?
response	Noted. Class Delta is used when naming the CCA and class Delta-4 is used when naming the C146e equipment that has a class Delta-4 performance. This is in line with FAA TSO. One typo has been corrected to remain along this convention.

comment	*110* comment by: *Garmin International* **ETSO-C146e A1 Page 188:** Appendix 2 Section 1.8.3 Paragraph 2 is missing this content from TSO-C146e: “RTCA/DO-326A and ED-202A along with RTCA/DO-355 and ED-204 may also be useful to assess vulnerabilities and identify mitigations".
response	Noted. See the response to comment #152.

comment	*153* comment by: *Garmin International* **ETSO-C146e A1 Page 194:** Appendix 2 Section 1.8.3 Paragraph 6 is missing this content from TSO-C146e: “Additionally, aircraft manufacturers should consider establishing appropriate procedures for aircraft operators to maintain security protection of the equipment during the life of the equipment installation in the aircraft".
response	Not accepted. See the response to comment #111.

comment	*154* comment by: *Garmin International* **ETSO-C146e A1 - Page 195:**

	Appendix 2 Section 2.2.1.3 the Holding legs listing uses different descriptions for HA and HF legs when compared to TSO-C146e. HA is “Terminates at an altitude” instead of “Hold to Altitude” and HF is “Terminates at a fix after one orbit” instead of “Hold to fix”. May consider changing for consistency between the TSO and ETSO.
response	Noted. See the response to comment #112.

comment	*155* comment by: *Garmin International* **ETSO-C146e A1 Page 195:** Appendix 2 Section 2.2.1.3 is missing ‘Note 2’ from TSO-C146e which reads: “Note 2: Cross-track deviation requirements are not applicable for VA, VI, and VM heading leg types”.
response	Accepted. Text added for clarification. It doesn’t result in a change to the MOPS.

comment	*156* comment by: *Garmin International* **ETSO-C146e A1 Page 195:** Appendix 2 Section 2.2.1.3.6 (FA leg) is worded differently than TSO-C146e.
response	Noted. The current text is considered sufficiently clear.

comment	*157* comment by: *Garmin International* **ETSO-C146e A1 Page 195:** Appendix 2 Section 2.2.1.3.7 (FM Leg) is worded differently than TSO-C146e ETSO-C146e A1: An FM leg shall be defined as a specified track over the ground from a database fix until a manual termination of the leg. TSO-C146e: An FM leg shall be defined as a specified track over the ground from a database fix until a manual termination of the leg. FM legs are similar to FA legs in terms of path construction except for manual termination versus terminating at an altitude. Consider changing language for consistency between the TSO and ETSO.
response	Not accepted. The second sentence of TSO-C146e is merely for clarification. The current ETSO text is considered sufficiently clear.

comment	*158* comment by: *Garmin International* **ETSO-C146e A1 Page 198:**

Appendix 2 Section 2.2.1.3.14 is listed twice. Once for HF and once for HM. It appears the HM section should be numbered 2.2.1.3.15. Note the TSO-C146e also has the same repeated 2.2.1.3.14 numbering.

An alternative interpretation could be that section number 2.2.1.3.11 was incorrectly left out of the appendix; however, this was possibly indicated by the […] added to the ETSO.

response

Noted.
EASA concurs with the comment, but in order to ensure consistency with the FAA TSO and ease the compliance demonstration of applicants, EASA prefers to keep the numbering as in FAA TSO-C146e.

comment *159* comment by: *Garmin International*

ETSO-C146e A1 - Page 200:

Appendix 4 is not found in TSO-C146e. While ETSO-C146d added Appendix 4 and it is unmodified in ETSO-C146e A1, Appendix 4 creates additional requirements not called out by FAA TSO-C146e. For technical equivalency, this modification should not be made without coordination with the FAA as some TSOA applicants would not be compliant with the EASA standard.

response

Not accepted.
Appendix 4 ensures that applicants use only the legacy GPS CA codes.
See also the response to comment #113 for the classification as an ETSO in the C series.

ETSO-C151d p. 201-242

comment *41* comment by: *Airbus Helicopters*

Comment
This equipment is intended for fixed-wing aircraft only" appears in a quite inconspicuous way
Rationale for Comment
Applicability of ETSO-C151d should be mentioned in §1.
Recommendation
Add in §1: "This ETSO is applicable for fixed-wing aircraft only"
Classification
Formal

response

Accepted.
This sentence has been moved into Section 1.

comment *48* comment by: *General Aviation Manufacturers Association*

Section 3.1.1 - Minimum Performance Standard amends the text from RTCA DO-367 to require Class A equipment to support both types of aural messages for Section

2.2.1.1.6.3.1 Aural Alert – Caution and Section 2.2.1.1.6.3.2. Aural Alert – Warning; this change is inconsistent with the equivalent FAA TSO. To ensure technical equivalency and preserve EASA-FAA reciprocity under the current TIP, this modification should be discussed with FAA, to ensure all TSOA applicants are compliant with the EASA standard.

response

Noted.
It is understood that the ETSO requests that the ETSO article should be capable of both aural alerts. DO-367 presents it as an option, and the ETSO makes it compulsory for the equipment level. This was also clear in the table of FAA TSO C151c, which actually required both aural options.

The only difference from the FAA TSO is that this option in DO-367 is made compulsory in EASA ETSO-C151e. Differences exist and will be assessed at the aircraft level. EASA did not find the difference significant enough to justify for pushing the C151e into Index 2 (as a 2C).

In addition, please note that there have been for years some differences between the ETSO standards from index 1 (C category) and the FAA standards, such as the DO-160 revision, and the software and the hardware requirements, which also count when assessing technical equivalency between the ETSO and TSO standards. (E)TSO applicants should evaluate these differences when intending to meet both the FAA and the EASA standards.

Finally, EASA coordinated with the FAA before the publication of the NPA.

comment

107 comment by: *Garmin International*

ETSO-C151d - Page 196:

The MPS Section 3.1.1 amends the text from RTCA DO-367 to require Class A equipment to support both types of aural messages for Section 2.2.1.1.6.3.1 Aural Alert – Caution and Section 2.2.1.1.6.3.2. Aural Alert – Warning.

For technical equivalency, this modification should not be made without coordination with the FAA as some TSOA applicants would not be compliant with the EASA standard.

response

Noted.
See the responses to comment #48.

comment

108 comment by: *Garmin International*

ETSO-C151d Page 201:

There are two typos in the amendment to DO-367 section 2.2.1.1.6.3.1 – the word “clue” is used instead of “due”.

- “The sentence ‘For a caution level FLTA alert clue to …”
- “‘ For a caution level FLTA alert clue to …”

response	Accepted. Text amended as suggested.

ETSO-C159d p. 243-250

comment	*30* comment by: *Airbus Helicopters* **Comment:** ED-243A was published on 4 April 2019. **Recommendation:** Correct the ED-243 reference in paragraph 3.1.1 and 3.2 **Classification:** Formal
response	Noted. A change in the industry standard document necessitates a new revision of the ETSO. This will be embodied as part of the next revision of this ETSO. The same purpose could be achieved by means of a deviation from the existing ETSO.

comment	*103* comment by: *Garmin International* **ETSO-C159d Page 243:** Section 3.2 states “There are 6 applicable equipment classes and 13 equipment subclass components identified” but there appears to only be 11 subclasses in Tables 1B and 2B. Table 3 includes ‘SBD’ and ‘LBT’ which might make the total 13.
response	Accepted. EASA agrees with the commentator, so the reference has been corrected.

comment	*104* comment by: *Garmin International* **ETSO-C159d - Page 247:** Table 3 includes ‘AES5’ in the leftmost column, instead of ‘AES6’ per Table 1B.
response	Accepted. EASA agrees with the commentator, so the reference has been corrected.

comment	*105* comment by: *Garmin International* **ETSO-C159d - Page 247:** Table 3 combination #10 has the ‘X’ in the 6F column while TSO-C159d has the ‘X’ in the 7MA column.
response	Accepted. EASA agrees with the commentator, so the reference has been corrected.

comment	*106* comment by: *Garmin International* **ETSO-C159d - Page 247:** Table 3 combination #3 in the top portion of the table has no corresponding 'X' in any columns. In TSO-C159d the 'X' is in the 'Complete System' column.
response	Accepted. EASA agrees with the commentator, so the reference has been corrected.

ETSO-C165b p. 253-259

comment	*77* comment by: *THALES-Avionics* § 3.1.1 MPS Sentence: "*Displays that are part of the electronic map system must also be approved in accordance with ETSO-C113 at the latest revision.*" should be remove as: - this is not in line with TSO C165b which does not contain such statement - this kind of requirement must be treated through ETSO overall process rather than ETSO by ETSO: in this case application for ETSO C113 will be done as per EASA process recognizing applicability of AC 21-46A (§ 5.4 Multiple TSO Authorizations for the Same Article), and so no statement is needed. - in case of application hosted on IMA platform, the ETSO C113 version can be different than the latest without impact on safety nor performances.
response	Partially accepted. EASA acknowledges that FAA TSO-C165b does not refer to TSO C113b. However, DO-257B Section 2.2.3 requests compliance with SAE AS8034B for readability. According to Section 1 of AS8034, this standard is intended to apply to Moving Map Displays and navigation displays for situation awareness and supplemental data, which are within the scope of C165b. Referring to ETSO-C113 offers a straightforward and visible means to ensure that these requirements are not overlooked by the applicant. It is recognised that AC 21-46A provides adequate guidance, but EASA receives applications from many new applicants, whose lack of awareness results in undue costs when such traceability is not provided in the technical standard. It is recognised that a previous version of ETSO-C113 may provide an adequate basis in the case of IMA applications. The text has been modified accordingly.

comment	*78* comment by: *THALES-Avionics* For a better consistency between DO257B and ETSO C165A, replace "Electronic MAP System" by "Electronic MAP Display (EMD)" Table 1 - "In Flight" : make clear by completing "InFlight (plan view display)"

	Table 1 - "Aerodrome surface (AMMD)": make clear by completing "Airport Moving Map Display"
response	Partially accepted. The term 'display' is inappropriate because in many cases, the application being approved is not embedded in a display. Thus, the term 'system' is used. The other comments have been taken into account in the text, except that in the EU context, the term 'airport' is replaced by 'aerodrome'.

comment	*79* comment by: *THALES-Avionics* § 3.2.1 Failure condition classification Remove the exception for the loss of the aerodrome moving map display, in the sentence *"RTCA DO-257B Section 2.1.8 defines the minimum failure condition classifications for the specific electronic map system functions that are summarised in Table 1, except for the loss of the aerodrome moving map display, which is a minor failure condition." as:* - the failure condition is already mentionned in RTCA DO-257B Section 2.1.8 and is "No safety effect" - the ETSO introduce a difference with FAA TSO, detrimental to European Industry and without justification.
response	Not accepted. 'loss of [AMDD] function has no safety effect': this is not in line with the latest revision of AMC 25.1309, or with the 25.1309 'arsenal version', since NSE was introduced for functions such as passenger in-flight entertainment systems. The loss of AMMD will induce a higher workload to revert to another means, which corresponds to a minor effect.

comment	*101* comment by: *Garmin International* **ETSO-C165b Page-254:** Table 1, Middle Row is labeled 'Aerodrome surface (AMMD)' while the same table in TSO-C165b is labeled 'Airport Moving Map Display (AMMD)'
response	Partially accepted. See the response to comment #78.

comment	*102* comment by: *Garmin International* **ETSO-C165b Page 253:** Section 2.3 calls out databases, but does not limit the scope to only minor failure conditions or above, as is done in TSO-C165b Section 3.g, which excludes No Safety Effect databases. Language should be updated to match FAA's exclusion.
response	Not accepted. See the response to comment #78.

comment	*147* comment by: *Brad Miller, FAA AIR-131*

	Appears to harmonize exactly with FAA TSO-C165b. However, EASA has not been requiring DO-200B compliance for raster/vector scanned databases in the same way as the FAA. The FAA has issued numerous LOAs for these databases utilizing an equivalency derived from RTCA-DO-257A Appendix F. The FAA has denied deviation from DO-200B compliance and rejected applications for systems not providing for compliance. EASA should do the same. Per FAA AC 20-153B and equivalent EASA policy, databases supporting intended function with a safety effect must be DO-200B compliant. Please apply this TSO in a harmonized manner for one of the most common databases utilized to support its function.
response	Not accepted. ETSO-C165b Section 2.3 and RTCA DO-257B Section 2.5.5.1 item 2 require that the process requirements for generating the database are defined and compliant with DO-200B/ED-76A. Furthermore, Commission Regulation (EU) 2017/373 Annex VII (Part-DAT) lays down the requirements for the database provider, including compliance with EUROCAE ED-76A/RTCA DO-200B. Note that EASA does not intend to accept deviations related to these requirements.

ETSO-C168 p. 260-261

comment	*31* comment by: *Airbus Helicopters* **Comment:** SAE AS 5134 reference should be at issue B **Recommendation:** Correct the AS 5134 reference in paragraph3.1.1 **Classification:** Formal
response	Noted A change in the industry standard document necessitates a new revision of the ETSO. This will be embodied as part of the next revision of this ETSO. The same purpose could be achieved by means of a deviation from the existing ETSO.

ETSO-C176b p. 262-264

comment	*4* comment by: *Curtiss Wright* Sections 2-4.2.7a and 2-4.2.7b are part of the same test sequence within ED-112A. Therefore, with the change to the wording, the same unit would undergo a 90 day deep sea pressure test and a 90 day seawater immersion test. This is 180 days in seawater altogether which seems unreasonable considering the underwater locator beacon is only expected to work for 90 days. Furthermore, requiring the completion of a six month test to verify the performance of a recorder is likely to obstruct innovation and the adoption of new technologies and inhibit the implementation of incremental improvements. Hence, recorder capability will suffer in the long term.

A better solution would be to require only one of the tests to be 90 days. Curtiss Wright propose that the deep sea pressure test be reduced to 24 hours without the need to justify the statement "*the methods and materials used to protect the recording medium have been shown to be unaffected by the deep-sea pressure test*" as long as the same sea water is subsequently used for a 90 day sea water immersion test. In other words, the recording medium is not removed from the sea water between tests.

The rationale being that 24 hours at deep sea pressure would be sufficient time to test the protective armour against collapse and to ensure that the sea water ingress into the unit is complete. The subsequent 90 day test in the warm sea water at 3m depth will then better test the corrosion effects of the unit under test.

At the very least, it should be made possible to allow the two tests to be carried out in parallel.

In 2-4.2.7b, the phrase "nominal temperature of at least" is ambiguous. The definition of nominal in ED-112A implies a minimum and a maximum. It would be better to remove the word "nominal".

response

Partially accepted.
See the response to comment #2

comment

99 comment by: *Garmin International*

ETSO-C176b Page 263:

In Table 1, the only occurrence of Section 3 has been struck out for deployable recorders, yet the Note still references Section 3 as being required for the given example. ED-112A, Section 3 is specific to deployable recorders. Add Section 3 back into the table or remove from all Notes and other references in ETSO-C176b.

response

Accepted.
The reference to Section 3 has been replaced by ETSO-2C517 in the note.

comment

134 comment by: *Airbus-EIAIX-SRg*

Page 259 of 372 pages [264/381]:
ETSO-C176 at issue b, Table 1 - Modification of EUROCAE ED-112A for ADFR systems. (Location 2-4.2.7a & 2-4.2.7b)

Airbus request:
The deep sea pressure test shall remain at a duration of 30 days for the recorder, to ensure that the recently updated recorders (updated with 90 days beacon) are still serviceable.

Rationale:
90 days deep sea pressure test will result in new more stringent qualification test level.
Consequently current recorders may not meet this requirement without considering

	significant cost and interchangeability impacts.
response	Not accepted. See the response to comment #132

ETSO-C177b p. 265-267

comment	*5* comment by: *Curtiss Wright* Sections 2-4.2.7a and 2-4.2.7b are part of the same test sequence within ED-112A. Therefore, with the change to the wording, the same unit would undergo a 90 day deep sea pressure test and a 90 day seawater immersion test. This is 180 days in seawater altogether which seems unreasonable considering the underwater locator beacon is only expected to work for 90 days. Furthermore, requiring the completion of a six month test to verify the performance of a recorder is likely to obstruct innovation and the adoption of new technologies and inhibit the implementation of incremental improvements. Hence, recorder capability will suffer in the long term. A better solution would be to require only one of the tests to be 90 days. Curtiss Wright propose that the deep sea pressure test be reduced to 24 hours without the need to justify the statement "*the methods and materials used to protect the recording medium have been shown to be unaffected by the deep-sea pressure test"* as long as the same sea water is subsequently used for a 90 day sea water immersion test. In other words, the recording medium is not removed from the sea water between tests. The rationale being that 24 hours at deep sea pressure would be sufficient time to test the protective armour against collapse and to ensure that the sea water ingress into the unit is complete. The subsequent 90 day test in the warm sea water at 3m depth will then better test the corrosion effects of the unit under test. At the very least, it should be made possible to allow the two tests to be carried out in parallel. In 2-4.2.7b, the phrase "nominal temperature of at least" is ambiguous. The definition of nominal in ED-112A implies a minimum and a maximum. It would be better to remove the word "nominal".
response	Partially accepted. See the response to comment #2

comment	*135* comment by: *Airbus-EIAIX-SRg* Page 262 of 372 pages [267/381]: ETSO-C177 at issue b, Table 1 - Modification of EUROCAE ED-112A for ADFR systems. (Location 2-4.2.7a & 2-4.2.7b) Airbus request: The deep sea pressure test shall remain at a duration of 30 days for the recorder,

	to ensure that the recently updated recorders (updated with 90 days beacon) are still serviceable. Rationale: 90 days deep sea pressure test will result in new more stringent qualification test level. Consequently current recorders may not meet this requirement without considering significant cost and interchangeability impacts.
response	Not accepted. See the response to comment #132

ETSO-C179b p. 268-269

comment	*98* comment by: *Garmin International* **ETSO-C179b Page 269:** Typo. In Section 4.2, Section 2.13 of RTCA DO-311A is referenced, but should be 2.1.3.
response	Accepted. Text amended as suggested.

ETSO-C196b p. 270-277

comment	*97* comment by: *Garmin International* **ETSO-C196b Page 271:** In Section 3.1.1, there is a reference to “MPS Section 2.5 performance testing”. The corresponding reference in TSO-C196b is to “MPS Section 2.3 performance testing”.
response	Accepted. The ETSO corrected the typo to reference MPS Section 2.3 performance testing.

ETSO-C199 A1 p. 278-310

comment	*93* comment by: *Garmin International* **ETSO-C199 A1- Page 304:** The Outline Number for Section A2.2.6.4 is missing the ‘A’ at the front.
response	Accepted. EASA agrees with the commentator, so the reference has been corrected.
comment	*94* comment by: *Garmin International*

ETSO-C199 A1 Page 287:

Section A1.2.3.5 refers to RTCA DO-181E Section 2.2.13.1.2.d, however the Table Caption refers to Section 2.2.13.1.2.c. The Table Caption should refer to Section 2.2.13.1.2.d.

response

Accepted.
EASA agrees with the commentator, so the reference has been corrected.

comment *95* comment by: *Garmin International*

ETSO-C199 A1 Page 282:

In Appendix 1, the first table is labeled with a caption of 'Table 3' while the text before the table refers to 'Table 1'.
This mismatch occurs throughout the Appendix. Table references in the text and Table numbers in Captions do not match.

This problem continues into Appendix 2 where 'Table 29' (caption) is referenced by 'Table 27' (text).

response

Accepted.
EASA agrees with the commentator, so the reference has been corrected.

comment *96* comment by: *Garmin International*

ETSO-C199 A1 Page 279:

In Section 3.1.1, the Class A TABS and Class B TABS definitions include references to subparagraphs (1), (2), (3) and (4). However, the subparagraphs appear to be labeled (a), (b), (c) and (d).

response

Accepted.
EASA agrees with the commentator, so the reference has been corrected.

ETSO-2C197a p. 316-317

comment *9* comment by: *FAA*

Pg 316 ETSO 2C204a Table 1, last line, "Fire, Flammability" "26.0" "Mandatory" should be "Optional" or "26.3.3" "Mandatory for Flammability only" as Circuit card assemblies are not intended for installations in Fire Zones and the end item containing the CCA is subject to the flammability test requirements without the other components being required to pass individual flammability tests.

response

Not Accepted.

DO-160G specifies that the test applies to enclosures that house electronics and non-metallic materials, component parts, sub-assemblies installed in pressurised or non-pressurised zones and non-fire zones, and the purpose of this test is to check

	the non-propagation of the flame in the case where ignition would appear inside or outside the equipment. Tests will be performed on specimens of material. In general, the applicability to a circuit card assembly and its devices is justified, and ED-14G/DO-160G Section 26 applies for flammability. This section explains some exclusions, which also apply.

ETSO-2C204a p. 318-327

comment	*10* comment by: *FAA* Pg 325 ETSO 2C205a Table 1, last line, “Fire, Flammability” “26.0” “Mandatory” should be “Optional” or “26.3.3” “Mandatory for Flammability only” as Circuit card assemblies are not intended for installations in Fire Zones and the end item containing the CCA is subject to the flammability test requirements without the other components being required to pass individual flammability tests.
response	Accepted. The text has been modified to include ‘Mandatory for Flammability’. The text of 2C204, 2C205 and 2C206 has been amended in the same way.

comment	*70* comment by: *THALES-Avionics* Section 3.1.2.Table1 line 1 (temperature): Installation Manual should also describe the way temperature is dissipated and the temperature test setup should be representative of such description (temperature may be dissipated by forced air flow or by conduction assuming a given heat sink mechanical interface in accordance with installation manual). Same Comment for ETSO 2C205a and 2C206.
response	Accepted. Text has been added into the referred line in 2C204a, as well as in EC205a and 2C206. Additional text has been added in the ETSO, Section 3.2.2, to document the intended environment and the associated environmental constraints.

comment	*71* comment by: *THALES-Avionics* Section 3.1.2.Table1 line 24 (ESD): This test should not be mandatory if in the Installation Manual it is mentioned that the CCA must be used (transportation, manipulations) in ESD controlled environment. Same Comment for ETSO 2C205a and 2C206.
response	Accepted. The ESD test was originally indicated ‘Mandatory for all areas that are subject to human contact during the operation of the CCA’, based on similarity requirements with IMA module (ETSO-2C153), but in the case of GNSS CCA, no manipulation in operation is expected. The ESD test has been updated to Optional. The corresponding text in 2C205a and 2C206 has been updated accordingly.

comment	*72* comment by: *THALES-Avionics* Appendix 1 The sentence “From a physical perspective, a manufacturer could consider connectors that require special tools to remove them to prevent passenger tampering, although navigation avionics are typically located in an avionics bay inaccessible to passengers.” could be supress for a board ETSO (mechanical protections at packaging level) Same Comment for ETSO 2C205a and 2C206.
response	Accepted. The sentence has also been moved into 2C205a.

comment	*91* comment by: *Garmin International* **ETSO-2C204a - Page 324:** Appendix 1, Note 14: There are two errors in the URL to the document. The root domain is missing a ‘c’ in ‘us-cert’ and a HTML-coded space character (%20) has been added between ‘Positioning_’ and ‘System’. The correct URL should be: https://ics-cert.us-cert.gov/sites/default/files/documents/Improving_the_Operation_and_Development_of_Global_Positioning_System_(GPS)_Equipment_Used_by_Critical_Infrastructure_S508C.pdf
response	Accepted. Text amended as suggested.

comment	*92* comment by: *Garmin International* **ETSO-2C204a Page 318:** Section 1-Applicability incorrectly lists the abbreviation for ‘Circuit Card Assembly’ as ‘(CAA)’ instead of ‘(CCA)’.
response	Accepted. Text amended as suggested.

ETSO-2C205a p. 328-338

comment	*11* comment by: *FAA* Pg 336 ETSO 2C206a Table 1, last line, “Fire, Flammability” “26.0” “Mandatory” should be “Optional” or “26.3.3” “Mandatory for Flammability only” as Circuit card assemblies are not intended for installations in Fire Zones and the end item containing the CCA is subject to the flammability test requirements without the other components being required to pass individual flammability tests.
response	Accepted.

	Text amended as suggested.

comment	*88* comment by: *Garmin International* **ETSO-2C206 Page 340:** Section 3.1.2.1 references DO-316 as dated 14 April 2009, while Section 3.1.2.2 references DO-316 as dated 15 December 2016. The correct date appears to be 14 April 2009
response	Accepted. Text amended as suggested.

comment	*89* comment by: *Garmin International* **ETSO-2C205a Page 335:** Appendix 1, Note 15: There is an error in the URL to the document. A space (HTML code %20) has been added between 'Positioning_' and 'System'. The correct URL should be: https://ics-cert.us-cert.gov/sites/default/files/documents/Improving_the_Operation_and_Development_of_Global_Positioning_System_(GPS)_Equipment_Used_by_Critical_Infrastructure_S508C.pdf
response	Accepted. Text amended as suggested.

comment	*90* comment by: *Garmin International* **ETSO-2C205a Page 335:** Appendix 1, First paragraph references 'this TSO' instead of 'this ETSO'
response	Accepted. Text amended as suggested.

ETSO-2C516	p. 349-359

comment	*8* comment by: *Luftfahrt-Bundesamt* In Point 5 "Equipment Installation" rechargeable lithium batteries are addressed only, but should it also be applicable for non-rechargeable batteries?
response	Noted. On the basis of the comments received, EASA has decided to postpone the publication of the proposed ETSO for video/audio surveillance system. Before proceeding with its publication, the proposed standard will have to be complemented with more specific guidance with respect to the performance

	requirements for DO-160 tests. Requirements needs to be identified for those DO160 tests requesting and system in operation. Additionally, considering that an applicant might wish to comply with this CS-ETSO only partially, a minimum performance standard need to be defined for each potential system component.
comment	*12* comment by: *FAA* Pg 358 ED-112A amendments Renumber 3-1.8.h and 3-1.8.i as 3-1.7.h and 3.1.7.i These requirements are mis-numbered as they are extracted and revised from 3-1.7.g and are a continuation of 3-1.7 Deployment Criteria, not 3-1.8 Crash Survival.
response	Accepted. See the response to comment #140.
comment	*13* comment by: *FAA* 3-1.8i reword as follows “i. When deployed from a fixed position in any direction the automatic deployable package point of impact shall be within 20 meters of the deployment mechanism in a horizontal plane and the speed of the package shall never exceed 14m/s.” Clarifies the distance is measured in a horizontal plane and not taking credit for rising terrain nor penalizing for downslopes.
response	Partially accepted. The text has been modified from the proposition and also taking into account comments 166 and 182.
comment	*14* comment by: *FAA* Pg 358 Note: Several of these requirements conflict and may be mutually exclusive such as 3-1.7 “the initial momentum shall not endanger ground personnel” when simply falling on a person from the height of the top a typical transport aircraft could injure a person struck by the ADFR. The 3-1.7 momentum limitation and 3-1.8(7).i 20 meter max point of impact distance are in conflict with the 3-1.5.2.b.9.c & d requirement to land outside the tested fire temps or collide with the aircraft.
response	Partially accepted. It is acknowledged that the objective of protection of the ground maintenance or rescue crew is contrary to the objective to obtain a clear separation from the aircraft. However, the protection of personnel has to be ensured when the aircraft is at rest, whereas the separation takes place when the aircraft is in moving. Most designs rely on aerodynamic forces to achieve a clear separation without requiring a large release energy.
comment	*32* comment by: *Airbus Helicopters* **Comment**: “Might” is the past simple of “may”. **Recommendation:** Replace “might” with” “may”

Classification:
Formal

response
Noted.
See the response to comment #8.

comment
174 comment by: *Airbus-EIAIX-SRg*

Page 345 of 372 [352 of 381] – ETCO-2C516, Appendix 1, System Architecture and components:
"Cameras shall have an infrared (IR) means of illumination to provide their function under conditions of poor illumination, if needed."

Airbus proposal - rephrase the sentence as follows:
"Cameras shall have an infrared (IR) means of illumination, if needed, to provide their function under conditions of poor illumination~~, if needed~~."

Rationale:
New cameras do not necessarily need IR to get very good performance under conditions of poor illumination, as it was the case in the past.

response
Noted.
See the response to comment #8.

comment
175 comment by: *Airbus-EIAIX-SRg*

Page 346 of 372 [353 of 381] – ETSO-2C516, Appendix 1, System Architecture and components (cont.):
"a) uniquely identify the identity of a person;
b) determine their visible state of health and well-being;
c) determine their position.**"**

Airbus proposal: Delete item b)
"a) uniquely identify the identity of a person;
~~b) determine their visible state of health and well-being;~~
c) determine their position.**"**
Rationale:
The identification of a person requires a video resolution that cannot be achieved in all cases (e.g. large cabin compartment surveyed by only one or two cameras). On the other side, the identification of a person is not required for all use cases.
The same comments applies for "determine their visible state of health and well-being": many video surveillance use cases do not require this aspect.

response
Noted.
See the response to comment #8.

comment	*176* comment by: *Airbus-EIAIX-SRg* Page 346 of 372 [353 of 381] – ETSO-2C516, Appendix 1, System Architecture and components (cont.): **"**The ADUs shall be able to be connected to each other in a daisy-chain configuration.**"** Airbus proposal: Delete this sentence: "The ADUs shall collect data streams and shall provide power supplies for the cameras. ~~The ADUs shall be able to be connected to each other in a daisy-chain configuration."~~ Rationale: Other network topology can be even more appropriate than the daisy-chain configuration, depending on the use-case.
response	Noted. See the response to comment #8.

comment	*177* comment by: *Airbus-EIAIX-SRg* Page 346 of 372 [353 of 381] – ETSO-2C516, Appendix 1, System Architecture and components (cont.), last section: **"**The ACPs shall allow the system to be operated via the HMI on a touchscreen. The ACPs shall be able to display live video streams from the cameras and shall provide playback of recorded streams from the DVR.**"** Airbus comment: Why is touchscreen required as ACP HMI? The replay function on a/c is not necessarily requested Airbus proposal: Delete these sentences or to replace "shall" by "should" Rationale: The wording is too restrictive. Other Means to operate the VSS might be appropriate as well. Function may vary due to the planned application.
response	Noted. See the response to comment #8.

comment	*178* comment by: *Airbus-EIAIX-SRg* Page 347 of 372 [354 of 381] – ETSO-2C516, Appendix 1), 2. General Requirements, Effects of Tests:

"Unless otherwise provided, the design of the equipment shall be such that, subsequent to the application of the specific tests, no condition exists which would be detrimental to the continued safe operation of the aircraft."

Airbus proposal: Delete the words "subsequent to the application of the specific tests":
"Unless otherwise provided, the design of the equipment shall be such that, ~~subsequent to the application of the specific tests~~, no condition exists which would be detrimental to the continued safe operation of the aircraft."

Rationale:
"Specific tests" are not defined.

response

Noted.
See the response to comment #8.

comment

179 comment by: *Airbus-EIAIX-SRg*

Page 350 of 372 [357 of 381] – ETSO-2C516, Appendix 1, 4. MINIMUM PERFORMANCE SPECIFICATION UNDER ENVIRONMENTAL TEST CONDITIONS, EQUIPMENT PERFORMANCE COMPLIANCE:
"The performance requirements as defined in Chapter 3 are not required to be tested under all of the conditions specified in CS-ETSO, Subpart A, paragraph 2.1."

Airbus comment:
If not "under all", this sentence does not specify under which conditions specified in CS-ETSO the performance requirements as defined in chapter 3 are required.

response

Noted.
See the response to comment #8.

comment

180 comment by: *Airbus-EIAIX-SRg*

Page 351 of 372 [358 of 381] – ETSO-2C516, Appendix 1, 4. MINIMUM PERFORMANCE SPECIFICATION UNDER ENVIRONMENTAL TEST CONDITIONS, "PERFORMANCE TESTS":
Table in general

Airbus comment:
The proposed environmental requirements categories might not fit to foreseen installation area on a specific airplane or rotorcraft.

Rationale:
The environmental category is dependent on the location of the equipment and it can also depends on the a/c where it is installed.
Therefore it is not possible to define the required categories in general.

response	Noted. See the response to comment #8.

ETSO-2C517 p. 360-374

comment	*28* comment by: *Airbus Helicopters* **Comment**: The referred ED-62A is superseded by ED-62B **Recommendation:** Correct the ED-62 reference in 3-1.8.2 **Classification:** Formal
response	Not accepted. The proposed ETSO text amends ED-112A by replacing the reference to ED-62A by a reference to ETSO-C126c, which is based on ED-62B.

comment	*29* comment by: *Airbus Helicopters* **Comment**: The referred ED-62A is superseded by ED-62B **Recommendation:** Correct the ED-62 reference in 3-3.2.2 **Classification:** Formal
response	Not accepted. See the response to comment #28.

comment	*53* comment by: *Blake van den Heuvel* DRS comments on proposed ETSO 2-C517 for ADFR 1. 1-Applicability: Other jurisdictions do not have Equivalent TSO for ADFR. This complicates certification for non-European OEMs. DRS cannot get a TSO for ADFR as TCCA does not have an equivalent. 2. 3.1.1 Min Perf Std: ADFR already will be certified to all of these individual relevant TSOs and MOPS. 3. 3.1.2 Environmental standards : Increased from ED-112A, 5mm icing may be a problem. Sec 24 Category C will conflict with 3-1.7 and 3-1.8.i deploy speed, additional energy during deploy will be required. 4. 3.2.1: does a major failure condition change the MEL classification for ADFR? 5. crash resistance and 121 homer is default for type AD. Table 1 – 6. 3-1.5.2 , Section 2-1.3.4, b.9. Installation : The survival levels are not reduced for ADFR, they are equivalent or better than fixed recorders and ELT(AF), considering the environment in which they operate.

	7. , b.9.b Installation : Installer to ensure impact speed is < speed used in shock test: This is very difficult for this installer to do. Installer cannot control crash scenarios. The fixed recorder requirements do not include these constraints. (should this be part of Type Cert or STC instead of TSO?) 8. , b.9.c Installation: Low temp fire test is same test as for fixed recorder 9. 3-1.7.g Lock ADFR on ground: This is a possible failure mode - lockout of deployment when aircraft is on ground may prevent a legitimate deployment. 10. 3-1.8i: deploy spec <14m/s and distance < 20m: Is this for inadvertent deployment on ground? OR is this also a requirement during a legitimate crash event. ?? Can the intent of this requirement be clarified to allow for further comment? This conflicts with the need to meet Icing category C 5mm ice build up. 11. 3.1.7 "impact speed of the automatic deployable package is less than tested": difficult to prove. There are too many variables to effectively perform a meaningful analysis regarding impact speed, distance from aircraft to deployable landing site, collision with the aircraft 12. 3.1.7 – initial momentum: This is already stated in 3-1.8i, although not as succinctly. This conflicts with table 2 Icing requirement category C 5 mm of ice. 13. Ignore 3-1.7.1 --some of this information on impact sensors is useful for reference. 14. 3.1.7.2—immersion shall not prevent deployment: ADFR cannot meet this requirement in all potential immersion attitudes and depths. Deployment should occur before complete immersion. HS or water switch should be located at the lowest point of the Aircraft. 15. 3-2.1 Table 2 enviro tests: Must monitor for false deployment for each DO-160 test.: Each test will now require all deployment sensors and wiring, which will add significant cost and schedule 16. 3-2.1 Enviro pass criteria – confirmation of good deployment test after each section of DO-160 adds significant cost and schedule delay, therefore impacting EIS of ADFR and will invalidate some tests such as Icing. Deployment requires rebuilding recorder release unit, which may invalidate the test so if the deployment occurs in the middle of the test the test must be restarted. 17. Table 2 : "Category to be defined by the manufacturer" -- define please, is category defined by Avionics OEM or Airframe manufacturer. 18. Appendix 2 – Danger Labels. : Airlines prefer to keep the visible covers free of bright labels and markings in order to accommodate Airline logos
response	Partially accepted. 1. Not accepted. The TIP with Canada relies on a list of common TSOs. Either this TSO standard is adopted by Canada and the manufacturer can receive such a CAN-TSOA in accordance with this standard, or otherwise, the Canadian manufacturer can have its article validated by EASA Furthermore, the ETSO remains an optional path, and a part without an ETSOA but compliant with the ETSO standard can be accepted to fulfil airworthiness or operational requirements. 2. Noted. Indeed, the objective of 3.1.1 is to make sure that the functional requirements that apply to the specific type of recording are also covered by the approval.

3. Partially accepted.

It is agreed that the 5mm may be over dimensioned in some cases (e.g. if heating is implemented). However, the requirement remains that the deployable package should be able to deploy when submitted to icing conditions. Similarly, the aircraft manufacturer must be aware of the thickness of ice that is acceptable to take off, so that de-icing is conducted when this value is exceeded.
The 5mm is replaced by 'as declared by the manufacturer'.

4. Noted

The major failure condition relates to the unintended deployment of the recorder. The MMEL is mainly driven by the availability of the equipment to fulfil the operational requirement. There is therefore no direct effect on the MMEL requirement.

5. Noted

The type (AD) does impose crash resistance, but the complete minimum set of ELT capabilities has been described for the sake of completeness.

6. Partially accepted.

The crash robustness of the memory module of an ADFR is less than that of a fixed recorder (because the deployable package is assumed to be exposed to less stringent conditions). It is better than that of an ELT(AF), but an ELT(AF) is only required to transmit when the impact is smooth enough that aircraft occupants may survive. The ELT embedded in the deployable package is expected to transmit in most aircraft accidents, even when the accident is not survivable. The objective of this section is to make sure that the installer can assess that the crash-protected recording medium is not exposed to an environment more hostile than the one used for the qualification.

That being said, it is recognised that the wording ‘Because of the reduced levels of qualification of the memory unit and of the ELT,’ has no added value and it has been removed.

7. Not accepted.

This section is intended to make sure that the installer is aware of the limitations of the environmental qualification of the deployable package, which is less stringent than that of fixed recorders. To provide an equivalent level of safety to existing recorders, the impact conditions must be demonstrated to not exceed the lower crash resistance of the deployable package. For example, the ED-112A impact speed is set to 46 m/s, which is significantly lower than the potential impact speed of the aircraft (50 to 150 m/s). The capability of the deployable package to decelerate in the short time beginning when the structural deformation of the aircraft triggers the deployment and the package makes contact with the ground is far from obvious. The installer cannot control crash scenarios, but a minimum demonstration of typical crash trajectories will have to be demonstrated.
See also the answer to comment #137

8. Accepted.

The reference to the low temperature fire test has been removed.

9. Accepted.

The original ED-112a text is kept.

10. Partially accepted.
See the response to comment #13.

11. Partially accepted.
A new Appendix 2 has been introduced to limit the conditions to a minimum set of typical trajectories.
See also the answer to comment #137.

12. Not accepted.
The speed requirement has been removed.

13. Not accepted.
The information in ED-112A Section 3-1.7.1 is relevant for the installation of the ADFR, but not for the approval of the ADFR as a part using the ETSO process.

14. Partially accepted.
3-1.7.2, 3-3.2.10 and 3-1.5.2 have been amended to recognise that the hydrostatic sensor is a back-up for accidents such that the frangible sensors are not activated, i.e. ditching. In such a case, the immersion is progressive and the aircraft upright. The deployment only needs to intervene before the level of water impedes it.

15. Not accepted
The equipment under test needs to include only those components which are within the scope of the ETSO approval. However, for installation, it will be expected that no unintended deployment should occur as a result of the aircraft environment (e.g. humidity, vibration, HIRF).

16. Not accepted.
It is acknowledged that this requirement has an impact on test costs and schedules, but demonstration that the deployment is successful in the accident environment will require this to show compliance with CS-25 25.1309 (a) (1).

To avoid having to interrupt the test, the test can be performed simultaneously on two units, one being intended for deployment. Another means may be to repeat the part of the test where the deployment is required to exercise the deployment at the end of the test.

17. Not accepted.
The category is defined by the applicant to the ETSO. This may be an assumption of the avionics OEM or a requirement from the aircraft manufacturer.

18. Not accepted.
It is acknowledged that airlines are reluctant to include such labels and that the appendix is prescriptive as to the label content. However, ground personnel need to be protected.

The appendix has been removed, and the text in 3-1.8.3 modified to require a 'conspicuous label'.

See also the response to comment #195.

comment	*137* comment by: *Airbus-EIAIX-SRg* Page 356 & 357 of 372 [363 & 364 of 381] ETSO-2C517 first issue Table 1, chapter 3-1.5.2 b, c & d, Airbus request: Clarification on the different trajectory scenarios and environmental conditions that have to be considered for this verification is required, because the items 3-1.5.2 9 b, c, d are dependent on the aircraft trajectory (speed) and impact surface soil conditions. In addition the figures to be considered for the impact speed and the distance to the crash site have to be clarified. Rationale: It is not feasible with a reasonable effort to consider various trajectory scenarios and environmental conditions that have to be respected for meaningful verification. The uncontrolled movement of the aircraft plus the deploying device makes it very difficult to assess and verify the impact speed and location of the deployable package. This includes also the collusion with aircraft.
response	Partially accepted. A limited set of cases has been defined in a new Appendix 2, and the wording of Section 3-1.5.2 has been modified to request the manufacturer to compute the distance required to decelerate to the impact test speed in these scenarios. The installation manual now focuses on verifying that the impact speed has not been exceeded. It is recognised that the trajectory may be highly variable and that demonstrating that it does not enter into the area of fire is difficult to achieve. Therefore, it is required to locate the recorder in a location limiting the exposure to fire before and after an accident. See also the answer to comment #53.11

comment	*138* comment by: *Airbus-EIAIX-SRg* Page 357&358 of 357 [363&364 of 381] ETSC-2C517 at first issue Table 1, chapter 3-1.5.2 d, Airbus request: The item 3-1.5.2 d is not in line with § 3.2.1 and should be covered by adapting item b accordingly. Rationale: To resolve the contradiction between § 3.2.1 stating that the automatic deployable package may collide with the aircraft while item 3-1.5.2 d requesting a statement that the automatic deployable package does not collide with the aircraft.

response

Partially accepted.
3.2.1 does not set the classification based on the presence of a collision, but only states that collisions with the aircraft may affect the classification. It is acknowledged that the trajectory of the automatic deployable package may be erratic and may vary greatly upon minimum variations of the aerodynamic flow, which makes the absence of a collision difficult to demonstrate. However, the deployment may occur as a result of an in-flight event such as an explosive decompression or explosion. In such a case, the deployment is normal, but it should not affect the capability of the aircraft to overcome this event. The wording is changed to 'c. the installation minimises the risk that the deployment of the automatic deployable package in normal flight conditions affects the capability of continued safe flight and landing.'

comment

139 comment by: *Airbus-EIAIX-SRg*

Page 358 of 372 [356 of 381]
ETSO-2C517 at first issue.
Table 1, chapter 3-1.7 g, Airbus request:
Change the wording as follows:
The ADFR system ~~shall~~ **may** provide a means to lock […]

Rationale:
Mechanical locking is not feasible since the ADFR installation may require support devices
(high lift platform truck) to reach the automatic deployable package including the lock before
and after the flight. Electronic locking is considered to be switching device instead of locking
device, which will in addition introduce more complexity to the deployment function and as
such creating an additional risk for intended and unintended deployment.
The Design Objective of 10^{-7} is already covering the locking need for unintended deployment.

response

Accepted.
See the response to comment #53.09

comment

140 comment by: *Airbus-EIAIX-SRg*

Page 358 of 372 [365 of 381]
ETSO-2C517 at first issue
Table 1, chapter 3-1.8.h & 3-1.8.i, Airbus assumes a typing error.

PLEASE CHECK, if the numbering 3-1.8.h & 3-1.8.i should be corrected into 3-1.**7**.h & 3-1.**7**.i

response

Accepted.
The text is modified as suggested.

comment

141 comment by: *Airbus-EIAIX-SRg*

Page 364 of 372 [372 od 381]

ETSO-2C517 at first issue, APPENDIX 2, Airbus Comment:

Depending on the installation location of the automatic deployable package the proposed external
danger label might not be visible and consequently not readable from the ground.
Therefore the external danger label is to be installed such that it is visible and readable from the ground.
The exact installation location is to be detailed in the explanatory box.

Rationale:
To ensure readability on the ground for any personnel (maintenance, servicing, rescue,…).
NOTE: The Airline image (livery paint) is impacted especially in the case when the external danger
label is installed in the area of the airline's logo on the VTP.

response

Not accepted.
The label on the automatic deployable package is also there to warn maintenance crew who may come close to the recorder during maintenance operation. It also intends to avoid rescue crew on an accident site and in the proximity of an undeployed recorder being injured.

If this label is not visible by the ground maintenance crew, the installer may add further labels as required, but this is out of scope of the ETSO. See also the answer to comment #195 about the removal of the detailed requirements on the content of the label.

comment

142 comment by: *Airbus-EIAIX-SRg*

Page 363 of 372 [370 of 381]
ETSO-2C517at first issue, Appendix 1, Table 2, Icing, Airbus request:
a
What is the reason to request an ice thickness of 5 mm?

Rationale:
Especially the ice thickness drives the initial deployment speed and force.
Therefore the ice thickness shall be in line with initial deployment characteristics of the automatic deployable package.

response

Partially accepted.
See the response to comment #53.03

comment

143 comment by: *Airbus-EIAIX-SRg*

Page 353 of 372 [360 of 381]
ETSO-2C517 at first issue, chapter 3.11, request for type ELT(AD), Airbus request:

The type of ELT shall not be limited to ELT(AD). In the case that an Autonomous Distress Tracking

function is implemented in the automatic deployable package, the ELT type changes to an
ELT(DT) type with crash survivability and crash detection means.

Rationale:
Airbus wants to avoid exclusion of other possible solutions.

response

Accepted.
The text has been amended, and 'as a minimum' has been added.

comment

145 comment by: *Airbus-EIAIX-SRg*

Page 358 of 372 [365 of 381]
ETSO-2C517 at first issue, Appendix 1, Table 1, chapter "3.1.7", Airbus request:

PLEASE CHECK the numbering of this chapter!

3-1.7.i is the number just before and 3-1.7.1 just after that chapter#.

response

Partially accepted.
See the response to comment #140.

comment

146 comment by: *Airbus-EIAIX-SRg*

Page 358 of 372 [365 of 381]
ETSO-2C517 at first issue, Appendix 1, Table 1, chapter "3.1.7", Airbus request:

The previous text of 3.1.7 [as per initial ED-112A] shall be kept.
The installer will not be in the position to provide the requested verification with a reasonable
effort to achieve a significant analysis concerning impact speed, distance to crash site and aircraft collision.

Rationale:
The available accident scenarios do not allow to derive the trajectories of an automatic
deployable package to define the maximum impact speed occurring when the device will reach its impact location.
It is not feasible with a reasonable effort to consider the airflow, the uncontrolled movement
of the aircraft plus the deploying device to assess the impact speed.
For the very same reason the distance from fire on crash site towards the deployed device cannot
be calculated at a reasonable accuracy.
A collision with the aircraft cannot be prevented under each possible situation especially if the
aircraft moves uncontrolled and trajectory analysis cannot rely on confirmed airflow conditions.

response	Partially accepted. See the response to comment #53.11.

comment	*164* comment by: *Airbus-EIAIX-SRg* Page 361 of 372 [368 of 381] ETSO-2C517, Appendix 1, chapter 3-3.2.9 b, Airbus request: This requirement is considered to be linked to the Underwater Locator Beacon (ULB) and as per ED-112A an ULB is only required for fixed installed recorders. Consequently this section 3-3.2.9 b is not applicable for deployable recorders and shall therefore be ignored. Rationale: As per ED-112A the ULB is not required for deployable recorders, as it is intended to float.
response	Accepted. It is true that no ULB is present in the automatic deployable package. Nevertheless, ULBs have been required to operate for 90 days because 30 days did not prove to be enough to retrieve a recorder in the sea. The extension is therefore relevant.

comment	*165* comment by: *Airbus-EIAIX-SRg* Page 362 & 363 of 372 [369 & 367 of 381] ETSO-2C517, Appendix 1, Table 2, Airbus request: The environmental test categories as per ED-14G / DO-160G have to be specified by the aircraft manufacturer in accordance to the aircraft type (capabilities) and equipment installation location. Therefore prescriptive environmental test categories as for e.g. chapter 5, 6, 8, 10, 11, 12, 13, 14, … shall not be listed in this ETSO (Table 2). Please provide clarification. What are the rationales for the prescriptive requirements as listed in Table 2 and why some chapter have prescriptive requirements and other are to be defined by manufacturer? Rationale: To achieve performance based (ETSO-) requirements.
response	Not accepted. The minimum environmental categories have been considered taking into account the exposure to the conditions that may be encountered before the deployment in case of an accident.

comment	*166* comment by: *Airbus-EIAIX-SRg* Page 358 of 372 [365 of 381] ETSO-2C517 at first issue, Appendix 1, Table 1, chapter "3-1.8.i" [3-1.7.i], Airbus request: Clarification on the intend of this requirement is needed for further comments. In addition clarifications on trajectory scenarios and environmental conditions have to be provided for the evaluation of the deployable package speed for deployment, separation and impact phase as well as the impact point. Rationale: It is not feasible with a reasonable effort to consider various trajectory scenarios and environmental conditions that have to be taken into for the evaluation of the speed and impact point of the deployable package. For which condition (intended or unintended deployment) is this requirement posted?
response	Partially accepted. This requirement limits the impact of an unintended deployment that may occur when the aircraft is at rest on the ground. See also the answer to comment #13.

comment	*181* comment by: *L3Harris* 3.1.7.g: Special procedures may be employed to satisfy the requirement, such as removal of release components or attachment of special brackets.
response	Noted. See the response to comment #139

comment	*182* comment by: *L3Harris* 3-1.8.i : Please provide additional explanation of the meaning of "when deployed from a fixed position in any direction over a horizontal plane."
response	Partially accepted. See the response to comment #13

comment	*183* comment by: *L3Harris* 3-1.7.2 : note that this section does not allow a water switch, which is mentioned in section 3-3.2.10. Only a pressure sensor/switch is described.
response	Accepted. Reference to a water sensor which is not pressure based has been removed from 3-3.2.10.

comment	*184* comment by: *L3Harris* 3-1.7.2 : note that deployment does not guarantee the unit will float free. The ADFR manufacturer and installer cannot guarantee all orientations or constraints due to airframe damage or debris will allow the device to float free.
response	Noted. The objective of the ETSO is to make sure that the minimum performance is met, i.e. here, that the unit is deployed and floats to the surface.

comment	*185* comment by: *L3Harris* 3-1.8.3 : if applicable (see comment to Appendix 2)
response	Accepted. See the response to comment #195.

comment	*186* comment by: *L3Harris* 3-2.1 : Suggest "Table 2 of this Appendix defines the *minimum* environmental tests to be performed on the ADFR system."
response	Accepted. The text has been modified as suggested.

comment	*187* comment by: *L3Harris* 3-3.2.5 : the ADFR fire survival criteria of ED-112A exceed the requirements of ED-62B, so this section is unnecessary
response	Not accepted. The ADFR fire criteria of ED-112A apply to the memory module but not to the ELT. ED-112A Section 3-1.8.1 sequences only test the beacon transmission in sequence iii where the fire tests are not required.

comment	*188* comment by: *L3Harris* 3-3.2.2 (note) , : the ADFR survival criteria of ED-112A exceed the requirements of ED-62B, so this section is unnecessary
response	Not accepted. The note does not constitute a requirement, but gives a link to other applicable requirements. The ED-112A requirement for penetration only applies to the memory module, but not to the ELT integrated in the automatic deployable package. ED-62B corrects this by setting an equivalent requirement for the ELT(AD) integrated in the ADFR.

comment	*189* comment by: *L3Harris*

	3-3.2.3 ; the ADFR static crush survival criteria of ED-112A exceed the requirements of ED-62B, so this section is unnecessary
response	Not accepted. ED-112A does not require the beacon to be able to transmit after the crush test (see the sequences in 3-1.8.1), and the ED-112A test applies only to the memory module (see ED-112A 3-3.2.3).

comment	*190* comment by: *L3Harris* 3-3.2.4 : the ADFR fire survival criteria of ED-112A exceed the requirements of ED-62B, so this section is unnecessary
response	Not accepted. See the response to comment #187.

comment	*191* comment by: *L3Harris* 3-3.2.10 : this is the first mention of a "water switch" as a means of deployment. Is this sensor an acceptable means of deployment?
response	Accepted. See the response to comment #183.

comment	*192* comment by: *L3Harris* 3-3.2.10 "Verify that the ADFR deploys when the **water sensor** is at a depth of between 1.5 and 5 m." should be "pressure sensor", not "water sensor".
response	Accepted. 'water sensor' has been replaced by 'Hydrostatic pressure sensor'.

comment	*193* comment by: *L3Harris* Table 2 Vibration : Vibration categories should be selected based on the aircraft type and installation location. Suggest changing this to "to be defined by the manufacturer"
response	Not accepted. See the response to comment #165.

comment	*194* comment by: *L3Harris* Table 2 Icing : Icing categories should be selected based on the aircraft type and installation location. Suggest changing this to "to be defined by the manufacturer". 5mm thick ice is not a reasonable requirement for many aircraft types and installation locations and could have the unintended consequence of increasing the required deployment energy, which is contrary to safety aspects.
response	Partially accepted.

The thickness is left open to the manufacturer to choose. The category, however, deals with different conditions: the effect of icing in flight and effect of icing on the ground followed by flight, which will both apply.

See also the response to comment #53.03.

comment *195* comment by: *L3Harris*

Appendix 2 : This entire section is predicated on the assumption that the ADFR deployment mechanism has sufficient energy to cause harm to maintenance or recovery personnel. Not all deployment designs pose an inherent hazard of this type.

Suggest making this requirement based on the kinetic energy of the deployment mechanism. If the kinetic energy is greater than xxx Joules, or the ejection speed is greater than xx m/s at a distance of 0.5m from the stowed position. This will address any safety hazard to service personel in close proximity to the device.

response Accepted.
3-1.8.3 has been reworded as follows: 'If the automatic deployable package (ADP) is designed to be installed with one side exposed to the exterior of the aircraft and if its kinetic energy can reach 44 Joules within 0.5 metre from the release point when the aircraft is standing on the ground, that side of the ADP shall bear a conspicuous label.' 44 Joules 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.

ETSO-2C518 p. 375-376

comment *168* comment by: *AIRBUS*

ETSO-2C518: Runway Overrun Awareness And Alerting System

In 3.1.1- Minimum Performance Standard, please change:

"The applicable standards are those provided in EUROCAE ED-250, Minimum Operational Performance Standards for a Runway Overrun Awareness and Alerting System, dated December 2017."

by:

"The applicable standards are those provided in EUROCAE ED-250, Minimum Operational Performance Standards for a Runway Overrun Awareness and Alerting System, dated December 2017 **or an existing means of compliance already agreed with the agency**."

Justification: Airbus has already developed and certified ROOAS on most of the fleet according to an EASA CRI. It is therefore requested to explicitly authorize the use of another means of compliance already agreed with the agency, to not unduly penalize

	Manufacturers who voluntarily adopt the technology in advance to regulation application.
response	Not accepted. See the response to comment #167.

ETSO-2C519 p. 377-378

comment	*39* comment by: *Airbus Helicopters* **Comment** There is no special category required in the ETSO 3.1.1 **Rationale for Comment** Acc. to EN4856 the CAT "A" EBS will be sufficient for helicopter ditching only **Recommendation** Proposal: add Category "A" **Classification** MAJOR
response	Accepted. The relevant operational regulation regarding the provision of an EBS is Commission Regulation (EU) No 965/2012, SPA.HOFO.165(c). AMC1 SPA.HOFO.165(c) states that the EBS system should be capable of 'rapid underwater deployment'. EN4856 contains the applicable standards for a Category 'A' and a Category 'B' EBS, but this standard only calls for the former to be capable of rapid underwater deployment. ETSO-2C519 has been revised to state that the applicable standards are those provided in EN4856 for a Category 'A' system.

comment	*40* comment by: *Airbus Helicopters* **Comment** Cold water performance for use in 12°C cold water – see EN4856 §5.10 **Rationale for Comment** There is no evidence required for use in colder water than 12°C! Usage in very cold water (lower than 12°C) is not considered! **Recommendation** Information: no verification for temperatures between 0°C and 12°C will be required by EN4856 and also not by ETSO-2C519. Proposal: extended verification for this temperature range should be required by ETSO. **Classification** MAJOR
response	Not accepted. Regarding the functioning of the EBS in cold water conditions, it is to be noted that Section 5.5.1 of the standard requires successful testing with a breathing simulator at a temperature no higher than 4.0 °C. The equipment is then prohibited from use at lower water temperatures than that. If it is desired that the EBS be used at

temperatures lower than 4.0 °C, Section 5.5.5 requires that the testing be successfully completed at the lower temperature selected by the manufacturer.

The testing at 12.0 °C referenced by the commenter is that performed by human test subjects, in order to prove the ergonomic fit. This temperature, which is determined from ethical considerations, is sufficiently challenging to obtain the data required.