European Aviation Safety Agency — Rulemaking Directorate

Comment-Response Document 2012-16

Systematic review and transposition of existing FAA TSO standards for parts and appliances into EASA ETSOs

CRD TO NPA 2012-16 — RMT.0186 (ETSO.008) — 12/07/2013

Related Decision 2013/012/R

EXECUTIVE SUMMARY

This Comment-Response Document (CRD) contains the comments received on NPA 2012-16 (published on 11 October 2012 and the responses provided thereto by the Agency.

The scope of this activity, outlined in the Terms of Reference (ToR) RMT.0186 (ETSO.008), Issue 3, of 08 February 2012, is to amend CS-ETSO including Subpart A and adding, updating or deleting some ETSO from index 1 or 2. Whenever possible the ETSO are included in index 1, which means that their content is equivalent to the corresponding FAA TSO standards for parts and appliances.

Specific objective of the task was to incorporate new standards and transpose updated FAA TSO standards into the EASA CS-ETS0 structure.

In principle stakeholders agreed to amend Subpart A and add, delete or amend all the ETSOs included in the NPA. 34 detailed comments were received from 14 commentators.

In total the Agency accepted (or partially accepted) 23 (almost 68 %) of the 34 received comments.

As a result:

- the text of CS-ETSO Subpart A has been significantly modified;
- the Agency acknowledges that the transition issues from ED-12B to C (software) require attention in the text of AMC 20-115C, but this document is out of scope of the present task, since progressed through RMT.0462;
- several ETSO have been modified as well;
- the proposal to amend ETSO-C161a to C161a A1 is withdrawn by the Agency;
- update of ETSO-C44 (from 'c' to 'd'), C113 (to 'a') and C161 (to 'a') has been included in the ToR for subsequent amendment of CS-ETSO (RMT.0206);
- the issue of lead-free soldering has been proposed for inclusion in RMT.0561 (regular update of AMC 20).

Based on the comments and responses, Decision 2013/XXX/R was developed and published simultaneously with this CRD, as allowed by the rulemaking procedure adopted by the Agency's Management Board on 13 March 2012.

Applicability	
Affected regulations and decisions:	CS-ETSO (Decision 2003/10/RM of 24 October 2003)
Affected stakeholders:	Equipment manufacturers
Driver/origin:	Level playing field
Reference:	CS-European Technical Standard Order (ETSO)

Process map	
Concept Paper:	No
ToR	06/02/2012
Rulemaking group:	No
RIA type:	Light
Technical consultation during NPA drafting:	No
Publication date of the NPA:	11 Oct 2012
Duration of NPA consultation:	3 months
Review group:	No
Focused consultation:	No
Publication date of the Opinion:	N.A.
Publication date of the Decision:	(simultaneously with this CRD)

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1. Procedural information

This CRD follows the 2012 rulemaking procedure. Please refer to the related Decision 2013/XXX/R for the procedural information.

No reactions are invited on this CRD.

2. Summary of comments and responses

NPA 2012-16 has received 34 individual comments by 13 commentators. The figures below show the distribution and statistics of comments and type of commentators:

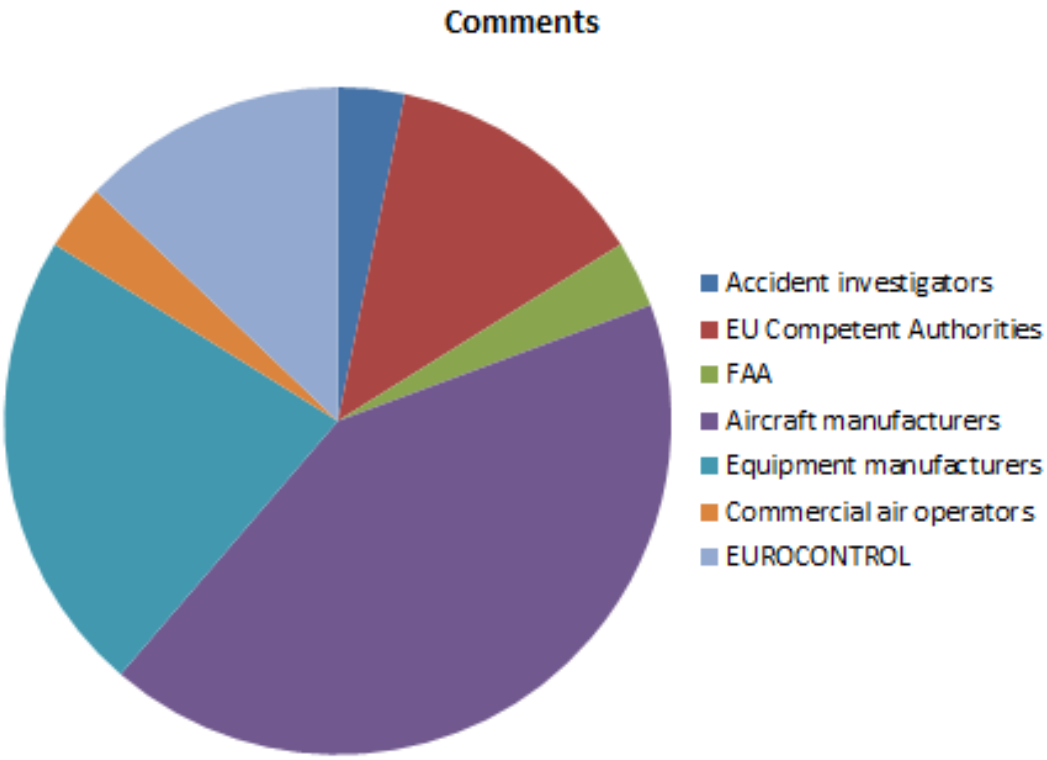

Figure 1: Distribution of comments per type of commentator

20 comments out of 34 (i.e. almost 60 %) came from manufacturers.

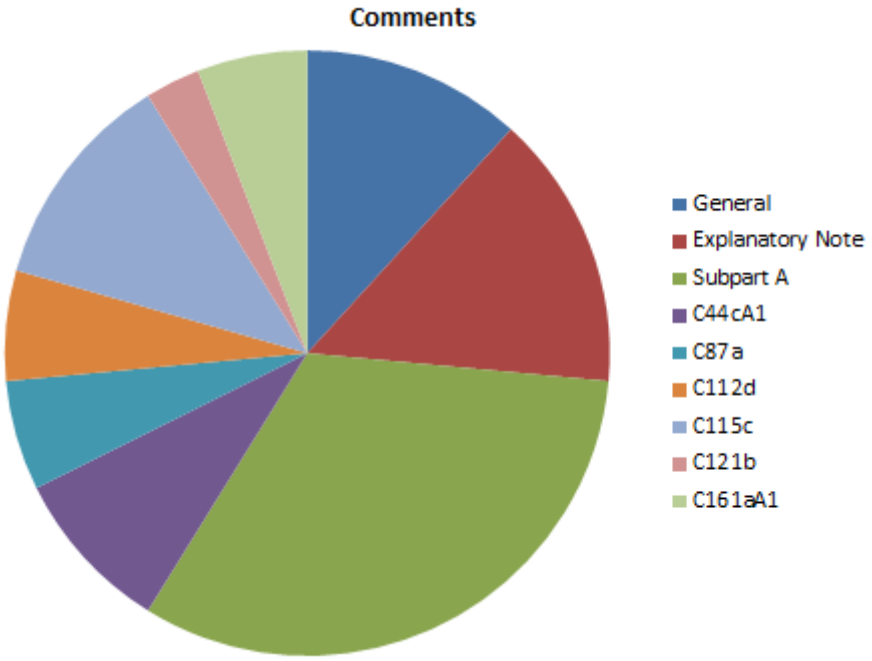

Figure 2: Statistics per type of commentators

No comments were received on the RIA. 25 comments out of 34 (i.e. almost 75 %) were received on the proposed amendments to CS-ETSO. Among these comments, 11 were related to Subpart A.

The following table shows that comments received on the individual new, revised or deleted ETSOs proposed by the NPA:

ETSO reference	ETSO title	Comments
Index 1		
Subpart A	General	**11**
~~ETSO-C9c~~	~~Automatic Pilot~~	**0**
ETS0-C44c A1	Fuel Flowmeters	**3**
ETS0-C45b A1	Manifold Pressure Instruments	**0**
ETS0-C47a A1	Pressure Instruments — Fuel, Oil, and Hydraulic (Reciprocating Engine Powered Aircraft)	**0**
~~ETSO-C52b~~	~~Flight Directors~~	**0**
ETS0-C56b A1	Engine-driven Direct Current Generators/Starter generators	**0**
~~ETSO-C60b~~	~~Airborne Area Navigation Equipment Using Loran C Inputs~~	**0**
~~ETSO-C74d~~	~~Airborne ATC Transponder Equipment~~	**0***
ETSO-C87a	Airborne Low-range Radio Altimeter	**2**
ETS0-C106 A1	Air Data Computer	**0**
ETSO-C112d	Air Traffic Control Radar Beacon System/Mode Select (ATCRSB/Mode S) Airborne Equipment	**2**
ETS0-C114 A1	Torso Restraint Systems	**0**
ETSO-C115c	Flight Management Systems (FMS) using Multi-Sensor Inputs	**4**
ETSO-C121b	Underwater Locating Device	**1**
ETSO-C155a	Recorder Independent Power Supply	**0**
ETSO-C160a	VDL Mode 2 Communications equipment	**0**
ETS0-C161a A1	Ground-Based Augmentation System Positioning and Navigation Equipment	**2**
ETSO-C164	Night Vision Goggles (NVG)	**0**
ETS0-C166b A1	Extended Squitter ADS-B and TIS-B Equipment Operating on the RF of 1090 Megahertz (MHz)	**0**
ETS0-C174 A1	Battery-Based Emergency Power Unit (BEPU)	**0***
ETSO-C178	Single Phase 115 VAC, 400 Hz Arc Fault Circuit Breakers	**0**
ETSO-C198	Automatic Flight Guidance and Control System (AFGCS) Equipment	**0**
ETSO-C200	Low-frequency Underwater Locating Device (ULD)	**0***
~~ETSO-2C87~~	~~Airborne Low-range Radio Altimeter~~	**0**
~~ETSO-2C91a~~	~~Emergency Locator Transmitter (ELT) Equipment~~	**0***

* comments on these ETSO were filed under 'general' comments or on the Explanatory Note.

In conclusion the text of 6 out of the 25 ETSOs (i.e. about 25 %) proposed for inclusion or amendment received comments. The other 19 (75 %) were accepted by stakeholders as proposed in the NPA with no comments addressed directly to that segment of the NPA, although some stakeholders erroneously commented to them in the 'general' comments to the NPA. Even these 'general' comments have, however, been replied individually.

In total the Agency accepted (or partially accepted) 23 (almost 68 %) of the 34 received comments as shown in the table below:

Disposition	**Comment No.**	**Total**	
		No.	**%**
Accepted	2, 11, 13, 14, 18, 20, 21, 22, 23, 28, 31, 32, 34, 36	**14**	**41**
Partially accepted	1, 5, 9, 12, 15, 16, 19, 35, 37	**9**	**26**
Noted	3, 4, 8, 17, 24, 26, 27, 29, 33	**9**	**26**
Not Accepted	7, 30	**2**	**7**
TOTAL		**34**	**100**

As a result:

- the text of CS-ETSO Subpart A has been significantly modified;
- the Agency acknowledges that the transition issues from ED-12B to C (software) require attention in the text of AMC 20-115C, but this document is out of scope of the present task, since progressed through RMT.0462;
- several ETSO have been modified as well;
- the proposal to update ETSO-C161a to C161a A1 is withdrawn by the Agency;
- update of ETSO-C44 (from 'c' to 'd'), C113 (to 'a') and C161 (to 'a') has been included in the ToR for subsequent amendment of CS-ETSO (RMT.0206);
- the issue of lead-free soldering has been proposed for inclusion in RMT.0561 (regular update of AMC-20).

Please refer to section 3 below for the responses to the individual 34 comments.

3. Individual comments (and responses)

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

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

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

(c) **Noted** — The Agency acknowledges the comment but no change to the existing text is considered necessary.

(d) **Not accepted** — The comment or proposed amendment is not shared by the Agency.

(General Comments) -

comment *1* comment by: *Luftfahrt-Bundesamt*

LBA comments
1. General/Administrative:
Cancelled ETSO´s should remain available on the EASA website for changes and analyses of occurences.
2. ETSO-C74 Mode A/C only XPDR:
This ETSO should not be cancelled because large parts of the world do not have a Mode-S mandate.
3. ETSO-2C91 121,5 MHz only ELT
This ETSO should be cancelled, because COSPAS Sarsat requires 406MHz signals worldwide and in any case.
4. Hazard classifications:
This can only be determined **after** a safety analysis on aircraft level (see ED79A/ARP4745A, CS-ETSO 2.4). Since the aircraft is not known at the time of the issuance of the ETSO authorisation it is not logical to require a minimum hazard classification on equipment repectively ETSO level. However, it may be sometimes useful to give a recommendation for that.
Especially, for the Fuel Flowmeters and the BEPU, the prescribed hazard classifications do not make sense for many aircraft applications.
CS-ETSO 2.4 is not logical in itself. It refers to documents describing the correct procedure, analysis on aircraft level first, then defining a DAL on equipment level. On the other hand, 2.4 asks for a wrong procedure, prescription of hazard classification on equipment level and maybe alleviations in a second step. Furthermore, it does not make sense to stress installation restrictions. By definition ETSO is an incomplete approval with a wide variety of classes and levels to be declared by the applicant. This will always lead to installation restrictions.

response

1. Noted.
   Cancelled ETSO are already still available in the published CS_ETSO initial text or in published amendments. All editions are accessible through the index which on the website: http://www.easa.europa.eu/agency-measures/docs/certification-specifications/CS-ETSO/ETSO%20Index.xls
2. Not accepted.
   LBA statement is correct. Nevertheless, no ETSO approval has been requested in the last 10 years. All new developments appear to use ETSO-C112. Please note that the cancellation of C74 means that manufacturers can no longer file new application to the Agency for ETSO authorisation (which covers also a new specific design of the article). Currently approved designs can still be produced and marketed with C74 ETSO marking. And of course the cancellation does not at all affect aircraft currently in the fleet.
3. Noted
   We note the agreement to cancel ETSO-2C91a.
4. Partially accepted.
   Clarifications have been added in paragraph 2.4 for ETSO context. Considering ETSO-C44c and ETSO-C174 A1, resulting text has been revised and minimum failure condition classification has been removed. General reference to CS-ETSO, Subpart A, section 2.4 has been maintained.

comment *24* comment by: *Swiss International Airlines / Bruno Pfister*

	SWISS Intl Air Lines take ote of NPA 2012-16 wthout further comments.
response	Noted

NOTICE OF PROPOSED AMENDMENT (NPA) 2012-16 — General comments p. 1-3

comment	*3* comment by: *CAA-NL* Please be advised that the Netherlands has no comment for this NPA
response	Noted

comment	*4* comment by: *SVFB/SAMA* **NPA 2012-16 ETSO** v130111-2059 **ECOGAS: European Council of General and Business Aviation.** We not only support this NPA but are delighted that a full harmonisation between FAA and EASA in regard to TSO is achieved with this NPA. The only remark we have: if option 2 is not possible due to legal reasons we request that the link to the reference document is always indicated in a manner, which allows easy access to the user. SAMA a member of ECOGAS fm
response	Noted. The legal reason for which it is not possible to 'copy, paste' and publish the entire text of industry standards, is that several standard making bodies (e.g. Eurocae, RTCA) sell their documents and protect their Intellectual Property Rights (IPR) through copyright. Although very brief, this was mentioned in the Regulatory Impact Assessment in the NPA. The rules on copyright are developed, adopted and promulgated in the various States outside the aviation domain and outside Agency's competence. It is not considered appropriate to spend Agency's resources for a detailed study on copyright legislation. In other words, applicable standards are not available in public domain and, should the Agency disclose them to any reader on the web, it may become liable for infringing IPR.

A. Explanatory Note — IV. Content of the draft Decision p. 6-15

comment	*7* comment by: *THALES-Avionics* THALES Avionics is very concerned by the reference to AMC 20-115 instead of ED12B/DO178B In CS-ETSO § 2.2. Indeed, in the NPA 2012-11 related to the Recognition of ED-12C/DO-178C in EASA AMC 20-115, the proposed revision C of AMC introduces not only the industrial standard ED-12C but also guidance for the use of previous versions of ED-12 for changes to pre-existing software. Due to the

	potential negative impact on industry that could have any differences between the final EASA AMC and FAA AC, THALES Avionics is very keen that EASA and FAA succeed in achieving a full harmonization on AMC/AC 20-115C. As a consequence, due to the importance of the subject, THALES Avionics suggest to wait for final comments on AMC 20-115 rev. C through NPA before proceeding to CRD and final rules.
response	Not accepted AMC 20-115C is part of another process (ref. NPA 2012-11), independent from CS-ETSO. Coordination between EASA and FAA on the software topic is, however, undergoing. Referring in CS-ETSO to a software policy different from AMC 20-115 would only cause confusion.

comment	*8* comment by: *THALES-Avionics* Index 1 ETSO technical content revised: The TSOs C113 has been updated by FAA into TSO C113a since 30/04/2012. Thales proposes to add ETSO C113a in the list of ETSOs proposed for update in Index 1 of next revised version of CS-ETSO.
response	Noted ETSO C113a is outside of scope of this NPA, and will be considered in next update of CS-ETSO.

comment	*17* comment by: *EUROCONTROL* EUROCONTROL agrees with the proposed deletion of ETSO-C74d; however it should be noted that this ETSO is referenced in the new CS-ACNS attached to EASA NPA 2012-19. Therefore a consistent approach has to be adopted; the corresponding comment (removal of reference to ETSO 74d in CS-ACNS) will be made in the frame of NPA 2012-19 consultation.
response	Noted The comment has been forwarded to the CS-ACNS development team.

comment	*29* comment by: *Eurocopter* ETSO-C200 Low-frequency Underwater Locating Device (ULD) (item 64) As the ULD is intended to be mounted directly to the aircraft, its integration will be easier than with a ULD fixed to the recorder. But in any case and due to the fact that the optimal position for the ULB is fixed to the recorder, the possibility of having the Low Frequency ULD fixed to the recorder must be open to the manufacturer when it is feasible. Nevertheless, this should remain a possibility, not become a requirement, as in many cases it won't be mechanically achievable.
response	Noted There's no such requirement on installation within ETSO-C200, and applicable standard SAE AS6254 differentiates installation considerations as following 'The low frequency ULD is intended to be mounted directly to the aircraft as a supplement to the existing ULDs which are attached directly to the crash protected recorders'. The comment, although its content is shared by the Agency, is considered not applicable to ETSO-C200.

comment	*30* comment by: *Eurocopter* ETSO 2C91a Emergency Locator Transmitter (ELT) equipment (item 73) This comment does not impact CS-ETSO, but underlines a probable inconsistency in the recent EASA operational regulation: • The NPA proposes to cancel ETSO-2C91a, due to the fact that the Cospas-Sarsat satellite system stopped processing signals from 121.5 MHz ELTs. • Nevertheless, the operational regulation (EU) No 965/2012 asks for equipping aircrafts with ELTs capable of transmitting simultaneously on 121.5 MHz and 406 MHz (paragraphs CAT.IDE.A.280 and CAT.IDE.H.280, respectively for airplanes and rotorcrafts).
response	Not accepted. ETSO-C126a requests compliance to ED-62a which includes with transmitter frequencies 121.5 MHz and 406MHz as Minimum Performance Standard. Therefore, cancellation of 2C91a has not the intent to remove 121.5 MHz requirement for the homing function.

B. Draft Decision — I. Draft Decision ETSO — SUBPART A — CS-ETSO p. 23-26

comment	*9* comment by: *THALES-Avionics* § 2.2 Software standards *Unless otherwise stated in paragraph 3.1.3 of the specific ETSO, one acceptable means of compliance for the verification and validation of the computer software is outlined in the latest revision of AMC 20-115 on software considerations in Airborne Systems and Equipment Certification"* As for subpart A 2.1 & 2.3, Thales recommend to stick the use of ED/DO references . Furthermore, as for Subpart A 2.1, such way permits to use several versions of a standard (ED-14/DO-160 D,E,F). Indeed, imposing ED-12C/DO-178C only through the AMC 20-115 latest version creates an unacceptable burden for the industry. As an example, an equipment subject to hardware major change as per 21A.611 would have to be re-qualified to ED-12C/DO-178C according to the AMC 20-115C as proposed in NPA 2012-11. Moreover, the proposed AMC 20-115 C is tailored for Type certification process but not for ETSO certification (e.g. ref to GM 21A.101 and Appendix to GM 21A.91 for SW change criteria) **Proposed text:** Unless otherwise stated in paragraph 3.1.3 of the specific ETSO, one acceptable means of compliance for the verification and validation of the computer software is outlined in EUROCAE/RTCA document on software considerations in Airborne Systems and Equipment Certification: ED-12B/DO-178B, dated December 1992 or ED-12C/DO-178C, dated January 2012. When ED-12C/DO-178C is used, its application may be supported by the following related documents and supplements: ED-215/DO-330 "Software Tool Qualification Considerations" document; ED-216/DO-333 "Formal Methods - Supplement to ED-12C and ED-109A"; ED-217/DO 332 "Object-Oriented Technology and Related Techniques Supplement to ED-12C and ED-109A"; and ED-218/DO-331 "Model-based Development and Verification - Supplement to ED-12C and ED-109A".

response	Partially accepted. Additional guidance for ETSO changes has been introduced in AMC 20-115C in comparison to the text proposed in NPA 2012-11, to avoid obliging to use editions C of ED-12 in cases where this is not necessary.

comment	*12* comment by: *Garmin International* Regarding 2.2 Software Standards: AMC 20-115 should continue to recognize ED-12B/DO-178B. Currently, ED-12B along with EASA Certification Memos and EASA Certification Review Items are an acceptable means of compliance. The agency's own assessment states, "there is no urgent need to do anything to solve a safety issue" (ref. Notice of Proposed Amendment (NPA) 2012-11, Part A "Regulatory Impact Assessment", Section V.1.3 "What are the safety risks"). Furthermore: • Industry *and* the agency have invested significant resources to develop accepted processes, and • A significant financial burden will be imposed if industry is required to show compliance to new standards, CMs and CRIs that have no appreciable impact on safety. Consequently, the agency is strongly urged to continue to recognize ED-12B as an acceptable means of compliance.
response	Partially accepted. ED-12B/DO-178B may be accepted for minor software changes. For new or major changes it is intended to use newly revised standards. See CRD to NPA 2012-11 for more details.

comment	*22* comment by: *AIRBUS* 2.4 Failure condition classification At the end the first sentence, the meaning of the "installation restrictions" needs to be clarified. Please provide some additional explanations.
response	Accepted. The paragraph has been reworded.

comment	*23* comment by: *AIRBUS* 2.4 Failure condition classification The determination of the classification of an aircraft failure condition must be assessed in light of aircraft integration and architecture, knowledge of human factors, operating procedures, training and others as per 25.1309. Therefore, these classifications should be assessed during the Type Certification exercise at aircraft manufacturer level. For example, in ETSO-C115c, it is surprising that failure conditions are defined in § 3 .2 without knowing the exact aircraft architecture. How an avionics supplier can demonstrate the compliance with these requirements that are at the aircraft level? Please clarify these points.
response	Accepted. The paragraph has been reworded. Failure conditions defined in some ETSOs as C115c has to be considered as a minimum.

comment	*31* comment by: *Eurocopter* Subpart A - § 2.2 Software standards In the present issue of CS-ETSO, there is a sentence indicating that "*The applicant must declare the level (or levels) to which the computer software has been verified and validated*". It seems that this sentence is unduly suppressed in this NPA.
response	Accepted. The corresponding sentence has been added.

comment	*32* comment by: *Eurocopter* Subpart A - § 2.3 Airborne electronic hardware (AEH) The requirement is to use ED-12/DO-254 for complex ASICs and complex programmable logic. This does not include complementary (equipment level) design assurance requirements which are imposed through interpretative material on HW design submitted for TC and STC in the following areas: • hardware design assurance for simple electronic hardware, • hardware design assurance at SRU (Shop Replaceable Unit) and LRU (Line Replaceable Unit) levels, • considerations for complex COTS components, • sensitivity and protection against neutron radiation. A solution should be found in order to allow TC / STC applicants to integrate ETSO authorized equipment into their aircrafts or appliances without the burden for complementary substantiation or even design changes to cope with above mentioned complementary requirements.
response	Accepted. The Agency agrees that integration of ETSO authorised equipment into aviation products should not lead to duplicated substantiation activities. The text proposed by the NPA has therefore been revised.

comment	*33* comment by: *Eurocopter*
	
	Subpart A - § 2.3 Airborne electronic hardware (AEH)
	Considering the risks for airborne electronic equipment when using lead-free soldering, requirements on this subject should be added.
	As no aeronautics safety regulation or guidance is available for the moment on this subject, the following standards could be referenced:
	• either US standards:
	  ○ GEIA-STD-0005-1 "Standard for managing the use of Pb-free solder and finishes in Aerospace, defense and High Performance Electronic Systems"
	  ○ GEIA-STD-0005-2 "Standard for mitigating the effects of tin whiskers in aerospace In high performance electronic systems"
	  ○ GEIA-STD-0005-3 "Performance testing for aerospace In high performance electronic interconnects Containing Lead-Free Solder and Finishes"
	• or international standards:
	  ○ IEC/TS 62647-1 "Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 1: Preparation of a lead-free control plan"
	  ○ IEC/TS 62647-2 "Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 2:

	Mitigation of deleterious effects of tin”
response	Noted. The Agency plans to cover this topic under a future task; possibly RMT.0561, ‘Update AMC 20’ for which the Terms of reference will be drafted in 2013 or a different task.

comment	*34* comment by: *Eurocopter* Subpart A - § 2.4 Failure condition classification "*Develop the system to, at least, the development assurance level equal to the failure condition classifications provided in the ETSO*" There is no direct correspondence between failure condition classifications and development assurance levels. Consequently, a different wording should be used, like: "*Develop the system to a development assurance level appropriate to the failure conditions classifications provided in the ETSO*"
response	Accepted. The corresponding paragraph has been reworded.

comment	*35* comment by: *Eurocopter* Subpart A - § 2.4 Failure condition classification The concept of acceptability of lower DAL should be clarified. The mitigation brought by installation restrictions is not understood: how can this point be managed by the aircraft manufacturer? It should be at least necessary to replace “installation restrictions” by “operational restrictions": an operational restriction may reduce a severity (e.g. a failure may be Catastrophic in IMC, while Major only in VMC), thus allowing a DAL reduction. Also, please consider that, if an equipment supplier develops COTS equipment with a lower DAL and receives an ETSO authorisation for this equipment, aircraft manufacturers may not be able to install such equipment in their aircrafts.
response	Partially accepted. Applicable guidance found in ED79A/ARP-4754A should be followed.

comment	*36* comment by: *Eurocopter* Subpart A - § 2.4 Failure condition classification The reference to AMC 25.1309 could be in some cases not relevant for helicopters under CS-27 and CS-29.
response	Accepted. The reference has been extended to all AMCs to CSxx.1309.

comment	*37* comment by: *Eurocopter* Subpart A Whereas the software and complex hardware design assurance are considered, the equipment / system level design assurance is not considered. A text in § 2.4 suggests that ED-79A/ARP 4754A may be used for system development assurance, including guidance for failure condition classifications. However: • The term "*may*" gives a great freedom for using or not ED-79A/ARP 4754A.

	• Moreover, as the text insists on the failure condition classification part and as it is included in a paragraph dedicated to failure condition classification, it may lead to using the document only for failure classification. Consequently, we suggest adding a new paragraph, dedicated to system / equipment level design assurance, with at least the following requirements: • Use of guidance of ED-79A/ARP 4754A for design assurance at system or equipment level, • Guidance for internal buses design assurance, • Guidance for cyber-security.
response	Partially accepted. ED-79A/ARP 4754A may be used as guidance for equipment development.

B. Draft Decision — I. Draft Decision ETSO — EASA European Technical Standard Order (ETSO) (ETSO-C44cA1) — Subject: FUEL FLOWMETERS p. 34-37

comment	*26* comment by: *FAA* ETSO-C44c A1 General Comment - The FAA is preparing to revise TSO-C44c. We recommend EASA take the proposed revision of the FAA TSO into account when finalizing the revision of ETSO-C44.
response	Noted. An update of ETSO-C44 from 'c' to 'd' is currently proposed be included in the next regular revision of CS-ETSO (i.e. RMT.0206; ToR planned in 2013).

comment	*27* comment by: *FAA* ETSO-C44c A1 Section 3.1.2 - The FAA has received deviation requests to use the requirements from AS407C and RTCA DO-160(multiple rev) in lieu of requirements in AS1055D. EASA may consider whether the requirements in AS1055D are necessary as minimum requirements for fuel flowmeters. The FAA is planning to revise TSO-C44c accordingly. The revised FAA TSO-C44d may include other minor revisions or clarification not addressed in the draft ETSO, based on feedback received during document coordination.
response	Noted. An update of ETSO-C44 from 'c' to 'd' is currently proposed be included in the next regular revision of CS-ETSO (i.e. RMT.0206; ToR planned in 2013).

comment	*28* comment by: *FAA* ETSO-C44c A1 Section 3.2.1 - The FAA has received deviation requests for the hazardous failure condition requirement. A lesser failure condition may be acceptable as a minimum performance standard for some applicants. The FAA is planning to revise TSO-C44c accordingly. The revised FAA TSO-C44d may include other minor revisions or clarification not addressed in the draft ETSO, based on feedback received during document coordination.

response	Accepted. The NPA text has been revised and 'minimum failure condition classification' has been removed. General reference to CS-ETSO Subpart A section 2.4 has been maintained.

B. Draft Decision — I. Draft Decision ETSO — EASA European Technical Standard Order (ETSO) (ETSO-C87a) — Subject: AIRBORNE LOW-RANGE RADIO ALTIMETER p. 46-48

comment	*13* comment by: *Garmin International* Regarding Table 1, Class A: It appears that this text was copied from the draft FAA TSO and not the published FAA TSO. Table 1 Class A calls for ED-30 Section 3.1. By calling for Section 3.1, this implies that Section 3.1.2 is also required, which is intended for Class B only. On both Class A and Class B, suggest removing the reference to Section 3.1 and explicitly call out only 3.1.1 and 3.1.2, respectively. This same comment was made on the draft FAA TSO-C87a and was accepted as a change to the published FAA TSO. Accepting this comment on the draft ETSO-C87a would align it with the published FAA TSO-C87a. The published FAA TSO-C87a lists the following for Class A: 2.1-2.8, 3.1.1, 3.2.1 (all), 3.3.1
response	Accepted The resulting text reflects the same class and applicability of ED-30 as specified within published FAA TSO-C87a in order to reflect the results of FAA TSO consultation.

comment	*14* comment by: *Garmin International* Regarding Appendix A, Section 1.3: It appears that this text was copied from the draft FAA TSO and not the published version. Suggest updating the text to the following to be consistent with the FAA published TSO-C87a: Add the following sentence to the beginning of ED-30 paragraph 2.5 to clarify that a failure detection system is required: "A failure detection system must be incorporated in the equipment to indicate to the pilot, and to any systems utilizing the radio altimeter data, **of** a failure of the radio altimeter to accomplish its intended function **because of the following conditions: (1) Loss of power, and (2) Loss of signal or altitude sensing capability when within the manufacturer's stated operating altitude range.**"
response	Accepted. Appendix 1 paragraph 1.3 resulting text is identical to FAA TSO-C87a reflecting the results of FAA TSO consultation.

B. Draft Decision — I. Draft Decision ETSO — EASA European Technical Standard Order (ETSO) (ETSO-C112d) — Subject: AIR TRAFFIC CONTROL RADAR BEACON SYSTEM/MODE SELECT (ATCRSB/MODE S) AIRBORNE EQUIPMENT p. 51-52

comment	*15* comment by: *Garmin International* Regarding Section 4: Listing minimum peak output power and optional features is not practical for an appliance label. To accurately convey the necessarily details for installation requires too much information for this space. The FAA has recognized the statement: "See Inst Mnl for Add'l Appliance Apprvls" as useful to direct installers to additional information regarding the approvals and limitations. Listing the minimum peak output power on the appliance label might give the false impression that this fully defines the minimum peak output power of the system. But the minimum peak output power is also dependant on other installation factors that cannot be conveyed on the appliance label. The lack of space is also problematic for listing the "optional additional features as provided for in ED-73E". Given the complexity and configurability of modern technology it would be appropriate to recognize these constraints and ask manufacturers to include the "See Inst Mnl…." notice on the appliance label and ensure all appliance approvals and limitations are contained therein.
response	Partially accepted. ETSO-C112d is harmonised with FAA TSO-C112d; nevertheless, text has been amended for more precision.

comment	*19* comment by: *EUROCONTROL* 1 - The title of the ETSO is the same as TSO C112d. It should be noted that the title of TSO C112d is derived from the title of document RTCA/DO-181C but the title of the equivalent EUROCAE Document ED-73E is different. Therefore as the ETSO references EUROCAE document ED-73E, the title of ETSO C112d should be derived from ED-73E title and be: "Secondary Surveillance Radar Mode S Transponder". "Air Traffic Control Radar Beacon System / Mode Select Airborne Equipment" and its associated acronym (ATCRBS) is only used in the US and is not recognised in Europe nor at ICAO level. By the way the title of ED-73E stated in § 3.1.1 is wrong; it should be "Minimum Operational Performance Specification for Secondary Surveillance Radar Mode S Transponders". 2 - As specified in TSO C112d the requirement to support Overlay Command Capability should also be included in § 3.1.1 of ETSO C112d (see TSO C112d Appendix 1 § 1.4.3.2.h). As a matter of consistency all the functions specified in TSO C112d Appendix 1 § 1.4.3.2.a to g may also be specified in ETSO C112d. 3 – § 3.2.1 Failure condition classification: the proposed text is not consistent with the text of TSO C112d (dated 06/06/2011) on which this ETSO is based (as stated in § 36 of NPA 2012-16). Unlike the ETSO, the TSO differentiates between mal-function of the function and loss of the function as follows: *"Malfunction of the function defined in paragraph 3.a of this TSO is a major failure condition. Loss of the function defined in paragraph 3.a of this TSO is a minor failure condition. Design the system to major failure condition classification."*
response	1. Accepted. The text has been changed as suggested. 2. Not accepted. ETSO-C112d is referring to ED-73E developed by Eurocae with support from

Eurocontrol, and it is not 100 % identical to DO-181E. Nevertheless, the requirements are considered equivalent. The overlay function is required through ED-73E in paragraph 3.23.2 with reference to paragraph 3.18.4.9 for Level 2 transponders as defined in paragraph 3.22.

3. Not accepted.
As stated in AMC 25-1309, a minor classification corresponds to Average Probability per Flight Hour on the order of 10-3 which leads to an equivalent Mean Time Between Failure (MTBF) of 1 000 hrs. On the contrary Commission Regulation (EU) No 1207/2011 laying down requirements for the performance and the interoperability of surveillance for the single European sky, Annex 2 Part A 6 demands a minimum MTBF of 5 000 hrs for continuity. Based on this requirement, severity of failure condition is classified major.

B. Draft Decision — I. Draft Decision ETSO — EASA European Technical Standard Order (ETSO) (ETSO-C115c) — Subject: AIRBORNE AREA NAVIGATION EQUIPMENT FLIGHT MANAGEMENT SYSTEMS (FMS) USING MULTI-SENSOR INPUTS p. 55-56

comment *5* comment by: *UK CAA*

Page No: 56
Paragraph No: ETSO-C115c Para 3.2.1 Failure Condition Classification
Comment:
The principle of specifying Failure Conditions on equipment is flawed. Failure Conditions have to be assessed at the aircraft installation level and should take into account other factors such as aircraft system architecture, Human Factors, Operational factors etc as considered within CS 25.1309. The practice of including Failure Conditions for a specific equipment appears to be common amongst a number of ETSOs, not just ETSO-C115c, but the complex nature of equipment such as FMS, which by its design is highly integrated with other airborne functions, makes it just one of a number of contributors to the overall aircraft level failure condition classification.
Justification:
It is not necessarily appropriate to apply an ETSO to equipment such as FMS which (at the OEM level) is invariably tailored to the aircraft design and envisaged operational capability. TSO/ETSO for Buyer Furnished Equipment (BFE) such as radios is fine. It takes the Minimum Operational Performance Standards/Specifications (MOPS) and ensures interoperability in terms of performance, functionality and design assurance. Trying to justify the same for large air transport FMS is not so obvious and does not remove the need for additional Part 25 requirements such as those invoked through the CS and the AMC. It is therefore not appropriate to apply an ETSO to complex equipment such as FMS, nevertheless industry (Honeywell, Rockwell Collins and CMC) pursued RTCA DO-283A, which will be amended by RTCA SC-227/ EUROCAE WG-85.
Proposed Text:
Notwithstanding the above, an ETSO does need to provide some indication or guidance as to the "expected" aircraft level Failure Condition that will be derived from installing an FMS within an aircraft to perform certain operations. How else would the FMS equipment designer know what level of software and electronic hardware design assurance to apply in their equipment development? However, UK CAA would not support making prescriptive statements as to the Software and Hardware Design Assurance Level (DAL) that should be applied, but the

	Functional Hazard levels that are mentioned could be indicated as the "expected" aircraft level events when installing an FMS in a large air transport aircraft be it for operations of RNP ≥ 0.3 or RNP <0.3. The risk therefore falls to the equipment manufacturer and the aircraft installer if the DAL is insufficient to support the aircraft level classification.
response	Partially accepted. The resulting text of CS-ETSO, Subpart A, Section 2.4 has been updated for clarification.

comment	*11* comment by: *FAA* For 3.2.1 Failure Condition Classification: ETSO-C115c states the system should be designed such that loss of vertical guidance for RNP >= 0.3 and for RNP < 0.3 is a minor failure condition. These failure condition classifications of the proposed ETSO do not align with AMC 20-26, which requires the system to be designed to meet at least a hazardous failure condition for the loss of vertical guidance for RNP operations less than RNP 0.3 and a major failure condition for loss of vertical guidance for RNP operations where the missed approach is less than RNP 1.0. This incompatibility should be addressed to ensure the ETSO provides a value for those seeking RNP AR approvals.
response	Accepted. Dedicated requirements for failure conditions classification have been deleted and reference to navigation specifications for failure conditions classification has been added.

comment	*16* comment by: *DGAC France* Although this ETSO is based on the FAA TSO, DGAC France does not agree with what is developped in the following paragraph: *"b. Failure Condition Classifications. The failure condition of the function defined in 3.a* *of this TSO is as follows. Design the system to the appropriate failure condition classification(s).* *(1) RNP ≥ 0.3.* *(a) Malfunction is a major failure condition for misleading lateral or vertical guidance.* ***Loss of the function defined in paragraph 3.a of this TSO is a major failure condition for lateral guidance*** *and a minor failure condition for vertical guidance.* *(2) RNP <0.3.* *(a) Malfunction is a hazardous (severe-major) failure condition for misleading lateral or vertical guidance****. Loss of the function defined in paragraph 3.a of this TSO is a hazardous (severe-major) failure condition for lateral guidance*** *and a minor failure condition for vertical guidance."* As the FMS is part of a function, to add failure condition classification requirement at the system level is not satisfying. The function will be realized through the use of different systems such as: positioning sensors, computation of the lateral/ vertical guidance, display of the position, deviations indicators, FD/AP. There will be different way to meet the objective in accordance with ARP 4754. FMS is just a piece of the function. Classification of an aircraft failure condition must be assessed in light of aircraft

	integration and architecture, knowledge of human factors, operating procedures, training and others as per 25.1309. Moreover some of these requirements are not consistent with AC 20-138C chapter 11-2 neither AMC 20-27 or TGL10 ... The Loss of the LNAV guidance is a minor failure condition if the operator can revert to a different navigation system. Finally such requirement as "the hazardous failure condition for the loss" will be difficult to fulfill with only one FMS (For such requirement we must **not** have a common failure mode, it will certainly entail the need to get 2 systems connected on 2 different electrical buses). So that it is more appropriate to have such requirement in an AC or AMC or CS rather than in an ETSO. If the purpose behind this requirement is to get a DAL B FMS (to cover integrity aspects) for RNP AR APCH, it would be more appropriate to write the E/TSO requirement in that prescriptive way: "*Software and complex hardware components have to be designed and developed in level B to meet RNP AR APCH performance requirements*."
response	Partially accepted. Dedicated requirements for failure conditions classification have been deleted and reference to navigation specifications for failure conditions classification has been added.

comment	*20* comment by: *EUROCONTROL* Section 3.2.1 Failure condition classification: DO 283A is for RNP and non-RNP FMS. The failure condition classification as specified does not address the non-RNP FMS. How are these FMS's being addressed? It is proposed to refer to the type of operation for which the FMS is to be developed or to specify the RNAV case separately.
response	Accepted. Dedicated requirements for failure conditions classification have been deleted and reference to navigation specifications for failure conditions classification has been added.

B. Draft Decision — I. Draft Decision ETSO — EASA European Technical Standard Order (ETSO) (ETSO-C121b) — Subject: UNDERWATER LOCATING DEVICE (ACOUSTIC) (SELF-POWERED) p. 57-58

comment	*2* comment by: *Adrian BURROWS* Reference to the SAE document should read "AS8045A" not "AS 8045A" (page 57) or "AS 8045a" (page 58). This is then also consistent with the reference made to SAE AS6254 on page 82 for the low-frequency device.
response	Accepted.

B. Draft Decision — I. Draft Decision ETSO — EASA European Technical Standard Order (ETSO) (ETSO-C161a A1) — Subject: GROUND-BASED AUGMENTATION SYSTEM (GBAS) POSITIONING AND NAVIGATION p. 63-64

EQUIPMENT

comment	*18* comment by: *EUROCONTROL* 1 - There must have been a mixed up with previous ETSO C161 and ETSO C161a versions. Text from ETSO C161a is to be reused. No further editorial seems necessary when considering ETSO C161a. 2 - In the case of loss of GBAS capability during approach, the failure classification should be major and not minor (increase of pilot workload due to go around phase).
response	1. Accepted The proposal to amend C161a is now withdrawn. 2. Noted. This comment may be taken into account in the next rulemaking task on CS-ETSO (RMT.0206).

comment	*21* comment by: *AIRBUS* In § 3.1.1, please modify the reference of the minimum performance standard by RTCA/DO-253**C**. Reason: Version C is the latest version available of this standard.
response	Accepted. the proposal to amend C161a is now withdrawn.