Software and AEH Updates

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Overview

- Terminology
- Software and Airborne Electronic Hardware (AEH) in TSO articles
- Scalability of development assurance levels
- Status of software and AEH policy
- Issue Papers for new, novel technologies

Terminology

- **Airborne Software**
  - Collection of instructions, procedures, and documentation that perform different tasks on a computer system installed in airborne systems and equipment
  - More simply stated, it is the code executed on the microprocessor

Terminology

- **Airborne Electronic Hardware (AEH)**
  - Electronic device such as a programmable logic device (PLD), field programmable gate array (FPGA), or application specific integrated circuit (ASIC) installed in airborne systems and equipment
  - AEH devices give the user more flexibility when performing specific tasks and execute faster than software code running on a general-purpose microprocessor
  - The term AEH includes both custom devices and commercial off-the-shelf (COTS) devices

Software in TSO Template

3. REQUIREMENTS …

e. Software Qualification. If the article includes software, develop the software according to RTCA, Inc. document RTCA DO-178C/EUROCAE ED-12C, Software Considerations in Airborne Systems and Equipment Certification, issued in December 2011/January 2012 respectively, including referenced supplements as applicable, to at least the software level consistent with the failure condition classification defined in paragraph 3.b of this TSO. You may also develop the software according to RTCA DO-178B / EUROCAE ED-12B, issued in December 1992, if you follow the guidance in AC 20-115D, Airborne Software Development Assurance Using EUROCAE ED-12( ) and RTCA DO-178( ), dated July 21, 2017.

If the article includes software…

- **Develop the software according RTCA/DO-178C and all applicable supplements**

OR

- **Develop the software according to RTCA/DO-178B if you follow the guidance in AC 20-115D**

Why DO-178C OR DO-178B?

- **DO-178C and DO-178B are similar in format and content**
- **DO-178C provides the interface to supplements that address certain software development strategies**
  - Model-based development (MBD)
  - Object-oriented (OO) technology
  - Formal methods (FM)

Why DO-178C OR DO-178B?

- **DO-178B is still an acceptable MOC in many cases**
- **AC 20-115D provides specific guidance for when DO-178B can be used for new development and modifications**
- **Harmonized with EASA AMC 20-115D**

Why not other DO-178 Revisions?

- **Older TSOs may reference DO-178, DO-178A, or not refer to software at all**
- **DO-178 and DO-178A are significantly different from DO-178B and DO-178C in format and content**
- **Do not support current installation requirements.**
- **Use of a later version of DO-178 is documented as a deviation, but the deviation can be granted by the certification branch**

AEH in TSO Template

3. REQUIREMENTS …

f. Electronic Hardware Qualification. If the article includes airborne electronic hardware, and the failure condition of paragraph 3.b.(1) of this TSO applies, then develop the component according to RTCA DO-254 / EUROCAE ED-80, Design Assurance Guidance for Airborne Electronic Hardware, issued in April 2000, and AC 20-152A, Development Assurance for Airborne Electronic Hardware, issued in October 2022, to at least the development assurance level consistent with the failure condition classification defined in paragraph 3.b.(1) of this TSO.

If the article includes AEH…

- **Develop the component according to RTCA/DO-254**

AND

- **Develop the component according to AC 20-152A, Development Assurance for Airborne Electronic Hardware, issued in October 2022**

Why DO-254 AND AC 20-152A?

- **DO-254 has not been updated since it was published in 2000**
- **AC 20-152A provides additional guidance and clarifications to supplement DO-254**
  - Custom Device Development (PLD/FPGA/ASIC)
  - Commercial-off-the-Shelf Intellectual Properties (COTS IP) within a custom device
  - Use of Commercial-off-the-Shelf (COTS) devices
  - Development of circuit board assemblies (CBA)
- **Harmonized with EASA AMC 20-152A**

Scalability of Software/AEH

- **The objectives in DO-178C and DO-254 are risk-based**
  - The software/AEH level determines which objectives the applicant must satisfy
  - The more safety critical the software or AEH function, the more objectives apply

Scalability of Software/AEH

- **Develop the software/AEH at least the level consistent with the failure condition classification defined in the TSO**
- **Development to a lower software/AEH level may be justified for certain cases**

Scalability of Software/AEH

- **DAL corresponds to classes of failure conditions**
  - Level A — Catastrophic
  - Level B — Hazardous/Severe-Major
  - Level C — Major
  - Level D — Minor
  - Level E — No Effect

Scalability of Software/AEH

- **AC 23.1309E and PS-ASW-27-15 allow for lower DAL for Class I and II (Amdt 23-64 Level 1 and 2) aircraft**
  - Level C — Catastrophic
  - Level C — Hazardous/Severe-Major
  - Level C — Major
  - Level D — Minor
  - Level E — No Effect

Scalability of Software/AEH

- **Development to a lower level may be justified based on intended installation**
- **May have installation restrictions**
- **Must be documented in the installation manual**

Software Policy Development

- **Joint FAA and EASA development of AC/AMCs**
  - AC/AMC 20-115D (Software)
  - AC/AMC 20-152A (Airborne Electronic Hardware)
  - AC/AMC 20-189 (Open Problem Reports)
- **Text of harmonized AC and AMC are technically equivalent**
- **Ensures mutual acceptance**

Software Policy Development

- **AC 20-193, *Multi-core Processors***
  - Developed jointly with EASA
  - Pending final FAA signature
- **AC 20-170A, *Integrated Modular Avionics***
  - Developed to be harmonized with AMC 20-170A
  - Resolving editorial comments

Issue Papers (IPs) for TSO Projects

- **IPs for TSO projects are allowed by Order 8110.112A**
- **IPs typically document issues at the aircraft level**
- **Order does not specifically address the process for an IP at the TSO article level**

Issue Papers for TSO Projects

- **Prototyping process to use IPs for new or novel features**
  - Multi-core Processors
  - Artificial Intelligence/Machine Learning
- **Address these issues while the TSO article is under development instead of retrospectively at installation**

Issue Papers for TSO Projects

- **Allow the substantiating data to be accepted by the FAA in the TSOA letter**
- **Substantiating data can be re-used without generating new IPs for each new installation**

Questions?