



ECSS
First step Tailoring

Document : DC-UQT-2024-010
Issue : A
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Project: "CALIGOLA"

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1. INTRODUCTION

1.1 SCOPE OF THE DOCUMENT


This document establishes the tailoring (first step/level tailoring) for applicable ECSS Standards, in accordance to the document [AD 01], taking into consideration Project risks, constraints and characteristics. According to the project phases all management, quality and technical aspects are evaluated through an integrated approach.

The document takes into consideration the main characteristics defined in [RD 01] and it is lower-level in hierarchy wrt the Contratto and "Allegato Tecnico Gestionale".

1.2 FIELD OF APPLICATION

The present document is applicable to the project "CALIGOLA Strumento"

The document covering all the branches S, Q, M, E and U of the ECSS system of standards. For the subsequent phases it will need to be revised and integrated to consider the maturity level of the project.

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2. DOCUMENTS

2.1 APPLICABLE DOCUMENTS

[AD 01] Istruzione Operativa "Istruzione Operativa "Linee guida per il Tailoring delle norme ECSS", ASI document n° OP-UQT-2022-001

2.2 REFERENCE DOCUMENTS

[RD 01] Capitolato Tecnico allegato alla Richiesta d'Offerta dell'Agenzia Spaziale Italiana (ASI) per il progetto 'Attività industriali di Fase A/B1 per lo strumento CALIGOLA.' ASI document n° DC-UIC-2024-78
 [RD02] Capitolato tecnico attività industriali di fase A/B1 per lo sviluppo della Piattaforma e del sistema per la missione Caligola

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3. TAILORING OF THE STANDARD

Section 4 defines the lists of ECSS standards which are applicable to the CALIGOLA project and to the next phases of the mission. The table contains two columns indicating the requirements applicable to the instrument and to the system.

The ECSS standards are intended to be used with the extension required by the program phase and project specificities.

The ECSS Standards shall be made applicable to all the supply chain.

Starting from the present document the Contractor shall develop the detailed tailoring of the requirements of the selected ECSS Standards (ECSS 2nd step tailoring), to be made applicable also to subcontractors on the basis of project characteristics.


In selecting the applicable standards and related requirements, the Contractor should also consider, as far as possible, the steps following phase A of the Project.

The Contractor shall ensure application of ECSS Standards down to the lower level of the supply chain.

Instructions for the second level tailoring development are included in Section 5.

For the subsequent phases of the project it will need to be revised and integrated to consider the maturity level of the project.


REMARK: as ECSS Standards are under continuous development/update, the final list of the applicable standards shall be frozen at beginning of the activities (kick-off meeting or contract signature).

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4. “FIRST STEP TAILORING” TABLES


General documents

Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date Of publication	Instrument Applicability	System Applicability
Top-level requirements are defined for implementation of the ECSS system in space projects	S-ST-00C	Description, implementation and general requirement	First issue Rev 1, 15 June 2020	Y	Y
The Glossary and general terms of ECSS are applicable	S-ST-00-01C Rev.1	Glossary of terms	Third issue, 01 October 2023	Y	Y
This document provides requirements and methodology for tailoring	S-ST-00-02C	Draft 1 “Tailoring	First issue DRAFT1, 15 June 2020	Y	Y

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Series ECSS "M" – Management

Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
For project/product/organization management	M-ST-10C	Project planning and implementation	Issue, Date of publication	Y	Y
A structured way to perform reviews is required also depending on project organization complexity.	M-ST-10-01C	Organisation and conduct of reviews	Third issue Rev 1, 06 March 2009	Y	Y
Configuration control is needed to ensure interface management, control of all the items also considering the project organization complexity	M-ST-40C	Configuration and information management	Second issue, 15 November 2008	Y	Y
Standard procedure for cost and schedule management shall be applied	M-ST-60C	Cost & schedule management	Third issue Rev 1, 06 March 2009	Y	Y
--	M-70A	Integrated logistic support	Third issue, 31 July 2008	N	N
Technological innovation and programmatic constraints could introduce risk factors, to be analysed and controlled.	M-ST-80C	Risk management	First issue, 19 april 1996	Y	Y

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Series ECSS "Q" – Product Assurance

Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
The Policy and general principle are applicable	Q-ST-10C	Product assurance management	First issue Rev 1, 15 March 2016	Y	Y
Need to control non-conformance items	Q-ST-10-09C	Nonconformance Control System	Third issue Rev 1, 01 March 2018	Y	Y
Need to control items potentially critical	Q-ST-10-04C	Critical-item control	Second issue, 31 July 2008	Y	Y
Quality Assurance is applicable in order to guarantee achievement of contractual obligation	Q-ST-20C	Quality Assurance	Third issue Rev 2, 01 February 2018	Y	Y
to ensure that space test centres working for project operate a quality and safety assurance system in line with ECSS requirements	Q-ST-20-07C	Quality and safety assurance for space test centres	Second issue, 03 Gennaio 2022	Y	Y
to ensure safe handling, storage, transportation of space segment hardware	Q-ST-20-08C	Storage, handling and transportation of spacecraft hardware	First issue, 1 October 2014	Y	Y
Utilisation of OTS is foreseen	Q-ST-20-10C	Off-the-shelf items utilisation in space systems	First issue, 8 October 2010	Y	Y
Dependability aspects shall be taken in due consideration during the definition phase	Q-ST-30C	Dependability	Third issue Rev 1, 15 February 2017	Y	Y
Need to support dependability analysis	Q-ST-30-02C	Failure Modes, effects (and criticality) analysis (FMEA/FMECA)	Second issue, 06 March 2009	Y	Y
System availability to be considered	Q-ST-30-09C	Availability analysis	Second issue, 31 July 2008	Y	Y
Need to limit the component stresses to specified levels order to increase its reliability	Q-ST-30-11C	Derating-EEE components	Third issue Rev 2, 23 June 2021	Y	Y
Safety aspects shall be taken in due consideration during the definition phase	Q-ST-40C	Safety	Third issue Rev 1, 15 February 2017	Y	Y

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Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
Need to support safety analysis	Q-ST-40-02C	Hazard analysis	Second issue, 15 November 2008	Y	Y
In support to failure analysis	Q-ST-40-12C	Fault tree analysis - Adoption notice ECSS/IEC 61025	Second issue, 31 July 2008	Y	Y
Need to ensure that EEE components used enables the project to meet its mission requirements	Q-ST-60C	Electrical, electronic and electromechanical (EEE) components	Third issue Rev 3, 12 May 2022	Y	Y
To set requirements for ASIC, FPGA e IP Core	Q-ST-60-03C	ASIC, FPGA and IP Core product assurance	First Issue	Y	Y
To set requirements for the user development of ASIC and FPGA	Q-ST-60-02C	ASIC and FPGA development	Second issue, 31 July 2008	Y	Y
Utilisation of Hybrids is foreseen	Q-ST-60-05C	Generic procurement requirements for hybrids	Second issue Rev 1, 06 March 2009	Y	Y
Applies to all types of MMIC (monolithic microwave integrated circuit) based on III-V compound materials for RF applications (i.e. frequency range ≥ 1 GHz)--	Q-ST-60-12C	Design, selection, procurement and use of die form monolithic microwave integrated circuits (MMICs)	Second issue, 31 July 2008	Y	Y
For selection, control, procurement and usage of EEE commercial components	Q-ST-60-13C	Commercial electrical, electronic and electromechanical (EEE) components	First issue, 12 May 2022	Y	Y
Need to garanty that initial quality and reliability of EEE components which are intended to be used in the project have not been affected by time.	Q-ST-60-14C	Relifing procedure - EEE components	First issue Rev 1 Corrigendum 1, 02 March 2020	Y	Y
Need to garanty that initial quality and reliability of EEE components which are intended to be used in the project have not be affected by space environment	Q-ST-60-15C	Radiation hardness assurance	First issue, 01 October 2012	Y	Y

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Need to ensure that MMPP used enables the project to meet its mission requirements	Q-ST-70C	Materials, Mechanical Parts & Processes	Third issue Rev 2, 15 October 2019	Y	Y
to satisfy specific requirements at system and mission level	Q-ST-70-01C	Cleanliness and contamination control	Second issue, 15 November 2008	Y	Y
to determine the outgassing screening properties of used materials	Q-ST-70-02C	Thermal vacuum outgassing test for the screening of space materials	Second issue, 15 November 2008	Y	Y
Defines requirements for measurements and verifications to guarantee that an anodized coating is adequate for the intended application	Q-ST-70-03C	Black-anodizing of metals with inorganic dyes	Second issue, 31 July 2008	Y	Y
To establish requirements for space items to withstand changes of ambient temperature under vacuum.	Q-ST-70-04C	Thermal testing for the evaluation of space materials, processes, mechanical parts and assemblies	Second issue, 15 November 2008	Y	Y
Defines test requirements for detecting organic contamination on surfaces using direct and indirect methods with the aid of infrared spectroscopy.	Q-ST-70-05C	Detection of organic contamination surfaces by infrared spectroscopy	Second issue Rev 1, 15 October 2019	Y	Y
Materials used in space applications need to be evaluated for their behavior under Particle and UV Radiation.	Q-ST-70-06C	Particle and UV radiation testing for space materials	First issue, 31 July 2008	Y	Y
For the methodology to be used to calculate the thermo-optical properties of thermal-control materials	Q-ST-70-09C	Measurements of thermo-optical properties of thermal control materials	Second issue, 31 July 2008	Y	Y
Specifies the requirements for the supplier and PCB manufacturer for PCB design	Q-ST-70-12C	Design rules for printed circuit boards	First issue, 14 July 2014	Y	Y

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to assess the suitability of coatings, paints, films and other thin materials in space	Q-ST-70-13C	Measurements of the peel and pull-off strength of coatings and finishes using pressure-sensitive tapes	Second issue Rev 1, 05 October 2011	Y	Y
to qualify the materials and processes selected to provide corrosion protection.	Q-ST-70-14C	Corrosion	First issue, 01 November 2016	Y	Y
--	Q-ST-70-15C	Non-destructive testing	First issue, 01 May 2021	Y	Y
To specify requirements for the adhesive bonding	Q-ST-70-16C	Adhesive bonding for spacecraft and launcher applications	First issue, 01 December 2020	Y	Y
To specify requirements for the durability testing of coatings used for space applications	Q-ST-70-17C	Durability testing of coatings	First issue, 01 February 2018	Y	Y
To define the technical and quality assurance requirements for the assembly and mounting of high-reliability RF coaxial-cable interconnections	Q-ST-70-18C	Preparation, assembly and mounting of RF coaxial cables	Second issue, 15 novembre 2008	Y	Y
--	Q-ST-70-20C	Determination of the susceptibility of silver-plated copper wire and cable to "red-plague" corrosion	Second issue, 31 July 2008	Y	Y
--	Q-ST-70-21C	Flammability testing for the screening of space materials	Second issue, 05 February 2010	N	N
to satisfy specific requirements at system and mission level	Q-ST-70-22	Control of limited shelf-life materials	Second issue, 31 July 2008	Y	Y
Specifies requirements for the following crimping wire connections intended for high reliability electrical	Q-ST-70-26C	Crimping of high-reliability electrical connections	Second issue rev. 1, 15 March 2017+Corr1.(1	Y	Y

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Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
connections for use on spacecraft and associated equipment operating under high vacuum, thermal cycling and launch vibration			June 2017)		
Requirements and procedures for repair and modification of single-sided, double-sided and multi-layer printed circuit board assemblies.	Q-ST-70-28C	Repair and modification of printed circuit board assemblies for space use	Second issue, 31 July 2008	Y	Y
--	Q-ST-70-29C	Determination of offgassing products from materials and assembled articles to be used in a manned space vehicle crew compartment	Second issue, 31 November 2008	N	N
Specifies requirements for preparing and assembling parts to be joined by wire wrapping, as well as the selection, calibration, use and certification of wire wrapping tools	Q-ST-70-30C	Wire wrapping of high-reliability electrical connections	Second issue, 31 July 2008	Y	Y
To control application of suitable paints	Q-ST-70-31C	Application of paints on space hardware	First issue Rev 1, 15 October 2019	Y	Y
To satisfy specific requirements at system and mission level	Q-ST-70-36C	Material selection for controlling stress-corrosion cracking	Second issue, 06 March 2009	Y	Y
to satisfy specific requirements at system and mission level	Q-ST-70-37C	Determination of the susceptibility of metals to stress corrosion cracking	Second issue, 15 November 2008	Y	Y
To provide process and quality assurance requirements for the different types of metallic welding applications.	Q-ST-70-39C	Welding of metallic materials for flight hardware	First issue, 01 May 2015	Y	Y

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--	Q-ST-70-40C	Processing and quality assurance requirements for brazing of flight hardware	First issue, 8 April 2022	Y	Y
--	Q-ST-70-45C	Mechanical testing of metallic materials	Second issue, 31 July 2008	Y	Y
--	Q-ST-70-46C	Requirements for manufacturing and procurement of threaded fasteners	Second issue Rev 1, 06 March 2009	Y	Y
To define the requirements and guidelines for the measurement of particulate contamination on the surfaces of space items and those of the cleanrooms	Q-ST-70-50C	Particles contamination monitoring for spacecraft systems and cleanrooms	First issue, 04 October 2011	Y	Y
--	Q-ST-70-53C	Materials and hardware compatibility tests for sterilization processes	First issue, 15 November 2008	N	N
--	Q-ST-70-54C	Ultracleaning of flight hardware	First issue, 15 February 2017	Y	Y
--	Q-ST-70-55C	Microbial examination of flight hardware and cleanrooms	First issue, 15 November 2008	N	N
--	Q-ST-70-56C	Vapour phase bioburden reduction for flight hardware	First issue, 30 August 2013	N	N
--	Q-ST-70-57C	Dry heat bioburden reduction for flight hardware	First issue, 30 August 2013	N	N
--	Q-ST-70-58C	Bioburden control of cleanrooms	First issue, 15 November 2008	N	N


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To define the requirements for evaluation, qualification and Procurements of PCB	Q-ST-70-60C	Corrigendum 1 – Qualification and procurement of printed circuit boards	First issue, 01 March 2019	Y	Y
Defines the technical requirements and quality assurance provisions for the manufacture and verification of high-reliability electronic circuits of surface mount, through hole, solderless assemblies and soldering of harness and wire interconnection	Q-ST-70-61C	High reliability assembly for surface mount and through hole connections	First issue, 08 April 2022	Y	Y
to satisfy specific requirements at system and mission level	Q-70-71C	Materials, processes and their data selection	Second issue Rev 1, 15 October 2019	Y	Y
To define requirements for processing and quality assurance of powder bed fusion technologies for space applications	Q-70-80C	Processing and quality assurance requirements for metallic powder bed fusion technologies for space applications	First Issue, 30 July 2021	Y	Y
Complex software development/use is foreseen	Q-ST-80C	Software Product Assurance	Third issue Rev 1,15 February 2017	Y	Y


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Series ECSS "E" – Engineering


Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
Complex system and subsystem activities are foreseen. A structured way to perform SE activities is mandatory.	E-ST-10C	System Engineering general requirements	Third issue Rev. 1, 15 February 2017	Y	Y
Complex system and subsystem activities are foreseen. A structured way to perform verification activities is mandatory.	E-ST-10-02C	Verification	Second issue Rev 1, 01 February 2018	Y	Y
A structured way to perform testing activities is mandatory.	E-ST-10-03C	Testing	Second issue, 31 May 2022	Y	Y
to satisfy specific requirements at system and mission level	E-ST-10-04C	Space environment	Second issue Rev 1, 15 giugno 2020	Y	Y
to satisfy specific requirements at system and mission level	E-ST-10-06C	Technical requirements specification	Third issue Rev 1, 15 June 2020	Y	Y
For definition of reference directions, coordinate systems and their inter-relationships	E-ST-10-09C	Reference coordinate system	First issue, 31 July 2008	Y	Y
--	E-ST-10-11C	Human factors engineering	First issue, 31 July 2008	Y	Y
To the evaluation of radiation effects on all space systems	E-ST-10-12C	Method for the calculation of radiation received and its effects, and a policy for design margins	First issue, 15 November 2008	Y	Y
To management and control of interfaces	E-ST-10-24C	Interface management	First issue 1 June 2015	Y	Y

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Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
For the assessment of technology maturity at each level	ECSS-E-AS-11C	Adoption Notice of ISO 16290, Space systems - Definition of the Technology Readiness Levels (TRLs) and their criteria of assessment	First issue, 01 October 2014	Y	Y
to satisfy specific requirements at system and mission level	ECSS-E-ST-20C	Electrical and electronic	Second issue Rev 1 15 October 2019	Y	Y
To define the requirements and recommendations for the design and test of RF components/equipment to achieve acceptable performance with respect to multipactor-free operation in space	ECSS-E-ST-20-01C	Multipactor design and test	Second issue, 15 June 2020	Y	Y
To avoid/minimize hazardous effects arising from spacecraft charging	ECSS-E-ST-20-06C Rev.1	Spacecraft charging	First issue Revision 1, 15 May 2019	Y	Y
For design of space system able to function satisfactorily in its electromagnetic environment	ECSS-E-ST-20-07C Rev.1	Electromagnetic compatibility	Second issue Revision 1, 07 February 2012	Y	Y
for the qualification, procurement, storage and delivery of photovoltaic assemblies	E-ST-20-08C Rev.1	Photovoltaic assemblies and components	Second issue Revision 1, 18 July 2012	N	Y
To identify the requirements needed to specify, procure or develop a space power distribution system	E-ST-20-20C	Electrical design and interface requirements for power supply	First issue, 15 April 2016	Y	Y
--	E-ST-20-21C	Electrical design and interface requirements for actuators	First issue, 15 May 2019	Y	Y

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to satisfy specific requirements at system and mission level	E-ST-31C	Thermal control	Second issue, 15 November 2008	Y	Y
--	E-ST-31-02C Rev.1	Two-phase heat transport equipment	First issue Revision 1, 15 March 2017	N	N
--	ECSS-E-ST-31-04C	Exchange of thermal analysis data	First issue, 01 February 2018	Y	Y
to satisfy specific requirements at system and mission level	E-ST-32C	Structural general requirements	Second issue Revision 1, 15 November 2008	Y	Y
to satisfy specific requirements at system and mission level	E-ST-32-01C	Fracture Control	Second issue Revision 2, 30 July 2021	Y	Y
To define the structural design and verification of metallic and non-metallic pressurized hardware	E-ST-32-02C Rev.1	Structural design and verification of pressurized hardware	First issue Revision 1, 15 November 2008	Y	Y
to satisfy specific requirements at system and mission level	E-ST-32-03C	Structural finite element models	First issue, 31 July 2008	Y	Y
to satisfy specific requirements at system and mission level	E-ST-32-08C	Space engineering – Materials	Second issue Revision 1, 15 October 2014	Y	Y
to satisfy specific requirements at system and mission level	E-ST-32-10C	Structural factors of safety for spaceflight hardware	First issue Revision 2, 15 May 2019	Y	Y

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--	E-ST-32-11C	Modal assessment survey	Second issue, 31 July 2008	N	N
Manage the requirements applicable to mechanisms on space items	E-ST-33-01C	Mechanisms	Second issue Revision 2, 01 March 2019	Y	Y
--	E-ST-33-11C	Explosive systems and devices	Third issue Revision 1, 01 June 2017	N	N
--	E-ST-34C	Environmental control and life support (ECLS)	Second issue, 31 July 2008	N	N
To specify the activities to be performed in the engineering of propulsion systems and their applicability.	E-ST-35 C	Propulsion requirements general	First issue Revision 1, 06 March 2009	N	Y
To specify the activities to be performed in the engineering of propulsion systems and their applicability.	E-ST-35-01C	Liquid and electric for propulsion spacecraft	First issue, 15 November 2008	N	Y
--	E-ST-35-02C	Solid propulsion for spacecrafts and launchers	First issue, 08 October 2010	N	N
--	E-ST-35-03C	Liquid propulsion for launchers	First issue, 13 May 2011	N	N
To define design requirements for cleanliness of propulsion components	E-ST-35-06C	Cleanliness requirements for spacecraft propulsion hardware	First issue Revision 2, 07 April 2020	N	Y


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--	E-ST-35-10C	Compatibility testing for liquid propulsion systems	First issue, 06 March 2009	N	Y
Complex software development/use is foreseen.	E-ST-40C	Software	Third issue, 06 March 2009	Y	Y
--	E-ST-40-07C	Simulation modelling platform	First issue, 02 March 2020	N	Y
Complex system and subsystem activities are foreseen.	E-ST-50C	Communications	Second issue, 31 July 2008	Y	Y
For requirements concerning spacecraft transponder and Earth station equipment	E-ST-50-02C	Ranging and Doppler tracking	Second issue, 31 July 2008	Y	Y
To define the radio communication techniques used for the transfer of information between spacecraft and Earth stations in both directions, and for the tracking systems.	E-ST-50-05C	Radio frequency and modulation	Second issue Revision 2, 04 October 2011	Y	Y
To support high data-rate and long distance communications	E-ST-50-11C	SpaceWire - Very high-speed serial link	First issue, 15 May 2019	Y	Y
to satisfy specific requirements at system and mission level	E-ST-50-12C	SpaceWire – Links, nodes, routers and networks	Second issue Revision 1, 15 May 2019	Y	Y
To use standard communication protocols for spacecraft communication links	E-ST-50-13C	Interface and communication protocol for MIL-STD-1553B data bus onboard spacecraft	First issue, 15 November 2008	Y	Y


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Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
to satisfy specific requirements at system and mission level	E-ST-50-14C	Spacecraft discret interfaces	Second issue, 31 July 2008	Y	Y
To use the CAN Network for spacecraft on-board communications	E-ST-50-15C	CANbus extension protocol	First issue, 01 May 2015	Y	Y
To define the interface services and to specify their corresponding network protocol elements for spacecraft using the Time-Triggered Ethernet data network	E-ST-50-16C	Time-Triggered Ethernet	First issue 30 September 2021	N	N
To distinguish between the various protocols	E-ST-50-51C	SpaceWire protocol identification	First issue, 05 February 2010	Y	Y
--	E-ST-50-52C	SpaceWire - Remote memory access protocol	First issue, 05 February 2010	Y	Y
--	E-ST-50-53C	SpaceWire - CCSDS packet transfer protocol	First issue, 05 February 2010	Y	Y
Complex system and subsystem activities are foreseen. To be used for Space Segment only.	ECSS-E-60-10C	Control performance	First issue, 15 November 2008	Y	Y
	E-ST-60-20C	Star terminology sensor and performance specification	First issue Revision 2, 15 May 2019	Y	Y
	E-ST-60-21C	Gyro terminology and performance specification	First issue, 15 February 2017	Y	Y
	E-ST-60-30C	Satellite attitude and	First issue,	Y	Y

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Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Issue, Date of publication	Instrument Applicability	System Applicability
		orbit control system (AOCS) requirements	30 August 2013		
Complex system including Ground Segment and Operations for definition phase.	E-ST-70C	Ground Systems and Operations	Second issue, 31 July 2008	Y	Y
To identify the on-board functionality for OBCP execution and the ground functionality for OBCP preparation and subsequent control.	E-ST-70-01C	Spacecraft on-board control procedures	First issue, 16 April 2010	Y	Y
For the design of on-board functions of space segments in order to ensure operability in-flight	E-ST-70-11C	Space segment operability	Second issue, 31 July 2008	Y	Y
To define the monitoring and control data in order to allow a customer to perform space system integration, testing and mission operations.	E-ST-70-31C	Ground systems and operations - Monitoring and control data definition	Second issue, 31 July 2008	Y	Y
To define language and procedures for space system testing and operations.	E-ST-70-32C	Test and operations procedure language	Second issue, 31 July 2008	Y	Y
to satisfy specific requirements at system and mission level	E-ST-70-41C	Telemetry and telecommand packet utilization	Second issue, 15 April 2016	Y	Y

ASI (ECSS) - NASA Verification Approach Tailoring


For what concern Verification Methods a tailoring between NASA and ECSS approach has been performed in order to have a common understanding in particular, the next Figure 1 shows the comparison between NASA and ECSS approach.

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	JPL Description	ECSS Description
TEST	The use of system, subsystem, or component operation to obtain detailed data to verify performance or to provide sufficient information to verify performance through further analysis. Testing is the detailed quantifying method of verification.	Verification by test shall consist of measuring product performance and functions under representative simulated environments.
ANALYSIS	The use of mathematical modeling and analytical techniques to predict the compliance of a design to its requirements based on calculated data or data derived from lower level component or subsystem testing. It is generally used when a physical prototype or product is not available or not cost effective. Analysis includes the use of both modeling and simulation.	Verification by analysis shall consist of performing theoretical or empirical evaluation using techniques agreed with the Customer.
DEMONSTRATION	Verification by demonstration is a minimum one-time, successful execution of a required operation/capability to prove that it can be achieved. It is generally used for a basic confirmation of performance capability, and differs from testing in that detailed data gathering or multiple tests under different scenarios/conditions is not required	-
INSPECTION	The visual examination of the system, component, or subsystem. It is generally used to verify physical design features or specific manufacturer identification. Can also mean inspection of a document.	Verification by inspection shall consist of visual determination of physical characteristics.
REVIEW OF DESIGN	-	Verification by Review-of design (ROD) shall consist of using approved records or evidence that unambiguously show that the requirement is met (i.e. design documentation).

Figure 1 NASA/JPL and ECSS Methods comparison

It was agreed (see Figure 2) that Review of Design method will be removed and included in Inspection method that will be characterized by: Visual/physical inspection, Inspection of documents. Demonstration method (NASA) will be removed and included in Test method (see Figure 2) that will be characterized by: Functional tests and Performance tests.

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	Description
TEST	Verification by test shall consist of measuring product performance and functions under representative simulated environments.
ANALYSIS	Verification by analysis shall consist of performing theoretical or empirical evaluation using techniques agreed with the Customer.
REVIEW OF DESIGN	Verification by Review-of design (ROD) shall consist of using approved records or evidence that unambiguously show that the requirement is met (i.e. design documentation).
INSPECTION	Verification by inspection shall consist of visual determination of physical characteristics or utilization of approved records or evidence that unambiguously show that the requirement is met (i.e. design documentation).
DEMONSTRATION	Verification by demonstration is a minimum one-time, successful execution of a required operation/capability to prove that it can be achieved. It is generally used for a basic confirmation of performance capability, and differs from testing in that detailed data gathering or multiple tests under different scenarios/conditions is not required

Figure 2 ASI-NASA Verification Tailoring

The final Agreement is shown in the next Figure 3.


	Description
TEST	Verification by test shall consist of measuring product performance and functions under representative simulated environments.
ANALYSIS	Verification by analysis shall consist of performing theoretical or empirical evaluation using techniques agreed with the Customer.
INSPECTION	Verification by inspection shall consist of visual determination of physical characteristics or utilization of approved records or evidence that unambiguously show that the requirement is met (i.e. design documentation).

Figure 3 ASI-NASA Verification Method Agreement

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Series ECSS "U" – Sustainability

Project Characteristics and Risks (justification for selection)	ECSS Standard	Title	Instrument Applicability	System Applicability
The key space debris mitigation requirements shall be considered	U-ST-10	Space Debris Adoption Notice of ISO 24113: Space systems - Space debris mitigation requirements	Y	Y
To select planetary protection requirements	U-ST-20C	Planetary protection	Y	Y

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5. SECOND LEVEL TAILORING”

The Second Level/Step Tailoring consists in the analysis and definition of the applicability of requirements included in each single ECSS standard.

This process is developed by the Contractor in conjunction with ASI and approved by ASI.

The Contractor shall repeat the Tailoring process (First and Second Level) with Subcontractor and require application of the Tailoring process at all level of the supply chain.

Each requirement included in the ECSS standard shall be analysed in order to assess its level of applicability and considered as follows, depending on the project characteristics:

- A= Applicable without change/ Applicabile senza modifiche
- MR= Applicable with modification/Applicabile con modifiche
- NA = Not Applicable (deleted)/Non Applicabile
- NR= Additional/New Requirement/ Requisito supplementare

The following table shows an example of the required output.

Example:

ECSS-Y-XX Req. /paragr.	Requirement Description	Applicability	Differencies
<u>2.3.1</u>	< Requirement description >	A	
<u>2.3.4</u>	< Requirement description >	NA	Not applicable, <to be justified>
<u>4.5</u>	< Requirement description >	MR	To write modified requirement
<u>5.6</u>	< Requirement description >	NR	To write text of the new requirement