European Aviation Safety Agency

# Explanatory Note to Decision 2016/006/R

# Integrated modular avionics

# CS-ETSO Amendment 10

RELATED NPA/CRD 2014-23 — RMT.0456 — 25.4.2016


**EXECUTIVE SUMMARY**

This Decision addresses an efficiency, level playing field, technological and economic issue related to the introduction of the European technical standard for the integrated modular avionics (IMA) platform and modules.

The specific objective of this Decision is to issue an ETSO-2C153 on the IMA platform and modules, to improve the efficiency and the transparency of the certification process. The ETSO-2C153 will offer the IMA platform/modules manufacturers, the possibility to obtain ETSO authorisations at platform/modules level, independent of the aircraft.

ETSO-2C153 is different from the corresponding FAA TSO-C153, therefore, it will be part of Index 2 of CS-ETSO Subpart B.


| **Applicability** | |
|---|---|
| Affected regulations and decisions: | ED Decision 2003/10/RM (CS-ETSO) |
| Affected stakeholders: | — certification authorities;<br>— IMA system integrators;<br>— application suppliers;<br>— platform and module suppliers;<br>— ETSOA holders. |
| Driver/origin: | Efficiency/level playing field/technological |
| Reference: | |

| **Process map** | |
|---|---|
| Concept Paper: | Yes |
| Terms of Reference (Issue 2): | 24.10.2013 |
| Rulemaking group: | No |
| RIA type: | Light |
| Technical consultation during NPA drafting: | Yes |
| Publication date of the NPA: | 10.9.2014 |
| Duration of NPA consultation: | 3 months |
| Review group: | No |
| Focused consultation: | Yes |
| Publication date of the Opinion: | N/A |
| Publication date of the Decision: | 2016/Q1 |


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# 1. Procedural information

## 1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed ED Decision 2016/006/R in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the Agency's Rulemaking Programme under RMT.0456. The scope and timescale of the task were defined in the related Terms of Reference (see process map on the title page).

The draft text of this Decision has been developed by the Agency based on the input of Rulemaking Group RMT.0456. All interested parties were consulted through NPA 2014-23[3]. 206 comments were received from interested parties, including industry and national aviation authorities (NAAs).

The Agency reviewed the comments received during the consultation process. Comments received and the Agency's responses thereto are presented in Comment-Response Document (CRD) 2014-23[4].

The final text of this Decision with the certification specifications (CSs) has been developed by the Agency based on the outcome of several focused consultations.

The process map on the title page summarises the major milestones of this regulatory activity.

## 1.2. Structure of the related documents

Chapter 1 contains the procedural information related to this task. Chapter 2 explains the core technical content. The text of ETSO-2C153 is annexed to the ED Decision.

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1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

2 The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See EASA Management Board (MB) Decision 01-2012 of 13 March 2012 amending and replacing MB Decision 08-2007 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ('Rulemaking Procedure').

3 In accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

4 http://easa.europa.eu/document-library/comment-response-documents

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# 2. Explanatory Note

## 2.1. Overview of the issues to be addressed

The use of integrated modular avionics (IMA) has rapidly expanded in the last two decades and is expected to progress even more in the future. Today, IMA can be found in all categories of aircraft, including the aircraft types certified by the Agency. Without constituting an official definition, IMA is commonly defined as a shared set of flexible, reusable and interoperable hardware and software resources that, when integrated, form a 'system' that provides computing resources and services, designed and verified to meet a defined set of functional, safety and performance requirements, as well as to host applications performing aircraft functions.

The concept 'one computer – one function' is now replaced by a set of non-system-specific and highly configurable computers. Multiple systems' applications are executed on the same platform and network.

IMA would allow recurrent development and maintenance cost savings, which could be tailored to the needs of the organisations.

To improve efficiency and transparency of the certification process, and considering the EU regulatory framework, the Agency proposed NPA 2014-23 containing ETSO-2C153 on 'IMA Platform and Modules'. The proposal diverged from FAA TSO-C153, therefore ETSO-2C153 is included into Index 2 of CS-ETSO Subpart B. While some stakeholders requested the Agency to remain harmonised with the US Federal Aviation Administration (FAA), more stakeholders actively supported the proposed text.

The Agency hereby provides ETSO-2C153 to align EU standards specifications with the latest industry developments in the field of IMA, taking into account the specificities of the EU regulatory framework.

**Note**: Currently, the EASA/FAA ETSO-2C153/TSO-C153 are among the ETSO/TSO articles that are not covered under reciprocal acceptance, therefore, validation is required by the importing authority. The 'Technical Implementation Procedures for Airworthiness and Environmental Certification' between FAA and EASA[5] provides further details.

## 2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2. The specific objective of this proposal is, therefore, to issue an ETSO for IMA platform and modules to reflect the current state of the art, and ensure a cost-efficient certification process.

## 2.3. Outcome of the consultation

206 comments from 17 commentators were received on NPA 2014-23, and the individual responses to each one of them were published in CRD 2014-23. The nature of the comments received ranges from specific technical comments, to comments on the IMA certification strategy as well as others on the regulatory impact assessment (RIA). The majority of the comments submitted were either accepted or partially accepted.

[5] http://easa.europa.eu/document-library/bilateral-agreements/eu-usa

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## 2.4. Summary of the regulatory impact assessment (RIA)

Five options were initially considered in the RIA, however, only four of them have been further taken into acount.

| Option No | Short title | Description |
|---|---|---|
| 0 | Do nothing | Baseline option (no change in rules; issues remain as outlined in the above analysis). |
| 1 | limited MPS | Follow the approach of FAA TSO-C153 (restricted to Hardware modules and limited Minimum Performance Standards (MPS) in ETSO-2C153) and address performance during integration at aircraft level. No link between aircraft certification projects and ETSO authorisation (ETSOA). |
| 2 | Deferred ETSOA | Follow the approach of FAA TSO-C153 (limited MPS) in ETSO-2C153 and address performance during integration at aircraft level. Additionally, grant ETSOA only after IMA equipment has been accepted in the context of a (S)TC project. |
| 3 | MPS | Publish ETSO-2C153 on 'IMA platform modules' (based on a modified FAA TSO-C153, in particular MPS for various IMA Classes). No link between ETSOA and any (S)TC project. After the ETSOA, the IMA components could be used during (S)TC projects without demonstrating the IMA performances (i.e. giving 'credit' to the ETSOA). |

All the options were analysed in NPA 2014-23. Option 3 (publish ETSO-2C153 in Index 2 of CS-ETSO and include in it minimum performance specifications), had the highest total score from the safety, environmental, social and economic point of view. The score has been reflected in NPA 2014-23. Therefore, Option 3 is the preferred option.

## 2.5. Overview of the amendments

Annex I (Preamble) lists the CS-ETSO Subparts and Indexes affected by this amendment.

Annex II contains the updated CS-ETSO Indexes as well as the newly introduced ETSO-2C153 with its structure as detailed below.

### 2.5.1 Core section of ETSO-2C153

The proposed ETSO-2C153 contains the minimum performance, standards for data and environmental qualification requirements for various IMA modules, which are parts designed to compose an IMA platform. Satisfying the standards for one or more modules would allow the holder of the ETSO

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authorisation to use the ETSO-2C153 marking and issue the declaration of conformity (i.e. EASA Form 1) for each produced unit.

ETSO-2C153 is composed of a core section and four appendices. Since ETSO 2C153 differs significantly from the corresponding FAA TSO-C153, it will be inserted in Index 2 of CS-ETSO Subpart B.

The core section follows the format of all other ETSOs, comprising five paragraphs, respectively, on applicability, procedures, technical conditions, marking and reference documents.

### 2.5.2 Appendix 1 to the proposed ETSO-2C153

Appendix 1 to the proposed ETSO-2C153 contains a descriptive overview of the IMA (Chapter 1), a list of applicable definitions (Chapter 2), the definitions of the classes of the intended functions (Chapter 3) and, finally, an illustrative example of an IMA platform using modules (Chapter 4).

In particular, seven function classes are identified in Chapter 3:

(a) Class RH (rack housing);

(b) Class PR (processing);

(c) Class GP (graphical processing);

(d) Class DS (data storage);

(e) Class IF (interface);

(f) Class PS (power supply); and

(g) Class DH (display head).

### 2.5.3 Appendix 2 to the proposed ETSO-2C153

Appendix 2 to the proposed ETSO-2C153 contains two introductory pages establishing the principle of the minimum performance specifications (MPSs), as well as the naming convention and the verification procedures.

Furthermore, it contains eight subappendices (2.1–2.8) describing in detail the MPS with which the applicant for an ETSO authorisation shall comply.

Subappendix 2.1 contains 'common' standards applicable to all IMA modules. It is structured in a way to first define the purpose and scope, and then list the standards for the performance as well as the verification procedures and test requirements.

Subappendix 2.2 on 'Class RH' also starts with a paragraph on purpose and scope. Furthermore, it contains parts related to standards and paragraph 6 on the verification procedure.

The same structure is used in the following subappendices, respectively, covering the remaining classes listed in Chapter 2.5.2 above.

### 2.5.4 Appendix 3 to the proposed ETSO-2C153

Appendix 3 to the proposed ETSO-2C153 contains standards on the data to be submitted by the applicant with reference to European Organisation for Civil Aviation Equipment (EUROCAE) ED-124 including the user guide and installation manual.

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### 2.5.5 Appendix 4 to the proposed ETSO-2C153

Appendix 4 to the proposed ETSO-2C153 contains standards on the environmental qualification of the various IMA modules referring to ED-14/DO-160, as appropriate.

### 2.5.6 Updated Index 2 of CS-ETSO Subpart B

Index 2 of CS-ETSO Subpart B has been updated to include the new ETSO-2C153 (NPA 2014-23, RMT.0456). The indexes of CS-ETSO Subpart B will subsequently be updated at the next CS-ETSO amendment to reflect the outcome of NPA 2015-02 (RMT.0206) on 'Systematic review and transposition of existing FAA TSO standards for parts and appliances into EASA ETSOs'.

### 2.5.7 Changes since the publication of the NPA

The changes highlighted below do not represent an exhaustive list of the changes made compared to the text proposed by the NPA, rather a high-level review of these changes. They are the result of the comments received during the public consultation of the NPA.

The core section of the ETSO-2C153 changes includes some rewording, note additions (i.e. the Note in 3.2.2.1) and deletions (e.g. a paragraph in 4.2).

In Appendix 1 to ETSO-2C153, a definition of 'Equivalence class' was removed and another one ('Resources/Shared resources') was added. Some notes have also been added (e.g. on the 'Usage domains').

In Appendix 2 to ETSO-2C153, the paragraph on 'Convention naming' has been updated.

Various changes were applied to Chapter 2 of Appendix 2.1. Additionally, the table containing the IMA module characterisation categories has been updated. The corresponding terminology has also been added to provide additional information on some IMA module characterisation items.

Changes to the paragraph numbering were applied to Appendix 2.2. Various other changes have been made to Appendix 2.2 through Appendix 2.8.

For Appendix 3 to ETSO-2C153, some further examples of information to be included in the 'User guide' have been added to Chapter 2 .The information on 'Usage domain' has been removed from this Appendix since it is already defined in Chapter 2 'Definitions' of Appendix 1.

For Appendix 4 to ETSO-2C153, the environmental-qualification table has been updated.

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# 3. References

## 3.1. Related regulations

None.

## 3.2. Affected decisions

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

## 3.3. Reference documents

— FAA Technical Standard Orders (TSO)-C153 — Integrated Modular Avionics Hardware Elements, 5 June 2002[6]

— FAA Advisory Circular (AC) 20-170 (including Change 1) — 'Integrated Modular Avionics Development, Verification Integration, and Approval, Using RTCA/DO-297 and Technical Standard Orders-C153[7], 21 November 2013

— EUROCAE ED-124 — Integrated Modular Avionics (IMA) Development Guidance and Certification Considerations, June 2007

— EUROCAE ED-12C — Software Considerations in Airborne Systems and Equipment Certification, January 2012

[6] http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgTSO.nsf/0/c07999442e496ada86256dc700717db5/$FILE/C153.pdf

[7] http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_20-170_w-chg_1.pdf

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