ECSS-S-ST-00-02C DRAFT 1
15 June 2020

ECSS System

Tailoring

DISCLAIMER
As decided by the ECSS Technical Authority at TA#70 (15 June 2020) is this document made available as Draft only, pending the Pilot Case of Tailoring.

ECSS Secretariat
ESA-ESTEC
Requirements & Standards Division
Noordwijk, The Netherlands

Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering, product assurance and space sustainability 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 Pre-Tailoring Task Force, and reviewed and approved by the ECSS Technical Authority.

Disclaimer

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Scope

This document provides requirements for tailoring of the ECSS system (at standards and requirements levels) using the pre-tailoring done by ECSS.

This Standard also describes in detail the tailoring methodology.

Pre-tailoring guidelines for pilot cases are given in Annex C.

2 References

The following documents are referenced in this text or provide additional information useful for the reader.

ECSS-S-ST-00	ECSS system – Description, implementation and general requirements
ECSS-S-ST-00-01	ECSS system - Glossary of terms
ECSS-S-ST-00-02 Table 5-1	ECSS system – ECSS Tailoring – Pre-Tailoring Table NOTE: *The latest version of this document is available from the ECSS.NL website as an Excel-file.*
ECSS-M-ST-10	Space project management – Project planning and implementation

3
Terms, definitions and abbreviated terms

3.1 Terms from other standards

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

1. **ground segment element**
2. **ground segment equipment**
3. **ground segment subsystem**
4. **ground segment equipment**
5. **launch segment element**
6. **launch segment equipment**
7. **launch segment subsystem**
8. **space segment element**
9. **space segment equipment**
10. **space segment subsystem**
11. **space system**

3.2 Terms specific to the present standard

3.2.1 standards tailoring baseline

list of ECSS standards from which the tailoring of the ECSS system for a particular project or application is started, in order to establish the final list of ECSS applicable standards

3.2.2 requirements tailoring baseline

list of requirements from the ECSS standards selected as applicable to a particular space project or application, from which the tailoring is started, in order to establish the final list of ECSS applicable requirements

3.2.3 tailoring

process to adapt the list of standards and requirements applicable to a project to the project specificities

3.2.4 pre-tailoring

process done by ECSS to define the list of standards and requirements applicable to a product type.

NOTE The result of the pre-tailoring of the ECSS standards is presented in this document and is to be used as input

to the preparatory activities to define the standards baseline for tailoring.

3.3 Abbreviated terms

The following abbreviated terms are used within this document:

Abbreviation	Meaning
EARM	ECSS applicable requirements matrix
EAT	ECSS applicability table
GSE	ground support equipment
HW	hardware
MTBF	mean time between failure
PRD	project requirement documentation
SW	software

3.4 Nomenclature of the ECSS system of standards

The following nomenclature applies to the ECSS system of standards, and in particular throughout this document. It does not apply to ECSS handbooks.

a. The word "shall" is used in the ECSS system of standards to express requirements. All the requirements in the ECSS system of standards are expressed with the word "shall".

b. The word "should" is used in the ECSS system of standards to express recommendations. All the recommendations are expressed in the ECSS system of standards with the word "should".

NOTE It is expected that, during tailoring, the recommendations in ECSS standards are either converted into requirements or tailored out.

c. The words "may" and "need not" are used in the ECSS system of standards to express positive and negative permissions respectively. All the positive permissions are expressed in the ECSS system of standards with the word "may", and the negative permissions with the words "need not".

d. The word "can" is used in the ECSS system of standards to express capabilities or possibilities, and therefore, if not accompanied by one of the previous words, it implies descriptive text.

NOTE In the ECSS system of standards, "may" and "can" have a complete different meaning: "may" is normative (permission) and "can" is descriptive.

e. The present and past tense, if not expressed by one of the previous words, are used in the ECSS system of standards to express statement of fact, and therefore they imply descriptive text.

4
Principles

4.1 Overview

The project's requirements within the PRD are composed by two sets:

- requirements covered by ECSS disciplines, subject to tailoring, and
- other requirements specific to the project (i.e. non-ECSS), e.g. mission specific requirements.

The ECSS Standards and requirements to be made applicable at each level of the customer–supplier chain are influenced by the product type, and by the type of business agreement to be used for managing the project.

The ECSS System provides a comprehensive set of coherent standards covering the requirements for the procurement of a generic space product. This system can be adapted to a wide range of project types. The process of adapting the ECSS requirements to the project specificities is called tailoring.

These tailoring activities have demonstrated to require a non-negligible effort. In order to facilitate these activities, the ECSS system includes tools to reduce the number of standards and requirements to be considered as a baseline for tailoring. These pre-tailoring tools consist of using, as starting point for the tailoring:

- instead of the whole list of ECSS standards, a **Standards Tailoring Baseline**, i.e. a pre-defined subset of all ECSS standards depending on the product type, and
- instead of the whole list of requirements inside the ECSS applicable standards for a project, a **Requirements Tailoring Baseline** i.e. a pre-defined subset of requirements in a standard depending on the product type and, in some cases, on the equipment features.

  NOTE Requirements Tailoring Baselines are provided not in all ECSS standards, but only in those standards where a pre-tailoring of the requirements for product types is meaningful.

It is important to note that the application of the pre-tailoring tool, as defined in this standard, is only the entry point for a meaningful tailoring process, and it does not relieve the customer from the obligation of performing such tailoring process to ensure that the whole set of requirements is fully adapted to the project needs. The pre-tailoring tool, however, helps the customer by reducing the amount of documentation to be considered in the tailoring process.

4.2 The tailoring process

4.2.1 Overview

Figure 4-1 describes a recommended 7-step process for the preparation and application of tailoring to establish the applicability of ECSS Standards and their requirements to a project and to apply tailoring as necessary.

These 7 steps are grouped in three major activities:

1. Preparatory activities, necessary to clearly identify the project specificities. It is important to complete these preparatory activities before addressing the range and degree of applicability of the total set of ECSS Standards to a particular project.
2. Core tailoring activities, where the ECSS list of standards and the requirements in each standard are tailored to the specificities identified in activity 1. above, including the addition and modification of ECSS requirements.
3. Finalization activities, including addition of mission or project specific requirements, check of overall consistency of the complete set of requirements, and document it.

Note that the process described in this clause 4.2 describes the generation of the complete set of requirements applicable for a PRD, i.e. ECSS and non-ECSS. The purpose of this clause is to show the context in which the list of ECSS requirements is to be reduced for a given project/mission through pre-tailoring and tailoring.

The actual reduction of the applicable ECSS requirements are the core tailoring activities mentioned in activity 2. and described in clause 4.2.3 below.

Preparatory activities (clause 4.2.2) and finalization activities (clause 4.2.4) are only described to show the necessity to harmonize the filtering of the ECSS requirements with other, non-ECSS, project/mission specific requirements.

Consequently, the requirements expressed in this document in clause 5 on the process how to reduce the number of applicable ECSS requirements through pre-tailoring and tailoring refers to the core tailoring activities only.

4.2.2 Preparatory activities

4.2.2.1 STEP 1: Identification of project characteristics

Overall project characteristics are identified taking into account experience gained and lessons learned from comparable projects, and are used for establishing the project context, scope, scale, orientation and other elements key to the successful achievement of the project objectives. They are specified in both programmatic and technical terms:

- Programmatic characteristics cover overall risk policy, including risk sharing, as well as political, financial, schedule, economic and contractual aspects.
- Technical characteristics cover mission objectives (including life cycle and environment), technical complexity, technology, engineering, quality, scientific and product–oriented aspects.

4.2.2.2 STEP 2: Analysis of project characteristics and identification of risks

After identifying its characteristics, the project is analysed to identify significant cost, schedule, technical drivers, as well as critical issues and specific constraints. These are used to identify and evaluate inherent and induced risks.

Main strategic, organisational, economical or technical characteristics considered for a project are as follows:

- Objectives of the mission (e.g. scientific, commercial, institutional);
- Product type;
- Mission characteristics (e.g. type of orbit, expected life duration, availability);
- Constraints from the environment (e.g. external interfaces, external regulations, procurement constraints) the project belongs to;
- Expected cost to completion;
- Schedule drivers;
- Level of commitment (e.g. partnership, supplier) or type of business agreement (e.g. fixed price, cost-reimbursement);
- Maturity of design or technology (e.g. recurrent development, TRL);
- Technical product complexity;
- Organisational or contractual complexity;
- Supplier maturity.

NOTE This list is not exhaustive and can be completed according to project needs. Some elements of this list are imposed to the project, whereas the others are subject to choice within the project itself.

The resulting project risk factors are documented and the causes and consequences of the identified risks are determined. This is the first step in the risk management process, which is continued to monitor and manage risk mitigation actions throughout the life of the project.

4.2.3 Core tailoring activities

4.2.3.1 STEP 3: Selection of applicable ECSS Standards -

Using the pre-tailoring table linked in clause 5.4 the Standards Tailoring Baseline can be directly derived.

Taking into account the results of the preparatory activities as a primary input, this Standards Tailoring Baseline is evaluated for relevance to the overall project needs to establish the list of ECSS applicable standards, to build the EAT, which will be made applicable as part of the PRD. Annex A provides the template of the EAT.

4.2.3.2 STEP 4: Selection of requirements from applicable standards

For standards in the EAT, which include a pre-tailoring table at requirements-level, the Requirements Tailoring Baseline is automatically established by this table.

For standards in the EAT, which do not include a pre-tailoring table at requirements-level, the Requirements Tailoring Baseline consists of all requirements of this standard.

Using the result of the preparatory activities as the primary input, this Requirements Tailoring Baseline is assessed against cost, schedule, and technical drivers, as well as against the identified risks and their mitigation strategies.

For applicable standards, the following two cases are possible:

a. Where all requirements in a standard are classified as applicable without change, the whole standard is fully applicable (applicable without modifications).

b. Where an applicable standard contains requirements of different classifications, the standard is applicable with modifications (sometimes called partially applicable), and these requirements are classified as follows:

   1. for each requirement classified as “applicable” (A), the requirement is applied without modification;

   2. for each requirement classified as “modified” (M), the requirement is applied with modification, which can be a change to, or a deletion of a part of the existing text, or new text added to the existing text to enhance or clarify the requirement.;

   3. for each requirement classified as “deleted” (D), the requirement is not applied and is deleted

   4. Missing generic (i.e. non mission specific) requirements can also be added if necessary, and therefore classified as “New” (N).

      NOTE Eventually this can lead to an ECSS Change Request (CR) to introduce the requirement in a new version of the document

The method of recording the applicability of ECSS Standards and requirements for a project in an efficient and structured manner is to consolidate it into an “ECSS Applicability Requirements Matrix” (EARM), which is made applicable as part of the PRD. Only the requirements classified (M), (D) or (N) shall be recorded in the EARM and the reasons for their modification, deletion or addition shall be justified / clarified. Annex B provides a template of the EARM for the requirements of this Standard.

4.2.4 Finalization activities

4.2.4.1 STEP 5: Completion of requirements

Now the set of requirements needs to be complemented with the project or mission specific (non-ECSS) requirements.

4.2.4.2 STEP 6: Harmonization of requirements

The coherence and consistency of the overall set of requirements to be made applicable to the project is reviewed to eliminate the risk of conflict, duplication, or lack of necessary requirements.

In this process, the EAT and EARM generated in the core tailoring activities will be updated if necessary leading to form the entire applicability table.

4.2.4.3 STEP 7: Documenting of requirements applicability

Taking the EAT and EARM from the core tailoring activities and adapting them as required to harmonize them with the non-ECSS project requirements in clause 4.2.4.2 leads to the complete versions of the EAT and EARM as outputs from the 7-step tailoring process.

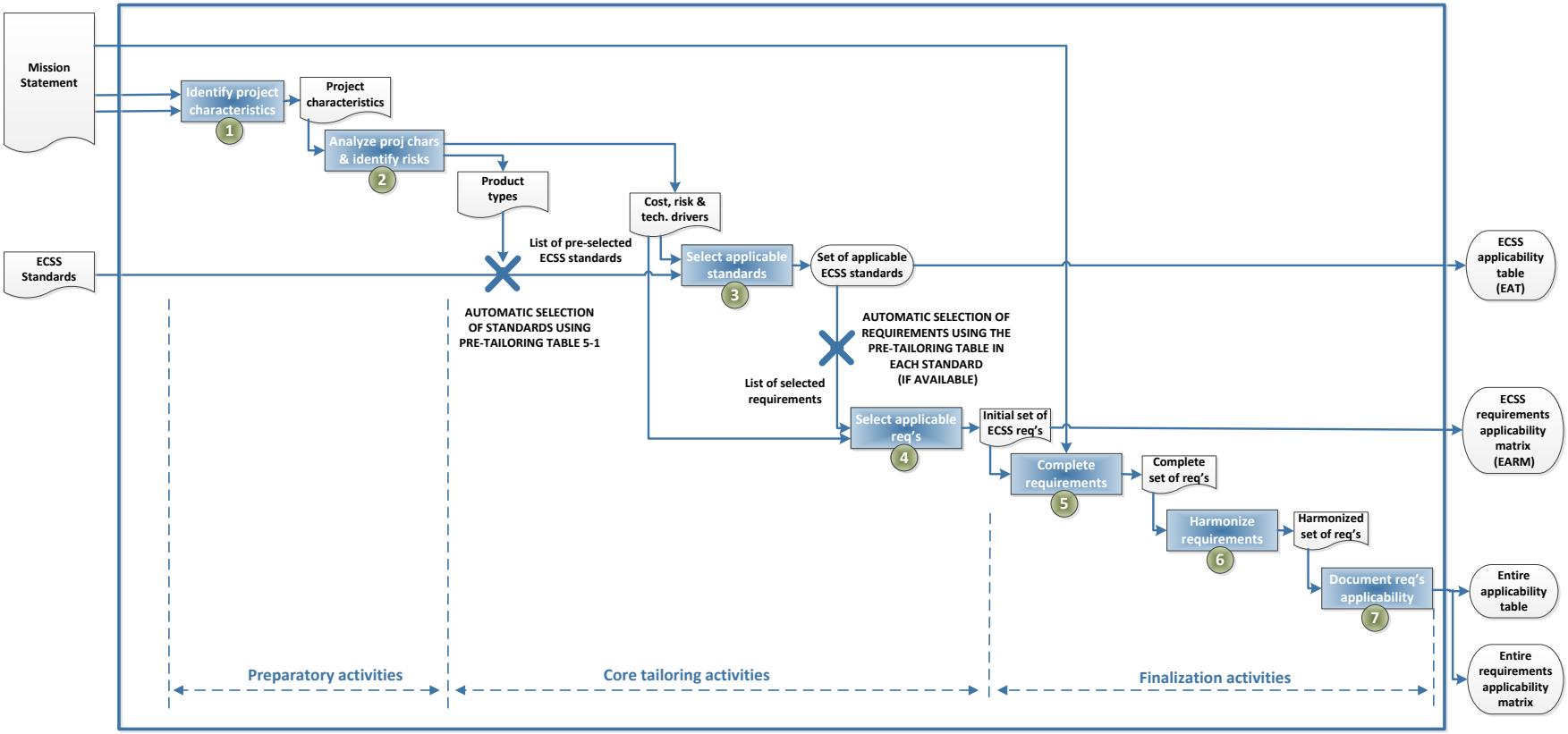

Figure 4-1: 7–step tailoring process at the top level of the customer-supplier chain

4.3 Pre-tailoring tables

4.3.1 General

Since it is acknowledged that a number of standards and requirements may not be applicable for specific type of products, it is considered of interest to identify such product types and the associated applicability of standards/requirements.

It is important to understand that pre-tailoring does not supersede the obligation of the customer of performing a meaningful tailoring to the specific application.

The present document provides the rules for establishing the baseline to start tailoring process, for both the list of standards and the list of requirements, against the following type of products:

a. Space system

b. Space segment element and subsystem

c. Space segment equipment

d. Launch segment element and subsystem

e. Launch segment equipment

f. Ground segment element and subsystem

g. Ground segment equipment

h. Ground support equipment

i. Software

Attention is drawn to the importance of the precise meaning of the above terms for the correct use of the present document. Reading of ECSS-S-ST-00-01 "Glossary of terms" clauses 2.2.3 to 2.2.6 is strongly recommended to ensure that the correct meaning is understood.

4.3.2 Context

Pre-tailoring tables can simplify significantly two of the steps of the tailoring process as shown in Figure 4-2:

- Step 3: Selection of applicable ECSS standards.

  The Standards Tailoring Baseline is automatically provided by filtering the list of ECSS standards (at top level customer), or the list of standards flowed down from the customer (at any other lower level) entering in the pre-tailoring table linked in clause 5.4with the type of product.

  It is important to note that, as shown in Figure 4-2, the step 3 of the tailoring process can modify this list of standards by adding or deleting standards, to produce the final list of applicable standards.

- Step 4: Selection of requirements from applicable standards.

  The pre-tailoring table in each individual standard, if available, provides the Requirements Tailoring Baseline, or list of requirements to be tailored, as an input to this step. Using this input, the tailoring activity is performed in order to obtain the list of applicable requirements.

  It is important to note that, as shown in Figure 4-2, the step 4 of the tailoring process can modify this list of ECSS requirements, by adding, deleting or modifying requirements, to produce the list of ECSS applicable requirements.

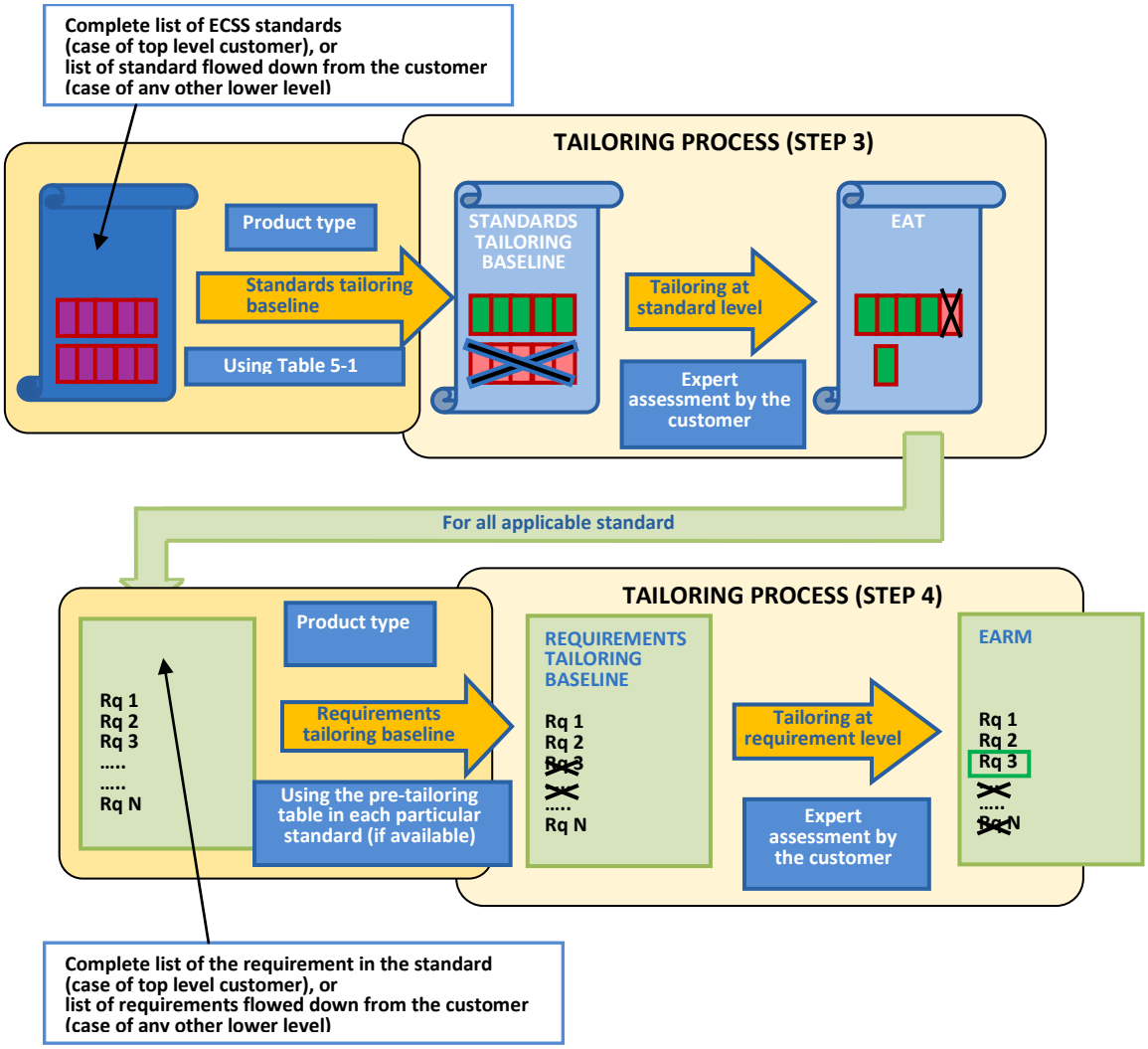

Figure 4-2: Pre-tailoring tool in a project context

5 Requirements

5.1 Applicability

This clause addresses the requirements to make the ECSS standards and requirements applicable for the development of space products.

It covers the core tailoring activities described in clause 4.2.3, i.e. the selection of applicable ECSS standards and requirements (output: EAT / EARM) only and not the preparatory activities (clause 4.2.2) nor the finalization activities (clause 4.2.4), i.e. the non-ECSS requirements.

5.2 Requirements for the establishment of the ECSS applicability table (EAT)

5.2.1 Requirements on the customer at top-level of the customer supplier chain

a. Top level customer shall establish the EAT for his supplier using as input

1. to establish the Standards Tailoring Baseline, the column in the pre-tailoring table linked in clause 5.4 selecting the product type in procurement,
2. the results of preparatory activity (see 4.2.2).

b. Top level customer shall establish the EAT for his supplier in accordance with Annex A, specifying the applicability (see Annex A) of each standard.

c. Top level customer shall justify/clarify in the EAT any deviation from the Standards Tailoring Baseline.

NOTE A deviation means that applicability is:

NA when a "**X**" or a ">>" is in the pre-tailoring table

A or **T** when a " – " or a ">>" is in the pre-tailoring table

>> when " – " or a "**X**" is in the pre-tailoring table

The meaning of the symbols NA, A, T, >> is given in 5.4.2.

5.2.2 Requirements on the customer on other levels than at top-level of the customer supplier chain

a. Customer other than top level customer shall establish an EAT for his supplier using as inputs:

1. the EAT received, as supplier, from his higher level customer
2. the column in the pre-tailoring table linked in clause 5.4 for the product type in procurement
3. the results of preparatory activity (see 4.2.2)

b. Customer other than top level customer shall establish the EAT for his supplier in accordance with Annex A.

c. Customer other than top level customer shall justify/clarify in the EAT any deviation from inputs 5.2.2a.1 and 5.2.2a.2.

NOTE 1 A deviation from input 5.2.2a.2 means that applicability is:

NA when a "X" or a "**>>**" is in the pre-tailoring table

A or **T** when a " **–** " or a "**>>**" is in the pre-tailoring table

>> when " **–** " or a "**X**" is in the pre-tailoring table

The meaning of the symbols NA, A, T, >> is given in 5.4.2.

NOTE 2 In case of inconsistency between inputs 5.2.2a.1 and 5.2.2a.2, input 5.2.2a.1 prevails.

d. In case of deviation from inputs 5.2.2a.1 and 5.2.2a.2, customer other than top level customer shall provide the EAT to his upper lever customer, in his role of upper level provider, for information/approval

5.3 Requirements for the establishment of the ECSS applicability requirement matrix (EARM)

5.3.1 Requirements on the customer at top-level of the customer supplier chain

a. Top level customer shall establish the EARM for his supplier using as inputs:

1. the EAT as specified in 5.2.1.
2. the requirements pre-tailoring provisions in each standard of the EAT as specified in 5.2.1.
3. results of preparatory activity (see 4.2.2)

b. Top level customer shall establish the EARM for his supplier in accordance with Annex B, providing:

1. justification/clarification in case of Modification, Deletion or introduction of a New requirement
2. complete formulation in case of Modification, or introduction of a New requirement

NOTE The requirements of the standards whose applicability is "A" in the EAT (without any modification), need not to be listed in the EARM

5.3.2 Requirements on the customer on other levels than at top-level of the customer supplier chain

a. Customer other than top level customer shall establish the EARM for his supplier using as input:
   1. the EAT as specified in 5.2.2.
   2. the EARM received as supplier, from his next higher level customer
   3. the requirements pre-tailoring provisions in each standard of the EAT as specified in 5.2.2.

      NOTE Input 5.3.1a.2 has to be taken into account to identify the tailored requirements applicable at higher level and which are also applicable for the product in procurement
   4. results of preparatory activity (see 4.2.2)

b. Customer other than top level customer shall establish the EARM for his supplier in accordance with Annex B, providing:
   1. justification in case of Modification, Deletion or introduction of a New requirement
   2. complete formulation in case of Modification, or introduction of a New requirement

      NOTE The requirements of the standards which applicability is "A" in the EAT (without any modification), need not to be listed in the EARM

c. customer other than top level customer shall provide the EARM to his upper lever customer, in his role of upper level provider, for information/approval

5.4 Pre-tailoring of the list of ECSS standards

5.4.1 Pre-tailoring against product types

In order to support the customer with the tailoring, the applicability of ECSS standards has been pre-tailored for the 9 product types as defined in clause 4.3.1

The pre-tailoring table of the ECSS standards is a living document, since it is being updated with every standard newly published or revised. It is therefore maintained on the ECSS website and can be accessed via the following link:

- www.ecss.nl
- Look for the download page of ECSS-S-ST-00-02.
- Download ECSS-S-ST-00-02C-Table 5-1 "ECSS – Pre-Tailoring Table"

5.4.2 Pre-tailoring symbols

The pre-tailoring table contains symbols to define the applicability of each ECSS standard for the above mentioned 9 product types with the following meaning:

"X" the standard is applicable to this product type. Responsibility of tailoring (if needed) resides with the customer of this product type.

"-" the standard is not applicable to that product type.

"//" pre-tailoring applicability not definable - to be determined during tailoring

">>" the standard is applicable to this product type on lower level only. Responsibility of tailoring (if needed) resides with the customer of this lower level product type.

X# the standard is applicable except in a specific case - the criteria for being "not applicable" are defined in the comments column

//# pre-tailoring applicability not definable - however supplementary indications regarding applicability in the tailoring are given in the comments column

NOTE 1 "#" is a number to uniquely identify every comment in the same row.

NOTE 2 the same symbols are used to determine the applicability of single requirements within a standard. Some of the symbols may not be used in every table.

Annex A (normative)
ECSS applicability table (EAT) DRD

ECSS Applicability Table (EAT)

Project/Programme:	**Mission type:**
Contract information	**Issue date:**
Originator:	**Event generation:**

Standard	Applicability (A / T / >> /NA)	Justification/Clarification (including justification/clarification of the use of other standard instead of)

A: Standard fully applicable without tailoring
T: Standard applicable with tailoring. For each of these standards, the generation of a EARM is expected.
>> Standard applicable at a lower level of product and to be tailored by the customer of this lower level
NA Standard not applicable

Figure A-1: Example of the ECSS Applicability Table (EAT)

Annex B (normative)
ECSS Applicability Requirement Matrix (EARM) DRD

ECSS Applicability Requirement Matrix (EARM)

Project/Programme:	**Contract information:**
Issue date:	**Originator:**
Event generation:	**Standard reference:**
Product type:	

THE COMPLETE SET OF REQUIREMENTS IN THE STANDARDS IN THE EAT ARE APPLICABLE, AS DETAILED BELOW					
1. **ECSS Standard**	**2.** **ECSS Req. identifier**	**3.** **Org. Req. identifier**	**4.** **Applicability** (A/M/D/N)	**5** **Modified or New requirement** (Full text)	**6.** **Justification/Clarification** (Only in case of M, D or N in column 4)
NOTE: Column 3 is provided to give the users the capability of using their own requirement identification system, in parallel with the identification of the requirement in the applicable standard (Column 2).				**A**: Requirement applicable as written **M**: Requirement applicable with **M**odification **D**: Requirement **D**eleted, not applicable **N**: **N**ew requirement (requirement added)	

Figure B-1: Example of the ECSS Applicability Requirement Matrix (EARM)

Annex C (informative)
Pre-tailoring guidelines for pilot cases

C.1 Context and objectives

ECSS-S-ST-00-02 "ECSS Tailoring" provides requirements for tailoring of the ECSS system at Standard and Requirement level using the pre-tailoring done by ECSS.

This Standard also describes in detail the tailoring methodology.

ECSS SB#52 took the decision to run some pilot cases (one or two projects) in order to have, before its publication, a feedback on the:

- described process and its efficiency
- quality of the requirements in ECSS-S-ST-00-02
- pre-tailoring of standards for the defined product types (clause 5.4)
- normative annexes of ECSS-S-ST-00-02 (Annex A "ECSS applicability table (EAT)" and Annex B "ECSS Applicability Requirement Matrix (EARM)"
- pre-tailoring annexes at requirements level of some standards

C.2 Principles and outputs of the pilot cases

ECSS SB#55 decided that the pilot cases will be run from top industry level of the costumer supplier chain to equipment level.

For each level of the chain (from top level of the costumer supplier chain down to equipment suppliers), each project actors will provide the ECSS Executive Secretariat with EARMs and EATs used in the relations customer-supplier. Collection will be decided by the upper customer PM. The recommended method is that the collected feedback is transferred in the customer chain up to the upper customer in charge of supplying the collection regularly to the ECSS secretariat.

In addition, the following feedback shall be provided by every actor in the customer supplier chain:

<u>From every customer:</u>

- Has applying this standard (ECSS-S-ST-00-02) reduced the number of requirements made applicable to your supplier? By which percentage (roughly)?
- Has it helped you to establish the EAT and EARM?
- Do you see any risk in over specifying or over tailoring when applying this standard?
- How difficult was it to be compliant with ECSS-S-ST-00-02 requirements?

- Does it change the way you were used to work in space projects and did the teams easily "took the method on board"?

From every supplier:

- Has the fact that your customer(s) have applied this standard (ECSS-S-ST-00-02) reduced the number of requirements made applicable to you? By which percentage (roughly)?
- What has been at your level of supplier the benefit of such a reduction (less effort, schedule gain, ….)
- Which are the standards from EAT not applied, with justification and Compliance Matrix to EARM.