TECHNICAL REPORT

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Standard for Preparing an Electronic Components Management Plan

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TechAmerica Standard

Standard for Preparing an Electronic Components Management Plan

EIA-STD-4899-A

November 2007

TechAmerica
WHERE THE FUTURE BEGINS
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Standard for Preparing an Electronic Components Management Plan

EIA-STD-4899-A

Revision	Description of change	Date
-	Initial Release	Dec 2001
A	Updated references, definitions, and added counterfeit parts requirement. Modified screening sampling rates and other changes.	Nov 2007

Table of Contents

Page

Purpose

This document is intended to help aerospace equipment manufacturers, subcontractors, maintenance facilities, and other aerospace component users develop their own Electronic Component Management Plans (ECMPs), hereinafter also called the Plan. This document states objectives to be accomplished; it does not require specific tasks to be performed, specific 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 effective and efficient for them in accomplishing the objectives of this document. In order to allow flexibility in implementing and updating the documented processes, Plan authors are encouraged to refer to their own internal process documents instead of including detailed process documentation within their Plans.

This component management document is intended for aerospace users of electronic components. This standard is not intended for use by the manufacturers of electronic components. Components selected and managed according to the requirements of a Plan compliant to this document may be approved by the concerned parties for the proposed application, and for other applications with equal or less severe requirements.

Organizations that prepare such Plans may prepare a single Plan, and use it for all relevant products supplied by the organization, or may prepare a separate Plan for each relevant product or customer.

This publication is not intended to preclude or discourage other approaches that similarly represent good engineering practice, or that may be acceptable to, or have been accepted by, appropriate bodies. Parties who wish to bring other approaches to the attention of the formulating committee to be considered for inclusion in future revisions of this publication are encouraged to do so. It is the intention of the formulating committee to revise and update this publication from time to time as may be occasioned by changes in technology, industry practice, or government regulations, or for other appropriate reasons.

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1 Scope

This document defines the requirements for developing an Electronic Components Management Plan (ECMP), hereinafter also called the Plan, to assure customers and regulatory agencies that all of the electronic components in the equipment of the Plan owner are selected and applied in controlled processes compatible with the end application; and that the Technical Requirements detailed in **clause 5.0** are accomplished. In general the owners of a complete Electronic Components Management Plan are avionics equipment manufacturers.

2 Normative References

The following normative documents contain provisions that, through reference in this text, constitute provisions of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TR 62240, Use of Semiconductor Devices Outside Manufacturers' Specified Temperature Ranges

IEC TS 62396-1, Process management for avionics – Atmospheric radiation effect ; Accommodation of atmospheric radiation effects via single event effects within avionics electronic equipment

JEP149, JEDEC Publication, JEDEC Standard Application Thermal Derating Methodologies

JESD47, Stress-Test-Driven Qualification of Integrated Circuits

JESD94, Application Specific Qualification Using Knowledge Based Test Methodology

MIL-HDBK-263, Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, assemblies and Equipment

IEC 61340-5-1 (1998), Electrostatics – Part 5-1: Protection of Electronic Devices from Electrostatic Phenomena – General Requirements

IEC 61340-5-2 (1999), Electrostatics – Part 5-1: Protection of Electronic Devices from Electrostatic Phenomena – User Guide

3 Informative References

The following is a listing of informative references.

AS 9000 Revised 1998, Aerospace Basic Quality System Standard, Appendix 1, Society of Automotive Engineers

CDF-AEC Q100, Stress Test Qualification for Automotive-Grade Integrated Circuits, Chrysler-Delco-Ford Automotive Electronics Council

CDF-AEC Q101, Stress Test Qualification for Automotive-Grade Discrete Semiconductors, Chrysler-Delco-Ford Automotive Electronics Council

CDF-AEC Q200, Stress Test Qualification for Automotive-Grade Passive Components, Chrysler-Delco-Ford Automotive Electronics Council

EIA JESD22-A112-A, JEDEC Standard – Test Method A112-A, Moisture Induced Stress Sensitivity for Plastic Surface Mount Devices

EIA JESD22-A113-B (1999), JEDEC Standard – Test Method A113-B Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing

EIA JESD 26-A, JEDEC Standard - General Specification for Plastic Encapsulated Microcircuits for use in Rugged Applications

EN ISO 9000-1 (1994), Quality Management and Quality Assurance Standards – Part 1: Guidelines for Selection and Use

EN ISO 9000-2 (1997), Quality Management and Quality Assurance Standards – Part 2: Generic Guidelines for the Application of ISO 9001, ISO 9002 and ISO 9003

EN ISO 9000-3 (1997), Quality Management and Quality Assurance Standards – Part 3: Guidelines for the Application of ISO 9001:1994 to the Development, Supply, Installation and Maintenance of Computer Software

EN ISO 9000-4 (1993), Quality Management and Quality Assurance Standards – Part 4: Guide to Dependability Program Management. IEC/CEI 300-1

IAQS 9100 (2001) Quality systems – Aerospace – Model for quality assurance in design, development, production, installation and servicing

IEC 61967-1 (2002) Integrated circuits – Measurement of electromagnetic emissions, 150 kHz to 1 Ghz – Part 1: General conditions and definitions

IEC 61967-6 (2002) Integrated circuits – Measurement of electromagnetic emissions, 150 kHz to 1 Ghz –Part 6: Measurement of conducted emissions – Magnetic probe

IPC/JEDEC J-STD-020A (1999), Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices

ISO 9000, Quality Management and Quality Assurance Standards

ISO 9001, Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing

GEIA-STD-0002-1, Aerospace Qualified Electronic Component (AQEC) Requirements, Volume 1 – Integrated Circuits and Semiconductors.

S0001, General Requirements for Integrated Circuits, Stack International

4 Terms and Definitions

For the purpose of this standard, the following definitions apply. Plan owners may use alternative definitions consistent with convention within their company in their Plan.

Acronyms

EMC – Electromagnetic compatibility
ECMP – Electronic Management Control Plan
OEM – Original Equipment Manufacturer
IEC – International Electrotechnical Commission
ISO – International Standards Organization
DSCC – Defense Supply Center Columbus
IECQ – International Electrotechnical Commission for Quality
STACK – An international organization coordinating component issues among the members
GEIA – Government Electronic Industries Alliance
EIA – Electronic Industries Alliance
JEDEC – Semiconductor industry standards alliance
MIL-HDBK – U. S. Department of Defense handbook

4.1 avionics equipment environment: the applicable environmental conditions (as described per the equipment specification) that the equipment shall be able to withstand without loss or degradation in equipment performance during all of its manufacturing cycle and maintenance life (the length of which is defined by the equipment manufacturer in conjunction with customers).

4.2 capable: indicates that a component can be used successfully in the intended application.

4.3 certified: indicates assessment and compliance to an applicable third party standard and maintenance of a certificate and registration [i.e., JAN, IECQ, STACK].

4.4 characterization: the process of testing a sample of components to determine the key electrical parameter values that can be expected of all produced components of the type tested.

4.5 component application: the process that assures that the component meets the design requirements of the equipment in which it is used.

4.6 component manufacturer: the organization responsible for the component specification and its production.

4.7 component obsolescence management: the range of management actions taken to avoid or resolve the effects of components not being procurable due to the manufacturer(s) ceasing production. Component obsolescence management should be

considered an element of risk management. (See Component Availability and Risk Assessment).

4.8 component qualification: the process used to demonstrate that the component is capable of meeting its specification for all the required conditions and environments.

4.9 component quality assurance: all activities and processes to provide adequate confidence that each individual component meets the performance and environmental requirements.

4.10 component selection: the process of choosing a specific component for a specific application.

4.11 component standardization: the process of developing and agreeing on (by consensus of decision) uniform engineering criteria for products and methods for achieving compatibility, interoperability, interchangeability, or commonality of material. Standardization is used to reduce proliferation of parts in inventory

4.12 dependability: the capability of a product that enables it to achieve the specified functional performance at the appropriate time and for the planned duration, without damage to itself or its environment.

4.13 distributor: an organization contractually authorized by a manufacturer to store, split, repack, and distribute completely finished components that have been declared by the manufacturer as conforming to their specifications. The distributor is responsible for providing any technical information and traceability information supplied by the component manufacturer.

4.14 Electronic Components Management Plan (ECMP): an equipment manufacturer's document that defines the processes and practices for applying components to an equipment or range of equipment. Generally, it addresses all relevant aspects of controlling components during system design, development, production, and post-production support.

4.15 electronic components: electrical or electronic devices that are not subject to disassembly without destruction or impairment of design use. They are sometimes called *electronic parts*, or *piece parts*. Examples are resistors, capacitors, diodes, integrated circuits, hybrids, application specific integrated circuits, wound components, and relays.

4.16 electronic equipment: an item, produced by the Plan owner, that incorporates electronic components. Examples are end items, sub-assemblies, line-replaceable units, and shop-replaceable units.

4.17 may: indicates a course of action that is permissible within the limits of this document

4.18 obsolete component: a component, which is no longer manufactured, and may or may not still be available.

4.19 package type: a generic package family describing the physical outline and lead style. Examples are plastic quad flat-package, ball grid array, chip scale package, SOIC package, SOT23, etc.

4.20 plan owner: the original design authority responsible for all aspects of the delivered equipments' design, functionality, and reliability in the intended application. The plan owner is responsible for writing and maintaining their specific ECMP.

4.21 risk: a measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints.

4.22 risk management: the act or practice of dealing with risk. It includes planning for risk, assessing (identifying and analysing) risk areas, developing risk handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program.

4.23 shall: indicates a requirement that is mandatory.

4.24 should: offers a guideline or recommendation that might be used or helpful to assure compliance to this document or to an ECMP.

4.25 single event effect: the radiation response of a component caused by the impact of galactic cosmic rays, solar enhanced particles, and/or energetic neutrons and protons. The range of responses can include both non-destructive (e.g., upset) and destructive (e.g., latch-up or gate rupture) phenomena.

4.26 subcontractor: a person or entity to whom the holder of obligations under a contract has delegated part or all of such obligations.

4.27 substitute component: a component used as a replacement in equipment after the equipment design has been approved. (In some contexts, the term "alternate component" is used to describe a substitute component that is "equal to or better than" the original component.)

4.28 validation: the method of qualifying components by the equipment manufacturer when no in-service data from prior use is available and there is no manufacturer's qualification data to analyse.

4.29 will: expresses a declaration of intent to be compliant to this document.

5 Technical Requirements

The Plan shall document the processes used by the Plan owner to accomplish the following requirements. These requirements shall apply to all electronic components,

including off-the–shelf components, which are defined by the component manufacturer data sheet, and custom components, which are defined by the original equipment manufacturer.

- Component Selection
- Component Application
- Component Qualification
- Component Quality Assurance
- Component Dependability
- Component Compatibility with the Equipment Manufacturing Process
- Component Data
- Configuration Control

The Plan shall state clearly, concisely, and unambiguously:

- What the Plan owner does to accomplish each of the requirements;
- How compliance to the Plan is demonstrated; and
- The evidence that is available to show that the requirements have been accomplished.

The Plan shall document the processes used to address each of the technical requirements of this clause.

Where specific requirements do not apply, the Plan owner may, with appropriate justification, amend the list of requirements by adding, deleting or modifying them. If this is done, the Plan shall be assessed according to the amended list of requirements as stated in the Plan.

The only type of amendment permitted is to add or delete entire requirements (those designated and described in the technical requirements list above). Modifications of any of the requirements listed above and described in this clause are not permitted.

All the requirements in this clause apply to deliverable flight equipment or subassemblies for the Avionics industry as stated in **clause 6.6**. The Original Equipment Manufacturer (OEM Plan owner) has the responsibility of satisfying the technical requirements given in clause 5. These requirements may be accomplished by either the OEM or may be subcontracted. In either case, the OEM has the responsibility for ensuring all requirements are met.

NOTE Ground support Test Equipment, Flight Demonstrator Assemblies, and Prototypes are typically exempt from these requirements, unless the Plan owner states otherwise in their Plan, see **clause 6.6**.

The plan must satisfy the requirements of this Clause, regardless of the source from which the plan owner obtains components.

5.1 Component Selection

All components shall be selected according to documented processes and shall satisfy the requirements of this Plan regardless of additional criteria such as standardization, order of preference, etc.

NOTE 1 Because of the highly individual nature of most Plan owners' administrative processes, no detail is included here. It may include the use of a standard component list, provided the requirements of this Plan are met when the components are placed onto the standard list. Components should then be selected from the standard list for use in specific applications. The selection process may include levels of preference. This may refer to another process document describing how parts are selected. A preference list may be something that would be included in a contract document.

NOTE 2 It is recommended that:

- The number of component types should be minimised;
- Components be selected from those readily available and produced in large volume;
- Components be selected from those in a preferred stage of their lifecycle.

The conditions for use of the component shall be adequately identified, from the component specification based on the component manufacturer's data sheet and any additional requirements to ensure suitability in the end application.

Availability and level of obsolescence risk shall be considered as major component selection criteria.

If additional performance is required (e.g., upscreening, uprating, additional parameters defined), then the component shall be considered as a specific one and shall be uniquely identified.

Each selected component shall be comprehensively identified within the selection process.

- For off-the-shelf components, as a minimum, the component manufacturer data sheet, component manufacturer technical and application notes, packaging, reliability and availability data, producability data (including storage, soldering conditions etc.) should be identified.

- For components specified by the Equipment Manufacturer, the specific documentation (including specification, manufacturer data and process, reliability, specific tests and screening, and associated in-house continuous monitoring) should be identified.

5.2 Component Application

Listed here are some categories of component application processes that may be documented in a Plan. Not all of the categories listed below are relevant to every component application; therefore, the requirements listed below are applicable only if relevant to the given application. The plan shall document the processes that are expected to be applicable to the majority of the plan owner's products, with the

understanding that some of the documented processes may not be used for specific programs or specific functionality of products.

In each case, the documented processes shall verify whether the equipment containing the component shall continue to meet its performance requirements and specifications throughout the manufacturing, full service storage, and operating lifetime. In order to determine design suitability of equipment, there shall be a formal design review. At the design review, consideration for each component shall be given to all design aspects including those given in 5.2.1 through 5.2.6. Evidence of compliance for each of the following design aspects shall be available.

5.2.1 Electromagnetic Compatibility (EMC)

EMC is demonstrated by analysis, testing, and simulation. The EMC guidelines shall form part of the design process. The component performance shall be capable of EMC compliance at the equipment level.

NOTE Certain components, e.g., high power switching components, can produce more electromagnetic signal than other types and, additionally, certain components can be more susceptible to electromagnetic interference than others. Component level EMC aspects have been addressed in IEC 61967-1.

5.2.2 De-rating and Stress Analysis

The documented processes shall verify that the component is used within the operating limits specified by the component manufacturer per a documented set of derating criteria.

When the component manufacturer provides derating criteria and methods, they shall be used where applicable. If the component manufacturer does not provide this information, or if it is not applicable, then the Plan owner shall develop and document appropriate derating criteria and methods. All instances in which a component is not used within the limits defined above shall be documented in the design records. In all such instances, either corrective action shall be taken, or justification for not satisfying the criteria shall be documented.

NOTE: JEP149 “Application Thermal Derating Methodologies” outlines derating methods that can be used in avionic’s applications. Components handled in the manner described in JEP149 are considered to be used within the specification limits provided by the manufacturer, if internal parameters and technical data used for component thermal modelling (which insures the application) are documented with the component manufacturer data. JEP149 outlines two important analyses related to thermal consideration of the application: reliability and functional performance, both of which employ a process utilizing junction temperature analysis. These analyses may require information from the component manufacturer not provided in published data sheets. In these cases, the manufacturer shall be contacted to determine the data needed to support appropriate application of the part with regard to these issues.

5.2.3 Thermal Analysis

The documented processes shall verify that the component is used within the temperature limits specified by the component manufacturer, or by the Plan owner.

If components are used outside the temperature ranges specified by the component manufacturer, then the supplier shall demonstrate how he controls this process. Recommendations and guidelines on how to do this are contained IEC TR 62240 and

may be used in addition to the plan prepared according to this document. Equivalent procedures from other documents may also be acceptable.

NOTE 1 A common maximum temperature for semiconductor devices is the junction temperature. In some instances, other limiting temperatures may be specified for semiconductor devices driven by physical properties of materials used in packaging, bond pad, and lead frame, etc., and other types of components. When the application thermal analysis has successfully implemented the thermal and stress analysis process outlined in the note in 5.2.2, in conjunction with the component manufacturer, the component is considered to be used within the manufacturer's rating.

NOTE 2 In some instances, the manufacturer may not specify the maximum temperature. However the maximum temperature may be calculated from other information supplied by the component manufacturer, such as component internal thermal impedances.

NOTE 3 Verification processes may include analysis, modelling, thermal survey, simulation, or testing.

5.2.4 Mechanical Analysis

The documented processes shall verify that the component is mechanically compatible with the application. This includes mechanical fit, as well as the ability to withstand vibration, mechanical shock, and mechanical stresses including those generated by mismatches of coefficients of thermal expansion of the different materials.

NOTE Verification processes may include analysis, modelling, simulation, or testing.

5.2.5 Testing, Testability, and Maintainability

The documented processes shall assure testability and maintainability of the equipment by the Plan owner.

NOTE 1 The focus here is on testing and testability with regard to component verification, not on software or system verification. Examples include board level or sub-assembly level testing, provision for test pins, and assurance that other equipment level tests will be available to verify component function at the appropriate level. Exhaustive testing of complex components is not always realistic, but documented processes should assure some level of evaluation of all components at appropriate points in the production flow.

NOTE 2 This requirement also includes design for maintainability, e.g., placement for ease of component replacement and mounting that minimises the risk of damage during maintenance and assures equipment quality following maintenance or repair by equipment manufacturer.

5.2.6 Avionics Radiation Environment

The documented processes shall verify that the component will operate successfully in the application with regard to the effects of atmospheric radiation. These include single event upset (SEU), single event latch-up (SEL), single event burnout (SEB) and total dose radiation for any identified application where it is a concern. If radiation effects are accommodated by the equipment design, then the method of accommodation shall be documented in the equipment design records. Refer to IEC TS 62396-1, Process management for avionics; Accommodation of atmospheric radiation effects via single event effects within the avionics electronic equipment.

5.3 Qualification Requirements

It is desired and expected that the majority of components be obtained from qualified component manufacturers; in which case the requirements of 5.3.1, 5.3.1.1 and 5.3.1.2 shall apply. In cases where the component manufacturer is not qualified, the requirements of **5.3.3.2.5** shall apply.

5.3.1 Component Manufacturer Quality Management

The Plan owner shall verify that the component manufacturer has a documented quality management system.

5.3.1.1 The component manufacturer shall have a quality system assessed to the relevant parts of the ISO 9000 family or equivalent.

5.3.1.2 Where the component manufacturer is not assessed in accordance with 5.3.1.1 above, then the Plan owner shall demonstrate how the quality management system of the component manufacturer will be maintained. Where the Plan owner conducts or enables an audit on the component manufacturing facility, then the audit shall be conducted in accordance with the relevant standards of the ISO 9000 family or equivalent system. Suitably trained auditors shall conduct that audit.

5.3.2 Component Manufacturer Process Management Approval

The Plan owner shall verify that the component manufacturer has a manufacturing process capability utilizing manufacturing technologies with demonstrable repeatability.

This may be satisfied by one of the following:

5.3.2.1 Manufacturing approval of the component technologies by a third party (e.g., DSCC, IECQ, STACK) or within an international second party system.

5.3.2.2 Where the component manufacturer is not assessed as in 5.3.2.1 above, then the Plan owner shall demonstrate how the process management capability of the component manufacturer is ensured. Where the Plan owner conducts or enables an audit on the component manufacturing facility then suitably trained and accredited auditors shall conduct the audit in accordance with one of the above systems (as in 5.3.2.1).

5.3.2.3 Manufacturers who do not have an appropriate internal quality management system may be used when their products are fully qualified by the plan owner in accordance with **5.3.3.2**.

5.3.3 Demonstration of Component Qualification

The Plan owner shall document the component qualification process for each component.

The qualification plan and test procedures, sampling and criteria of acceptance (with the defined margins) shall be described. The approach to quality and reliability required in the application shall be outlined.

This can be demonstrated by any of the following, but the choice shall be justified:

5.3.3.1 Component Qualification by an external party

Components qualified in accordance with a second or third party approval system as in 5.3.2.1.

5.3.3.2 Component Qualification by the Equipment Manufacturer

Component qualification by the equipment manufacturer can be demonstrated by one or more of the following:

5.3.3.2.1 Component Manufacturer Technology Qualification Data.

Component manufacturers typically record data from initial and regular ongoing qualification testing on significant numbers of components. The Plan owner shall review such defined qualification testing and resulting data with acceptance criteria for suitability in the end application. Component manufacturers produce components across a wide range of market sectors, and qualification testing will reflect these. Stress levels in the component qualification should equate to or exceed those of the end application or additional testing will be necessary. In this last case, additional testing shall be defined and documented by the Plan owner to the satisfaction of the customer

The provisions of both JESD47 and JESD94 shall be considered when using manufacturer's qualification information, ensuring that the manufactures qualification conditions are compatible with the specific avionics application.

5.3.3.2.2 Avionics qualified Electronic Component Program

The integrated circuit manufacturers are increasingly limiting their products to commercial or industrial temperature range products. This trend is most pronounced in the functional areas that are critical to avionics products, microprocessors, FPGA's, and memories. These are also typically sole source products and the manufacturers will not supply information relative to test programs. The complexity of many of these products effectively prevents either the avionics manufacturer or a 3rd party test house from doing an *effective test program* for the part. The *Avionics Qualified Electronic Part* Program is being developed to give access to internal manufacturer information that can be utilized to evaluate the suitability of AQEC parts for specific applications. Reference GEIA-STD-0002-1, Aerospace Qualified Electronic Component (AQEC) Requirements, Volume 1 – Integrated Circuits and Semiconductors

AQEC products shall be considered when their use will avoid using commercial devices outside the manufacturers' data sheet range without validating information from the manufacturer.

5.3.3.2.3 In-Service Experience

Satisfactory performance including reliability of the component in a similar or more harsh environment shall be documented.

5.3.3.2.4 Similarity

Documentary evidence from test data or in-service experience of a previously qualified associated component shall be given. The plan shall address the ground rules for assessment by

similarity to other components. For further details on similarity rules refer to relevant standards.

NOTE For example: EN 100114, EIA/JESD 47 Annex A (see Informative References).

5.3.3.2.5 Equipment Manufacturer Validation

Validation may be employed particularly if components are from a manufacturer, component type, or package technology not previously used before.

The Plan owner may need to perform component qualification at component level, with completion at equipment level, for new technologies or package types not used before. New components using existing technology and package styles used previously by the plan owner can be qualification tested within the equipment assembly qualification testing, without testing at the component level.

Component qualification with completion tests at equipment level shall be documented and used only when none of the other methods specified are possible.

5.3.3.2.6 Qualification of components from a supplier that is not qualified

If the component supplier is not qualified, The plan shall document how the components are qualified.

NOTE Examples of such processes are the development and implementation of a component qualification process conducted by the plan owner, the component distributor, component manufacturer, or a third party.

5.3.4 Distributor Quality and Process Management Approval

The Plan owner shall verify that the distributors have a documented quality management system.

NOTE The distributor quality management system shall be assessed in a similar way to either 5.3.1.1 or 5.3.1.2 above and shall be applicable to distributors. The distributor shall have an approved management system in a similar way to section 5.3.2 above, for all its activities including storage, component handling, traceability, testing, shipment, information, and technical data handling.

5.4 Continuous Component Quality Assurance

5.4.1 General Quality Assurance Requirements

The documented processes shall assure the continuous quality and performance of all components used throughout the production cycle, prior to delivery. This is to assure that the impact of component manufacturer lot to lot variations; lot to lot assembly handling variations, etc., are minimized and controlled. This will assure that the delivered components conform to the delivered equipment requirements.

5.4.2 On-going Component Quality Assurance

One or more of the following methods shall be used to assure component manufacturer quality:

5.4.2.1 Qualified and Assessed Components

Components shall be purchased from sources that have been successfully assessed by an accredited component assessment system, which includes a means to assess continuous quality assurance. Such assessment systems include applicable international and industry consensus standards, or the Plan owner's approved process for evaluation of the component manufacturer's internal quality assurance processes.

NOTE Examples of government or industry standards are the DOD qualified manufacturers lists, DSCC(JAN), EIA or JEDEC standards; examples of international standards are IECQ, and STACK International.

5.4.2.2 Component Quality Assurance Data

Where the requirement of 5.4.2.1 is not met, the Plan owner shall have a process to assure that compliance to the component specification is maintained, either by component manufacturer test or Plan owner test.

- A component manufacturer assessment shall include component test processes, ongoing component qualification test plans, and acceptance criteria. The method by which this information is obtained shall be documented.

  NOTE 1 Typical quality assurance processes include statistical process control, periodic qualification testing, component testing and screening, etc.

- Plan owner performs process control tests and has documented quality acceptance criteria.

  NOTE 2 The following recommendations apply if component level screening is done:

  - The components are subjected to screening conditions of sufficient rigor and duration to detect defects.
  - A process for screening sampling rates may be proposed by the plan owner, provided that sufficient data is available, and the reject rate is low enough. A process for screening sampling rates may be proposed by the plan owner to reduce from 100%, provided that sufficient data is available, and the reject rate is acceptable for the application.

5.4.3 Plan Owner In-house Continuous Monitoring

The Plan owner shall have a process to assure the required performance of components prior to delivery of the equipment. This process includes various levels of processing, assembly, and test of the equipment.

A process for identification, recovery, and recording of component removals or replacements during in-house processing and test shall be documented. Significant component replacement trends, equipment repair actions or a pattern of component replacements that are indicative of a potential component problem shall be investigated to determine root cause. Appropriate corrective actions shall be conducted.

5.4.4 Component Design and Manufacturing Process Change Monitoring

The process of tracking (or detecting) and monitoring component design and manufacturing process change data shall be documented. The effects of these changes on equipment performance shall be reviewed and assessed. This process could include: direct information from

component manufacturers or distributors, sharing technical information sources, information from other users, functional or physical analysis during in-house processing. Following analysis, appropriate corrective action shall be conducted. All design changes shall be in accordance with **5.8**

NOTE 1 Most of the components used in aerospace applications are designed, manufactured, and targeted for other industries, and are beyond the control of the Plan owner. Frequent design and manufacturing changes are made to improve yield, reduce cost, and enhance performance. Although these changes are documented by the component manufacturer and evaluated for their effects on high-volume applications, their effects on the unique applications of the Plan owner may not be evaluated or documented by the component manufacturer. The purpose of this section is to describe a process to monitor the components to detect any changes that may affect their performance in the applications of the Plan owner.

NOTE 2 Typically, the processes will include:

a) Awareness process, such as access to notices of change from the component manufacturer or distributor.

b) An evaluation process, such as periodic functional testing and/or destructive physical analysis or construction analysis (assuming an initial physical analysis) of a sample of each component.

c) Review of the component manufacturer reliability monitor data or quality data to look for failures and other reports of change.

NOTE 3 Alternatively, a process of periodic lot re-qualification of the component may be documented. If used, the periodic lot re-qualification process should be described here and include test frequency, sample size, etc.

5.5 Component Dependability Management

The documented processes shall assure the reliability, availability, obsolescence management, and maintainability of the components used throughout the customer agreed warranty period or maintenance period and/or agreed lifetime of the equipment, provided the customer uses the components within the agreed environmental limits. The process for component risk assessment and rating shall be identified by the plan owner and the rational documented including the following:

5.5.1 Reliability Assessment

The documented processes shall verify that the installed component is compatible with the circuit application requirements for performance and reliability through the processes listed in this document. These processes include component qualification (including a life test requirement), assurance of quality (consistency), equipment reliability assessments, qualification of the equipment (environments), and equipment reliability monitors.

NOTE This could be produced either by using a standard method, component manufacturer reliability tests, equipment field return data, similarity with any other similar applications, etc.

5.5.2 Component Availability and Risk Assessment

The documented processes shall identify risks associated with availability of the component, and methods to mitigate those risks.

Note 1 These may include low volume manufacturers, allocation risks, financial stability of manufacturers, single source manufacturers, etc.

Components considered to be at risk shall be rated using appropriate metrics that reflect their susceptibility to technology change and obsolescence.

NOTE 2 Input for consideration of metrics may include: technology risk and maturity, life cycle, level of confidence in the manufacturer, predicted obsolescence, single source component, manufacture supply file information, imprecise manufacture specification of component performance (specified as “typical”, not specified, etc.), components other than those readily available in large volumes and identified on avionics technology roadmaps. Use of components outside manufacturer’s specifications and component obsolescence are specific risk issues that may be addressed outside of or included in this sub clause.

The documented processes shall include tracking and reporting the status of risk mitigation efforts when required by customer or business needs.

The documented processes shall address logistics supportability and life management issues when required by customer or business needs.

NOTE 3 The following are primary examples of component risk areas that may be addressed in the Plan, specifically or generically: These risk areas may be addressed as part of other design, production, procurement ,or marketing processes or practices.

a) New technology availability or maturity for meeting the specified requirements,
b) Component delivery and production rate schedules,
c) Component obsolescence during design, production, or support,
d) Lack of qualification or quality assurance data,
e) Qualification test schedule (especially risk of failure),
f) Cost drivers (especially with custom components),
g) Component changes (design or process changes, known and unknown),
h) Quality and reliability of product from component manufacturer (especially new manufacturer), and
i) Radiation effects, such as single event upset.

5.5.3 Component Obsolescence

A written procedure shall be in place that addressees the management of component obsolescence:

5.5.3.1 Component Obsolescence Awareness

The Plan shall document the processes utilized for obsolescence awareness.

NOTE This includes processes used to become aware of existing and impending component discontinuance situations, changes in component design or manufacturing processes, and other component manufacturer actions that may result in components becoming unavailable. This may include use of one or more commercial services or in-house processes.

5.5.3.2 Reaction to Component Obsolescence

The Plan shall document the processes used by the Plan owner to resolve obsolete component occurrences to assure continued production and support as required.

NOTE This includes processes used to react to component obsolescence occurrences. They may include last- or lifetime buy, identification of alternative sources, equipment re-design, etc.