



Space product assurance

Product assurance management

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Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards. Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

This Standard has been prepared by the ECSS-Q-ST-10 Working Group, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

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Change log

ECSS-Q-ST-10A	Never issued
ECSS-Q-ST-10B	Never issued
ECSS-Q-ST-10C	First issue
15 November 2008	Transfer of PA related requirements from the ECSS-Q-20B standard.

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Scope

The ECSS standards of the Q branch describe a set of requirements for a Product Assurance programme to be implemented throughout the phases of a space project.

This document defines the Product assurance management requirements for space projects.

This document is structured in two main parts, the first part presenting the principles of Product Assurance management and the second providing the detailed requirements.

In addition, the expected content of the Product Assurance plan is specified in Annex A. Information on the expected delivery of ECSS PA management discipline documents per review is provided in Annex C.

This Standard is applicable to all space projects.

This standard may be tailored for the specific characteristic and constraints of a space project in conformance with ECSS-S-ST-00.

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Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

ECSS-S-ST-00-01	ECSS system – Glossary of terms
ECSS-Q-ST-10-04	Space product assurance – Critical-item control
ECSS-Q-ST-10-09	Space product assurance – Nonconformance control system

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Terms, definitions and abbreviated terms

3.1 Terms and definitions from other standards

For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01 apply, in particular for the following terms:

acceptance
alert
approval
audit
configuration item
critical item
customer
dependability
EEE component
failure
function
management
nonconformance
objective evidence
organization
performance
procedure
process
product
product assurance
programme
project
project phase
qualification process

quality assurance
record
review
risk
risk management
safety
software product assurance
supplier
system
traceability
waiver

3.2 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
EEE	electrical, electronic, electromechanical
MIP	mandatory inspection point
PA	product assurance
QA	quality assurance
QSL	qualification status list

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Principles

4.1 General principles

The prime objective of Product Assurance is to ensure that space products accomplish their defined mission objectives in a safe, available and reliable way.

Commitment to quality of the entire organization is key to the Quality of the product and success of the space mission. The management of Product Assurance is fully embedded in the management of the project and receives the highest priority from the organization management.

The early identification of aspects potentially detrimental for safety and mission success, and the cost-effective prevention of any adverse consequence of such aspects are the basic principles for the ECSS Product Assurance requirements.

Product Assurance Management ensures the integration of activities from the Product Assurance disciplines defined in the other ECSS standards of the Q branch, namely:

- Q-20 Quality assurance
- Q-30 Dependability
- Q-40 Safety
- Q-60 Electrical, electronic, electromechanical (EEE) components
- Q-70 Materials, mechanical parts and processes
- Q-80 Software product assurance

4.2 PA programme planning

The requirements for Product Assurance planning specified in clause 5.1 address the following aspects:

- Definition of a Product Assurance organization with the allocation of adequate resources, personnel and facilities
- Definition of Product Assurance requirements for lower tier suppliers
- Definition of a Product Assurance Plan describing the Product Assurance programme and how it fulfils project objectives and requirements

4.3 PA programme implementation

The requirements for Product Assurance programme implementation specified in clause 5.2 address the following aspects:

- Management and control of the PA tasks performed by the PA disciplines
- Progress reporting of all Product Assurance matters
- Management of audits, critical items, nonconformances and alerts,
- Support to the risk management, in coordination with the Project Management functions
- Support to the documentation and data control , quality records and to configuration management.
- Lower-tier supplier control for ensuring implementation of PA requirements by the suppliers

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Requirements

5.1 PA programme planning

5.1.1 Product Assurance organization and responsibilities

5.1.1.1 Organization

- a. The supplier shall identify the personnel responsible for implementing and performing PA management and other PA disciplines.
- b. The supplier shall assign a project PA manager reporting to the project manager and having unimpeded access to higher management.
- c. The appointed project PA manager, irrespective of other responsibilities, shall have organizational authority to establish and implement a product assurance programme in accordance with the project product assurance requirements.
- d. The project PA Manager shall act as the focal point of contact within the project concerning Product Assurance matters.

NOTE The project PA manager is referred to as "PA manager" in the rest of this document.

5.1.1.2 Responsibility and authority

- a. The supplier shall define and document the responsibility, the authority and the interrelation of personnel who manage, perform and verify work affecting product assurance.
- b. The supplier shall define and document the responsibilities and the interfaces of the PA functions, either external or internal, involved in a project.
- c. When the supplier's PA organization delegates product assurance tasks to another organization it shall be done in a documented and controlled way monitored by the PA organization.

NOTE The supplier PA organization retains the responsibility towards the Customer

5.1.1.3 Resources

- a. The supplier shall identify the PA resources needed to implement the PA programme.
- b. The supplier shall provide resources capable to perform the PA tasks identified in the PA programme.
- c. Reviews and audits of the product assurance programme, of processes or of product shall be carried out by personnel not directly involved in the work being performed.

5.1.2 PA management interfaces

- a. The PA manager shall interface with project management, ensuring that the contractual provision and schedule planning for the definition and phasing of PA activities are met.
- b. The PA manager shall interface with risk management, configuration management, engineering, procurement and AIV for the definition and execution of tasks in which PA activities are involved.
- c. The PA manager shall interface with the customer regarding all Product Assurance matters.
- d. The PA manager shall interface with lower-tier suppliers regarding all Product Assurance matters.

5.1.3 PA plan

- a. The supplier shall prepare, maintain and implement a plan of the PA activities in accordance with the customer PA requirements.
- b. The Product Assurance plan shall be prepared in conformance with DRD in Annex A.
- c. The Product Assurance plan shall be submitted to the customer for approval.

NOTE 1 The Product Assurance plan can refer to Clauses of the Company Quality Manual and to in-house procedures.

NOTE 2 Information on the schedule for delivery of PA management documents is given in Annex C.

5.2 PA programme implementation

5.2.1 Product assurance management

- a. The PA manager shall ensure that PA disciplines are organized at the beginning of the project according to customer contractual requirements.

- b. The PA manager shall ensure that the inputs used by the PA disciplines are consistent and complete, and available in line with the project schedule.
- c. The PA manager shall ensure that the PA disciplines perform the tasks described in the PA Plan in line with the project schedule.
- d. The PA manager shall ensure that the outputs produced by the PA disciplines are consistent and complete, and delivered in line with the project schedule.
- e. The PA manager shall ensure the application of processes defined in applicable project plans and documents.
- f. The PA manager shall control the quality of his supplier's products by:
 - 1. issuing product assurance requirements applicable to the supplier
 - 2. ensuring the implementation of the PA requirements by the supplier.
- g. The PA manager shall ensure that PA contributions to verification are defined and provided.
- h. The PA manager shall ensure that a qualification programme is defined, approved and maintained by the relevant organization.

NOTE Requirement for the qualification programme are addressed in ECSS-Q-ST-20, ECSS-Q-ST-60, ECSS-Q-ST-70, ECSS-E-ST-10-02 and ECSS-E-ST-10-03.

- i. The PA manager shall ensure that the qualification programme is implemented and the qualification results are recorded, evaluated and documented.
- j. The PA manager shall ensure that a Qualification Status List of the programme items is maintained in conformance with Annex B.
- k. The PA manager shall review and approve the achieved qualification status.
- l. The PA manager shall approve the product acceptance during the Acceptance or Delivery Review.

NOTE The PA manager approval is based on the outputs of the Acceptance or Delivery Review.

5.2.2 PA reporting

- a. The supplier shall report on the status and progress of the product assurance program implementation.
- b. The PA report shall include at least the following items for the reporting period:
 - Progress and accomplishment of each major product assurance task including resolved and new problems, future planning of major activities and events

- Status of PA reviews, Audits and MIPs, Waiver requests, Non conformances (minor and major), Critical items (including mitigation action plan status), Qualification status, EEE component status, Material and processes status, Alerts status.
- c. The PA progress report may be part of the project progress report.
 - NOTE The general contents of the project progress report are detailed in ECSS-M-ST-10 Annex E.

5.2.3 Project PA audits

- a. The supplier shall perform audits on his own performance to verify the implementation and effectiveness of the provisions defined in the PA plan.
 - NOTE 1 Audits can be performed by sampling on various projects or by periodic audits of the supplier quality system.
 - NOTE 2 The general contents of project audits are detailed in ECSS-M-ST-10 clause 5.2.3.
- b. The supplier shall establish and maintain an audit plan for procurement activities on the project, designating the lower tier suppliers to be audited, the current status and the schedule for auditing.
- c. In addition to the planned audits, extra audits shall be performed when necessary to overcome failure, consistent poor quality, or other problems.
- d. The supplier shall plan and perform audits using established and maintained procedures.

5.2.4 Critical items control and PA interfaces to project risk management

- a. The supplier shall establish a critical items control programme in conformance with ECSS-Q-ST-10-04.
- b. The PA manager shall identify and evaluate critical items in support of the overall project risk management activities.
- c. The PA manager shall ensure that a critical item control programme is implemented to eliminate or mitigate associated risks.

5.2.5 Documentation and data control

- a. The PA manager shall ensure that the applicable issues of all documents and data are available at all locations where activities required for the implementation of the PA programme are performed.
- b. The PA manager shall ensure that invalid or obsolete documents and data are removed from all points of issue or use, or assured against unintended use.

- c. The PA manager shall ensure that obsolete documents and data retained for legal or knowledge preservation purposes are identified as such.
- d. The PA manager shall identify the project documents requiring approval including those requiring approval by PA.

5.2.6 Quality records

- a. The supplier shall establish and maintain quality records to provide objective evidence of complete and successful performance of all PA discipline tasks and to demonstrate compliance with requirements.

NOTE Requirements for the storage, retrieval and archiving of quality records are addressed in ECSS-M-ST-40.

5.2.7 PA contribution to configuration management

- a. The PA manager shall verify during Configuration Control Boards the suitability for release of drawings, plans, specifications, procedures and changes thereto.

NOTE The operation of Configuration Control Boards is detailed in ECSS-M-ST-40

- b. The PA manager shall ensure that:
 - 1. the as designed status is defined and released prior to manufacturing;
 - 2. the as-built documentation is properly defined, identified and maintained in order to reflect approved modifications; and
 - 3. items delivered comply with the as-built documentation.

5.2.8 Nonconformance control

- a. The supplier shall establish and maintain a nonconformance control system in conformance with ECSS-Q-ST-10-09.

5.2.9 Management of alerts

- a. The supplier shall notify its customer of preliminary information on failures or problems that can result in an alert.

NOTE 1 The above is applicable to failure or problems detected by the supplier or by one of his lower tier suppliers.

NOTE 2 The above is only applicable to failures or problems meeting all of the following criteria:

- The item with the observed failure or problem has multiple applications, which

- can have implications for more than one project, thus requiring prompt action.
- The failure or problem has occurred in the application of an item within the specified design and usage limitations.
 - Failures or problems due to usage within reasonably expected limits of performance, but where these limits were not specified precisely.
 - A preliminary investigation has provided evidence of the root cause of the failure or problem.
 - Failure or problems are confirmed not to be of a random nature.
- b. The supplier shall investigate in cooperation with the originator of the failure or problem to define the immediate measures to be taken, to identify the causes, and to recommend corrective actions for similar items.
- c. The PA manager shall ensure:
1. the assessment of any failure having the potential to lead to an alert by the customer,
 2. the investigation, until disposition of the items subject of the potential alert, and
 3. the assessment of incoming alerts for the definition, implementation and follow-up of necessary actions.
- d. The supplier shall participate in the alert system organized by the customer or other sources, by:
1. assessment of the impact of incoming alerts to project work, and definition, implementation and follow-up of necessary corrective actions at any contractual level.
 2. distribution of incoming alerts to the possible affected users within the project.

NOTE The alert system is set up for the prompt interchange of information on failures or problems which can affect more than one user, or can recur in other projects or circumstances, if no preventive actions are taken.

Annex A (normative)

Product Assurance Plan (PAP) - DRD

A.1 DRD identification

A.1.1 Requirement identification and source document

This DRD is called by the ECSS-Q-ST-10C, requirement 5.1.3b.

A.1.2 Purpose and objective

The objective of the PAP is to describe the activities to be performed by the supplier to assure the quality of the space product with regard to the specified mission objectives and to demonstrate compliance to the applicable PA requirements.

A.2 Expected response

A.2.1 Scope and content

<1> Introduction

- a. The PAP shall introduce the purpose, objective and the reason prompting its preparation.

NOTE For example: programme or project reference and phase.

<2> Applicable and reference documents

- a. The PAP shall list the applicable and reference documents in support of the generation of the document.

<3> Product assurance management

<3.1> PA Planning

- a. The PAP shall describe the organization (including responsibilities and authorities), the activities, processes and procedures to be applied by the supplier to fulfil the applicable product assurance planning requirements defined in clause 5.1 of ECSS-Q-ST-10C.

<3.2> PA implementation

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable product assurance implementation requirements defined in clause 5.2 of ECSS-Q-ST-10C.

<4> Quality assurance

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable quality assurance requirements.

<5> Dependability

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable dependability requirements.

<6> Safety

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable safety requirements.

<7> EEE components

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable EEE Component requirements.

<8> Materials and processes

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable Material and Processes requirements.

<9> Software product assurance

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil the applicable Software product assurance requirements.

<10> Other PA requirements

- a. The PAP shall describe the activities, processes and procedures to be applied by the supplier to fulfil all other applicable PA requirements not covered in the clause A.2.1<3> to clause A.2.1<9> (e.g. Security, Planetary Protection, Off-The-Shelf, Customer Furnished equipment).

NOTE The order of the sections is not mandatory.

A.2.2 Special remarks

- a. The response to this DRD may be combined with the response to the project management plan, as defined in ECSS-M-ST-10.
- b. The response to this DRD may be performed by reference to separate discipline plans addressing some of the above clauses of this DRD.

Annex B (normative)

Qualification Status List - DRD

B.1 DRD identification

B.1.1 Requirement identification and source document

This DRD called by the ECSS-Q-ST-10, requirement 5.2.1j

B.1.2 Purpose and objective

A Qualification Status List (QSL) is issued at equipment, subsystem and system levels.

The purpose and objective if this QSL document is to summarize for each configuration item the status achieved with respect to the planned qualification.

B.2 Expected response

B.2.1 Scope and content

- a. The QSL shall include or refer to the following information:
 1. Equipment designation:
 - (a) Identification of hardware by name,
 - (b) Configuration Item number and model.
 2. Next higher assembly level :
 - (a) Identification of next higher assembly.
 3. Manufacturer's name :
 - (a) Identification of Item Supplier.
 4. Reference of requirements documents
 - (a) Reference numbers of applicable requirement specifications.
 5. Design heritage:
 - (a) Specify if the design is "New", otherwise identification of the project in which the design was used.

- (b) Summary of current qualification status:
 - Basis for qualification (qualification test results, heritage, and qualification on other projects) programme on which the qualification test was conducted;
 - Project on which the test was conducted.
- 6. Proposed category A, B, C, or D (related to Design heritage):
 - NOTE Qualification approach as defined in the ECSS-E-ST-10-02.
- 7. Reference of Qualification plan document:
 - (a) Current qualification status/screening and applicability of qualification test versus requirements.
 - (b) Reference numbers of Qualification Plan(s).
 - (c) Identification of developments models (EM, EQM, QM, PFM) to be manufactured and tested for the project.
- 8. Reports:
 - (a) Reference to Verification Control Document and/or reference to Analyses, Test and Inspection Reports;
 - (b) Qualification Authority: Organization in charge of the item qualification (if any).
- 9. The qualification status:
 - o QUALIFIED,
 - o TO BE QUALIFIED,
 - o QUALIFICATION IN PROGRESS
- 10. Open Actions / Due dates/Remarks:
 - (a) For an open action: summary of missing qualification actions and planned dates for the closure of such actions.
 - (b) List of major NCRs and associated waivers to the qualification items

B.2.2 Special remarks

- a. The form may be a table which contains the here above information of B.2.1 or reference to separate document.

NOTE An example of such a table is shown in Figure B-1.



Item Designation	Next Higher Assembly	Manufacturer's name	Requirements Specifications	Design Heritage	Qualification					
				Summary data	Category	Development Model	Plans/ Procedures	Reports	Status	Open actions / Due dates/ Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7)	(8)	(9)	(10)

Figure B-1: Example of a Qualification status list (QSL)

Annex C (informative)

PA document delivery with respect to milestones

Table C-1 present the reviews at which the different issues of the Product Assurance plan and the critical item list are expected.

NOTE Other PA deliverable document requirement lists are contained in the ECSS-Q-Series Level 2 documents.

Table C-1: PA document requirement list with respect to milestones

Document Title	Phase												DRD Ref.
	0	A	B		C	D		E					
	MDR	PRR	SRR	PDR	CDR	QR	AR	ORR	FRR	LRR	CRR	ELR	
Product Assurance Plan		(X)	(X)	X	X			(XX)					ECSS-Q-ST-10, Annex A
Critical-Item List			(X)	X	X	X	X		X				ECSS-Q-ST-10-04, Annex A
Qualification Status List		(X)		X	X	X	X						ECSS-Q-ST-10, Annex B
(X): Preliminary version													
(XX) PA Plan covering Operational Phase													

Bibliography

ECSS-S-ST-00	ECSS system – Description, implementation and general requirements
ECSS-E-ST-10-02	Space engineering – Verification
ECSS-E-ST-10-03	Space engineering – Testing
ECSS-M-ST-10	Space project management – Project planning and implementation
ECSS-M-ST-40	Space project management – Documentation and information management
ECSS-Q-ST-20	Space product assurance – Quality assurance
ECSS-Q-ST-30	Space product assurance – Dependability
ECSS-Q-ST-40	Space product assurance – Safety
ECSS-Q-ST-60	Space product assurance – Electrical, electronic, electromechanical (EEE) components
ECSS-Q-ST-70	Space product assurance – Materials, mechanical parts and processes
ECSS-Q-ST-80	Space product assurance – Software product assurance