



# TECHNICAL REPORT

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## (R) Requirements for a COTS Assembly Management Plan

### RATIONALE

EIA-933 Rev. B was published in March 2015. It is out of date due to technology progress.

### FOREWORD

This document defines the requirements for developing a Commercial-Off-The-Shelf (COTS) Assembly Management Plan (CAMP) to integrate COTS electronic assemblies into aerospace, defense, and high-performance (ADHP) electronic equipment and systems, in such a manner that the performance and reliability of the ADHP equipment and systems are assured. This is accomplished by documenting and implementing the processes required in Clause 3 of this document.

In this document, a COTS assembly is defined as: *"An assembly developed by a supplier for multiple customers, whose design and configuration is controlled by the supplier's or an industry specification."* Therefore, the organization that integrates the COTS assembly into the ADHP equipment or system is the owner of the CAMP, hereinafter called the Plan. It is the responsibility of the Plan owner to develop and implement a Plan that satisfies the requirements of this document. The requirements of Clause 3 are not intended to be levied on the COTS assembly supplier; rather they are the responsibility of the organization that integrates the COTS assembly into the ADHP equipment or system (hereinafter called the System). See Figure 1 for an illustration of the aerospace supply chain, with respect to COTS assemblies.

This document is intended for use by ADHP equipment and system integrators, manufacturers, subcontractors, maintenance facilities, etc., to develop and implement their own Plans. It also is intended for use by regulatory and certification agencies to evaluate applications for certification of Systems containing COTS assemblies.

This document states objectives to be accomplished, in the form of documented processes to satisfy the requirements for COTS assemblies in Systems. This document does not specify how tasks are to be performed, specific tests to be performed, data to be collected, or reports to be issued. Those who prepare Plans in compliance with this document are encouraged to document processes that are the most efficient and effective for them and their customers to accomplish the objectives of this document. To allow flexibility in implementing, maintaining, and updating the documented processes, Plan owners are encouraged to refer to their own internal processes, as opposed to including the detailed process descriptions within their Plans.

The Plan documents the processes that the Plan owner has available or that will be developed to address the requirements of this document. For each instance of COTS assembly integration into a System, the Plan owner selects which of the documented processes will be used, based on the System requirements and the application of the COTS assembly in the System. The Plan owner then prepares a COTS Assembly Integration Report, using the format of Appendix A, or an equivalent.

A Plan owner may prepare a single Plan, and use it for all relevant products supplied by the Plan owner; alternatively, the Plan owner may prepare a separate Plan for each relevant product, program, market segment, or customer.

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## 1. SCOPE

This document applies to the development of Plans for integrating and managing COTS assemblies in electronic equipment and Systems for the commercial, military, and space markets; as well as other ADHP markets that wish to use this document.

For purposes of this document, COTS assemblies are viewed as electronic assemblies such as printed wiring assemblies, relays, disk drives, LCD matrices, VME circuit cards, servers, printers, laptop computers, etc. There are many ways to categorize COTS assemblies<sup>1</sup>, including the following spectrum:

- At one end of the spectrum are COTS assemblies whose design, internal parts<sup>2</sup>, materials, configuration control, traceability, reliability, and qualification methods are at least partially controlled, or influenced, by ADHP customers (either individually or collectively). An example at this end of the spectrum is a VME circuit card assembly.
- At the other end of the spectrum are COTS assemblies whose design, internal parts, materials, configuration control, and qualification methods are not controlled, or controllable, in any way by ADHP customers (either individually or collectively). An example is a disk drive targeted for an industry other than ADHP use. It is critical for the Plan owner to (1) review and understand the design, internal parts, materials, configuration control, reliability and qualification methods of all “as-received” COTS assemblies<sup>3</sup>, and their capabilities with respect to their application in the intended System and environment; (2) identify risks, and where necessary, (3) take additional action to mitigate the risks associated with the performance and reliability of the COTS assembly in the ADHP system.

## 2. REFERENCES

For dated references, only the revision cited applies. For undated references, the latest revision of the referenced document (including any amendments) applies.

1. Parts Management, MIL-STD-3018.
2. Process Management for Avionics - Preparation of an Electronic Components Management Plan, IEC TS 62239-1, International Electrotechnical Commission.
3. Standard for Preparing an Electronic Components Management Plan, ANSI/EIA-STD-4899, TechAmerica.
4. Design Assurance Guidance for Airborne Electronic Hardware, RTCA DO-254, Radio Technical Corporation of America.
5. Guidelines for Development of Civil Aircraft Systems, ARP4754A, SAE International.
6. Process management for avionics - Electronic components capability in operation - Part 1: Temperature uprating, IEC TR 62240-1, International Electrotechnical Commission.
7. Long-term Storage of Electronic Devices, TechAmerica GEIA-STD-0003.
8. Environmental Conditions and Test Procedures for Airborne Equipment, RTCA DO-160, Radio Technical Corporation of America.

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<sup>1</sup> The distinction between an electronic component and an electronic assembly is not always recognized or agreed upon by the various industries involved; for example, filters, contactors, power supply modules, relays, magnetic assemblies, etc., may be considered as either components or assemblies. In each application, it is a recommended practice for the user of this document to clarify this distinction.

<sup>2</sup> Requirements for managing the electronic components within electronic assemblies may be found in References 1 through 3, which describe the ADHP Electronic Management Program (ECMP). In some cases, it may be appropriate to view the COTS assembly as a component that can be managed with ECMP processes, using the requirements of References 1 through 3.

<sup>3</sup> It is noted that some assemblies are completely within the control of the aerospace customer, but they are not considered COTS, and are not addressed in this document.

9. Process Management for Avionics - Atmospheric Radiation Effects, IEC 62396, Parts 1-5, International Electrotechnical Commission.
10. Measurement and Reporting of Alpha Particle and Terrestrial Cosmic Ray-Induced Soft Errors in Semiconductor Devices, JESD89, JEDEC®.
11. Integrated Circuits - Measurement of electromagnetic emissions, integrated circuits, IEC 61967, parts 1-8, International Electrotechnical Commission.
12. Derating of Electronic Components, TechAmerica GEIA-STD-0008.
13. Application Thermal Derating Methodologies, JEP149, JEDEC.
14. Electronic Reliability Design Handbook, MIL-HDBK-338.
15. General Guidelines for Electronic Equipment, MIL-HDBK-454.
16. Failure Mechanisms and Models for Semiconductor Devices, JEP122, JEDEC®.
17. Early Life Failure Rate Calculation Procedure for Electronic Components, JESD74, JEDEC®.
18. Physics of Failure Reliability Predictions, ANSI/VITA 51.2-2011, VITA.
19. Guidelines for Preparing Reliability Assessment Plans for Electronic Engine Controls, ARP5890, SAE International.
20. Reliability Prediction of Electronic Equipment, MIL-HDBK-217.
21. Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment, ARP4761, SAE International.
22. Standard Practice System Safety, MIL-STD-882.
23. Standard Best Practices for System Safety Program Development and Execution, GEIA-STD-0010, TechAmerica.
24. Configuration Management Standard, EIA-649, TechAmerica.
25. Quality Management Systems - Requirements for Aviation, Space and Defense Organizations, AS9100, SAE International.
26. Quality Management System - Requirements, SAI AS/NZS ISO 9001.
27. Performance Standard for Aerospace and High Performance Electronic Systems Containing Lead-free Solder, GEIA-STD-0005-1, TechAmerica.
28. Process Management for Avionics - Aerospace and Defence Electronic Systems Containing Lead-free Solder - Part 1: Preparation of a Lead-free Control Plan, IEC TS 62647-1, International Electrotechnical Commission.
29. Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition, AS5553, SAE International.
30. Counterfeit Material; Assuring Acquisition of Authentic and Conforming Material, AS6174, SAE International.
31. Standard for Preparing a DMSMS Management Plan, STD0016, SAE International.

### 3. REQUIREMENTS

A COTS Assembly Management Plan compliant to this document includes documented processes that are available for use by the Plan Owner to accomplish steps (a) through (d), listed below, for each of the requirements in sub-clauses 3.1 through 3.16:

- a. Understand the System requirements allocated to the COTS assembly.
- b. Understand the capability of the “as-received” COTS assembly, with respect to the allocated System requirements.
- c. Prepare a System risk analysis, based on a comparison of (a) and (b), above; and document the method of risk analysis, including criteria used.
- d. Document appropriate risk mitigation methods<sup>4</sup> available for use to assure that the COTS assembly accomplishes its allocated System requirements reliably throughout the specified system lifetime in the intended environment.

The above steps correspond to the columns labeled (a) through (d) in Appendix A, which is a format that can be used for each instance of COTS Assembly integration to demonstrate compliance to this Standard.

*(The requirements in this Clause can be satisfied only by the Plan owner, and are not intended to be flowed down to a supplier, subcontractor, or other organization that is not responsible for the integration of the COTS assembly into the System.)*

*(It is acknowledged that not all the requirements listed below will be applicable for all programs. See the note in Appendix A for further information.)*

#### 3.1 Functionality

The documented processes shall assure that the COTS assembly performs the function(s) allocated to it by the System design, reliably throughout the specified system lifetime, using appropriate risk mitigations as required. Allocated functions include, but are not limited to, inputs and outputs for electrical, mechanical, optical, hydraulic, and pneumatic signals, duty cycle, etc.

*(Refer to References 4 and 5 for guidance on design and development of aerospace electronic Systems, including allocation of System requirements.)*

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<sup>4</sup> The intent of this Clause is for the Plan owner to document the risk mitigation methods available to the Plan owner; with the understanding that the risk mitigation methods actually employed on a given System depend on the application and the criticality of the System. Examples of risk mitigation methods include modification of the COTS assembly, redundancy and other System design methods, modification of the COTS assembly's local operating environment, increased maintenance, planned replacement, etc. More detail regarding these methods is included in Appendix B.

### 3.2 Operating, Storage, and Transportation Environmental Stresses

The documented processes shall assure that the COTS assembly accomplishes its allocated System requirements with respect to each of the operating, storage, and transportation stresses listed below, using appropriate risk migrations as required.

|        | Stress                       | Application Consideration                                                                                                                         | Applicable Standards (Ref. No.)                          |
|--------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 3.2.1  | Temperature limits           | Damage can occur when specified maximum or minimum temperature limits are exceeded during operation, storage, or transport.                       | IEC TR 62240 (6)<br>GEIA-STD-0003 (7)<br>RTCA DO-160 (8) |
| 3.2.2  | Temperature variations       | Temperature cycling over long periods of time can cause damage due to mismatches of thermal coefficients of expansion of COTS assembly materials. |                                                          |
| 3.2.3  | Heat dissipation and cooling | Proper heat dissipation and cooling methods may be required to prevent damage to COTS assemblies.                                                 |                                                          |
| 3.2.4  | Mechanical shock             | Mechanical stress limits may be exceeded when COTS assemblies are exposed to mechanical shock.                                                    |                                                          |
| 3.2.5  | Mechanical vibration         | Damage can occur due to long term exposure to certain mechanical vibration profiles.                                                              |                                                          |
| 3.2.6  | Natural radiation            | Radiation due to cosmic rays, neutrons, heavy ions, etc., may cause Single Event Effects (SEE).                                                   | IEC 62396 series (9)<br>JESD89A (10)                     |
| 3.2.7  | Induced radiation            | Damage can result from exposure to nuclear radiation.                                                                                             |                                                          |
| 3.2.8  | Moisture and corrosion       | Damage can result from exposure to moist and/or corrosive environments.                                                                           |                                                          |
| 3.2.9  | Electromagnetic capability   | Assemblies can produce electromagnetic noise through electrical transitions, and assemblies can be susceptible to electromagnetic interference.   | IEC 61967 series (11)                                    |
| 3.2.10 | Other relevant stresses      |                                                                                                                                                   |                                                          |

### 3.3 Derating

The documented processes shall assure that the de-rating criteria and methods used for the COTS assembly are appropriate for the application, using appropriate risk mitigations as required.

*(Refer to References 12 through 15 for additional guidance about de-rating.)*

### 3.4 Compatibility with System Assembly Processes

The documented processes shall assure that the COTS assembly is compatible with System assembly processes, including repair and rework, using appropriate risk mitigations as required.

### 3.5 Ageing

The documented processes shall include provisions to satisfy the ageing requirements of the System, with the integrated COTS assembly, using appropriate risk mitigations as required. This includes an application-appropriate understanding of all relevant life-limiting or wear-out failure mechanisms of the COTS assembly and its internal parts, including advanced technology semiconductor devices and other parts susceptible to degradation or early wear-out.

*(References 16 through 18 provide information that can be used to satisfy this requirement.)*