EUROPEAN COOPERATION

ECSS

FOR SPACE STANDARDIZATION

ECSS MasterDB

User Requirements Document

Foreword

This document has been prepared by the ECSS MasterDB Task Force, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

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Change log

ECSS MasterDB URD	Under construction...
Issue 1.1	The user requirements document is still under construction.
	This issue is produced for the sole purpose of the October 2018 "call for interest".
	It is noted that the previous versions of the URD contained some inconsistencies due to an ambiguity of the "structural element" concept. The concept of "configuration item" has been introduced to solve this ambiguity. At the time of issuing this version of the URD, still some ambiguities exist from clause 5.1.2 onwards. They will be solved in the next issue.

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Introduction

Since its inception in 1996 the ECSS organisation has codified more than 120 standards, containing around 25.000 requirements for the development and operations of European Space Systems. These standards are currently available in the form of documents (MS Word and PDF). With the objective of moving from paper documents as a reference to a digital databased system, the requirements have been copied to a requirements management system using IBM Rational DOORS ®, tailored for the purpose of the ECSS context.

The requirements developed in the ECSS standards constitute a consistent set of requirements covering all activities, phases and levels:

- for the development and operations of any European Space System, and

- for direct use in the implementation of space programmes/projects and in the development of space products.

These standards are completed by:

- technical memoranda as early versions of potential future standards, and

- handbooks supporting the application of ECSS standards and describing solutions that comply with the ECSS requirements e.g. guidelines, good practices, collection of data.

The standards are written in English (based on the Oxford Dictionary), augmented by the ECSS Glossary that:

- provides the meaning of the abbreviated terms used, and

- specifies the terms to use and related definitions for specific ECSS concepts.

A DOORS database is produced from these standards to collect and ease use of the requirements in space systems development and operation, in a form suitable for inclusion in legally binding documents.

More information is available at http://www.ecss.nl.

The next step towards the full digital management of the ECSS system requires functionalities going beyond the capabilities offered by the current tools. This is the purpose of the ECSS requirements management system (E-RMS), specified in this user requirements document. The E-RMS is a database system that includes the capability:

- of managing the creation and maintenance process of the ECSS requirements,

- of controlling the ECSS requirements configuration at all levels,

- of providing, to the programmes and projects managers, easy means:

  - to access the ECSS requirements,

  - to render them applicable (after a tailoring phase where needed) through a legal document such as business agreement (e.g. a contract) or internal directives,

o to provide feedbacks related to the use of the ECSS requirements during all phases of the projects and product developments life cycles.

The E-RMS offers to the ECSS community a new way to work whereas information, currently put in documents, is stored and maintained as data items in a database. The E-RMS still provides means e.g. to export the data items under the form of documents for those who prefer or need working with documents instead of using some database human machine interfaces.

1
Scope

The purpose of this document is to specify the user requirements for taking ECSS into the next generation of digital requirements management system, called E-RMS below.

This user requirements document (URD) has been elaborated by the ECSS Master Database Task Force, involving ESA, National Space Agencies and European Space Industry.

This document includes a general description, in chapter 4, which introduces:

- the ECSS organisation and its users,

- high level use cases considered for the development of this user requirements specification,

- operational scenarios and implied constraints.

The set of functional and non-functional requirements to be satisfied by the E-RMS is specified in chapter 5.

The data model requirements are specified in the E-RMS conceptual data model (refer to E-RMS-CDM).

2
References

2.1   Applicable documents

ECSS-S-ST-00-01C   ECSS system – Glossary of terms

http://www.ecss.nl/standards/ecss-s-st-00-01c-glossary-of-terms-1-october-2012

ECSS-D-00   ECSS – ECSS Organization and processes

E-RMS-CDM   E-RMS conceptual data model

E-RMS-Native-ICD   E-RMS native interface control document

E-RMS-Doors-ICD   E-RMS from/to DOORS mapping specification

E-RMS-ReqIF-ICD   E-RMS from/to OMG requirement interchange format (ReqIF) mapping specification

E-RMS-Excel-ICD   E-RMS from/to MS Excel mapping specification

E-RMS-Word-ICD   E-RMS from/to MS Word mapping specification

E-RMS-CR-Report-ICD   E-RMS change record reporting interface specification

ISO/IEC 9834-8:2014   Information technology – Procedures for the operation of object identifier registration authorities – Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers

https://www.iso.org/standard/62795.html

The UUID concept is also specified in ITU-T X.667 (10/2012) : "Information technology - Procedures for the operation of object identifier registration authorities: Generation of universally unique identifiers and their use in object identifiers", refer to http://www.itu.int/itu-t/recommendations/rec.aspx?rec=X.667 and freely accessible from https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-X.667-201210-I!!PDF-E&type=items

It is noted that the ISO or ITU UUID Version 4, i.e. the random-number-based version as specified in e.g. ITU Clause 15 is applicable.

The E-RMS-CDM is delivered with the ITT as a draft only document. The contractor is asked to produce the operational version of the CDM with ESA/ECSS support. Producing the Software requirements, the Contractor shall fully specify the processes related to the creation and maintenance of each type of structural elements as of the E-RMS CDM, the related external interfaces and the related human machine interfaces,

in accordance with the community, role and privilege concepts introduced in this URD. Refer to SoW

The draft B of the ECSS-D-00 is delivered together with the ITT. The version of the ECSS-D-00 to be used will be given at K.O.

The ICDs have to be written by the contractor with ESA/ECSS support. It is noted that a given ICD may propose different interfaces taking into account the specific needs of stakeholders/communities, Refer to SoW

2.2   Reference documents

DOORS	Rational dynamic object oriented requirements system
	https://en.wikipedia.org/wiki/Rational_DOORS
ECSS-M-ST-40C.rev.1	Space project management – Configuration and information management
	http://ecss.nl/standard/ecss-m-st-40c-rev-1-configuration-and-information-management
ECSS-P-00C	Standardization objectives, policies and organization
	http://ecss.nl/standard/ecss-p-00c-standardization-objectives-policies-and-organization-22-march-2013-current-version
ECSS-S-ST-00C	ECSS system – Description, implementation and general requirements
	http://www.ecss.nl/standards/ecss-s-st-00c-description-implementation-and-general-requirements-31-july-2008
ECSS-E-ST-40C	Space engineering – Software
	http://www.ecss.nl/standards/ecss-e-st-40c-software-general-requirements
ECSS-E-ST-70-41C	Space engineering – Telemetry and telecommand packet utilization
	http://ecss.nl/standard/ecss-e-st-70-41c-space-engineering-telemetry-and-telecommand-packet-utilization-15-april-2016
ECSS-E-TM-10-23A	Space engineering - Space system data repository
	http://www.ecss.nl/hbstms/ecss-e-tm-10-23a-space-system-data-repository
ECSS-E-TM-10-25A	Space engineering – Engineering design model data exchange
	http://ecss.nl/hbstms/ecss-e-tm-10-25a-engineering-design-model-data-exchange-cdf-20-october-2010
ECSS-Q-ST-80C	Space product assurance – Software product assurance
	http://www.ecss.nl/standards/ecss-q-st-80c-software-product-assurance

IETF-RFC-3987   Internationalized Resource Identifiers - IRI

https://tools.ietf.org/html/rfc3987

IETF-RFC-4511   Lightweight directory access protocol - LDAP

https://tools.ietf.org/html/rfc4511

ISO/IEC   Systems and software engineering -- Life cycle processes -
29148:2011   Requirements engineering

https://www.iso.org/standard/45171.html

OMG-ReqIF   OMG requirements interchange format
http://www.omg.org/spec/ReqIF

OSLC   Open services for lifecycle collaboration

https://open-services.net

QUDV   Quantities, Units, Dimensions and Values

http://www.omgwiki.org/OMGSysML/doku.php?id=sysml-qudv:quantities_units_dimensions_values_qudv

For the complete set of ECSS documents, refer to www.ecss.nl

3
Abbreviated terms

The following abbreviations apply:

Abbreviation	Meaning
ANSI	American national standards institute
CDM	conceptual data model
DB	database
DiFP	discipline focal point
DoFP	document focal point
DRR	document review report
ECSS	European cooperation for space standardization
E-RMS	ECSS requirements management system
IRI	internationalized resource identifier
ITT	invitation to tender
KO	kick-off
LDAP	lightweight directory access protocol
MS	Microsoft
NWIP	new work item proposal
OMG	object management group
QUDV	quantities, units, dimensions and values
SB	ECSS steering board
SDO	standards development organization
SoW	statement of work
SQL	structured query language
TA	ECSS technical authority
TAAR	ECSS technical authority area responsible
TF	task force
ToR	terms of references
URD	user requirements document
WG	working group

4
General description

4.1 Background

ECSS provides the European space community with a set of space-specific requirements that cover the project management, quality, engineering and sustainability disciplines related to the development and operation of space programs and projects (refer to ECSS-S-ST-00).

The ECSS system mainly consists of standards, handbooks and technical memoranda. The standards describe the "what" whilst the handbooks describe the "how". Standards are formulated as a collective set of requirements, recommendations or permissions focussing on a specific area.

The ECSS system can be used for any type of space development project (hardware and software) and for services. They focus on the contractual relationships and address the complete chain of customers and suppliers involved in the overall space products' life cycle. The ECSS standards, handbooks and technical memoranda are organised for their users, in the following branches, each one further consisting of ECSS documents grouped by disciplines:

- S-Branch, describing the Standardization system,

- M-Branch for Space Project Management,

- Q-Branch for Space Product Assurance,

- E-Branch for Space Engineering, and

- U-Branch for Space Sustainability.

The applicability of the ECSS requirements depends on the product to be developed or operated, or the service to be provided. The extent to which each ECSS requirement applies is called "tailoring". In a contractual relationship, each customer and supplier agrees on the tailored set of ECSS requirements that applies.

After nearly 2 decades of operations (1996 to 2015) while working with documents, users have stated that ECSS needs to be improved for requirements utilisation though electronic databases.

To better meet the user's needs, since 2015, ECSS provides its standards as MS Word documents as a reference, ECSS Applicable Requirement Matrix (EARM) as an MS Excel file issued from the MS Word documents and DOORS modules also issued from the MS Word documents (one DOORS module for each ECSS standard). This delivery approach is appreciated but there are still difficulties such as:

- the different means to uniquely identify requirements in MS Word and in DOORS[1];

- the difficulties in the flow-down of selected requirements (i.e. subsets of one or more standards) to lower level suppliers, with today ECSS document architecture;

- the difficulty to maintain the overall consistency amongst all ECSS standards and their different publications;

- the complex management of any feedback.

Despite the parallel use of DOORS and MS Word to handle requirements at standard's level, the "in document" characteristics of the ECSS information cause difficulties. This is due to the proliferation of electronic files and tracked changes within these files that render the maintenance of ECSS information difficult or even impossible. Working with MS Word, many electronic files are produced for each ECSS standard resulting in a proliferation of duplicated information, leading to unnecessary inconsistencies, and also much effort and time for maintaining the overall requirements set. Using the existing ECSS configuration with DOORS is not sufficient.

The recent addition of the ECSS collaborative web environment provided through MyTeams.ecss.nl for ECSS administration and management, still leaves a need:

- to better support the overall ECSS processes (refer to ECSS-D-00), the way ECSS actors and stakeholders (refer to chapter 4.2) interact with ECSS and its information;

- to increase the overall use and usability of the ECSS information throughout its entire life cycle.

4.2   Actors and Stakeholders

The main ECSS actors and ECSS stakeholders are listed in Table 4-1.

Table 4-1: ECSS actors and stakeholders

Actor / Stakeholder	Definition
ECSS Full Member	European space sector stakeholders that indicate their intention to actively participate in ECSS document production, maintenance, use and the associated feedback [Ref. ECSS-P-00]

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[1] Since their origin, in Microsoft Word, the requirements have always been identified according to the chapter structure of the document. This caused problems when changing the structure of the document, resulting in a change of identifier for some requirements. In DOORS, requirements are identified by a unique identifier that is not linked to any document structure. However, still today the DOORS identifiers are not used in the MS Word or PDF publications.

Actor / Stakeholder	Definition
ECSS Associate	European space sector stakeholders that indicate a desire to participate in ECSS document production but at a reduced level of effort or limited to some specific aspects/disciplines [Ref. ECSS-P-00]
ECSS Observer	European space sector stakeholders desiring a formal tie with the ECSS through which they can observe the development process and contribute to the ECSS system [Ref. ECSS-P-00]
ECSS Steering Board (SB)	Body that defines ECSS objectives, policy and strategy and endorses the work plan [Ref. ECSS-P-00]
ECSS Technical Authority (TA)	Body that implements the objectives, policy and strategy defined by the SB; sets up, approves, implements and monitors the Work-plan endorsed by the SB [Ref. ECSS-P-00] The TA is the technical approval authority for the initiation and release of new ECSS documents, and for all changes to existing ECSS documents.
ECSS Executive Secretariat	Support the TA and WGs, enforces drafting rules, provide administrative support to the TA and SB, and ensure promotion of ECSS and interface with other SDOs [Ref. ECSS-P-00]
ECSS Task Force (TF)	Support the SB or the TA in performing a specific task such as identifying the need for the development (or not) particular ECSS documents or performing transversal activities.
Technical Authority Area Responsible (TAAR)	member of the ECSS TA responsible for the coordination of a specific discipline [Ref. ECSS-D-00]
Discipline Focal Point (DiFP)	The DiFP supports the TA in managing the documents within each discipline from a technical point of view, ensuring consistency of all documents in this discipline [Ref. ECSS-D-00]
ECSS Working Group (WG)	Group convened as necessary by TA and in charge of producing/modifying the standards as required by the endorsed Work-plan [Ref. ECSS-P-00]
ECSS WG Convenor	WG member endorsed by the TA to lead and coordinate the WG activities and to formally interface for WG aspects to the TA, TAAR, executive secretariat and DiFP [Ref. ECSS-D-00]

Actor / Stakeholder	Definition
SDO mirror Working Group	Group of ECSS representatives in charge to form an ECSS position versus a specific SDO standard and represented in SDO by the mirror WG convenor
Document Focal Point (DoFP)	The DoFP is the first point of contact supporting the TA and ES on technical matters regarding the relevant document interpretation and feedback.
Network of Experts	Document and Discipline Focal Points that, with the addition of ad hoc experts, support TA and ES in specific tasks [Ref. ECSS-P-00]
ECSS User	organization or person using ECSS published documents in pursuit of their business [Ref. ECSS-D-00]
ECSS representative	person, member of the SB, TA, TF, or any other ECSS group, representing his/her organization within that group

4.3   E-RMS perspective

4.3.1   Introduction

The ECSS digital Requirements Management System (E-RMS) has, as objective, to address the full set of ECSS needs. It is sketched in Figure 4-1 together with some of its key architectural elements further detailed in the remainder of this chapter.

With the development of the E-RMS, the ECSS objective is:

- to move away from the shortcomings caused by today's document centric ECSS way of working and resulting document-dependent organization of the ECSS information, and

- to move to a fully relational organization of ECSS information enabling full context dependent access and navigation, in accordance with each ECSS process, stakeholder roles and associated privileges, and context dependent (and as such limited) user view of that ECSS information,

- to facilitate the ECSS requirements production and maintenance with collaborative solutions.

Although the present user requirements document focuses on the ECSS need, future versions of the E-RMS software could provide additional functionalities such as those required by project-specific (agency and industry) development and operations requirements management systems. To ease such developments, the E-RMS data model (refer to E-RMS-CDM) complies with the "modelling at conceptual level" constraints introduced in the ECSS-E-TM-10-23 Space System Data Repository.

For the fulfilment of the E-RMS objectives, the information maintained by ECSS is decoupled from the ECSS document structure. That information is structured and organised under the form of "configuration items".

A configuration item is a user concept. Each configuration item corresponds to a subset of the information considered by the users of relevance to handle as a coherent whole and to be treated as a single entity by the E-RMS configuration management. Each version of a configuration item is for the E-RMS a structural element. There exist different types of structural elements, each one corresponding to a type of configuration items[2] such as "requirement" or "change request".

The structural elements are the entry points to the database from which navigation through the stored information is provided.

The E-RMS facilitates the management and maintenance of the complete ECSS system and supports the improvement of the quality and consistency of the ECSS information. The E-RMS also supports the use of ECSS requirements by projects as an integral part of the project specific requirements.

The E-RMS provides the means to produce user-specific views of the ECSS requirements, enabling traceability between ECSS requirements and their use through the different levels of project or product developments and operations. The E-RMS provides users with a means to provide feedback on the ECSS system e.g. information on how requirements have been used.
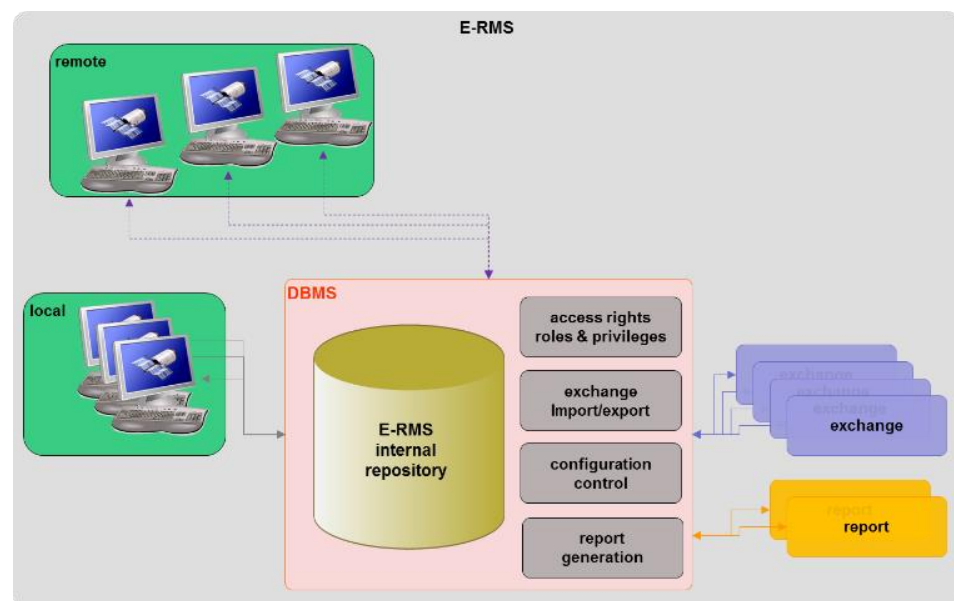

Figure 4-1 The E-RMS product overview

The E-RMS is a database system to be used by ECSS executive secretariat and has the capability to support their day-to-day work by:

- providing adequate online and offline means to produce and maintain all ECSS information.

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[2] For the types of configuration items, refer to E-RMS-CDM.

— Online facilities with secure human machine interfaces (local or remote), that present and maintain the information to the ECSS actors (i.e. the E-RMS users) according to their assigned access rights (being deduced from user roles and privileges).

— Offline facilities that provide the means to access information of interest.

    o   Export facilities are used to extract the information of interest under the form agreed with the offline users, for their offline processing.

    o   Import facilities allow information of interest to ECSS, produced by the offline users, to be imported and merged within the E-RMS after verification of compliance with the offline users' rights and privileges.

— Facilities that allow for the signing and authorisation of workflows as part of an ECSS approval management capability.

— Facilities to enable push and pull communication (e.g. using email messaging, notifications, download and upload capabilities).

- enabling the storage and retrieval of any information produced by ECSS

- enabling storing and linking information of interest to ECSS,

- guaranteeing the persistence of any published information,

- optimizing the overall administration of ECSS information in compliance with all ECSS processes[3].

Numbers of users

The E-RMS provides the means to register all users (without any limitation in their number) wishing to access ECSS information. This implies not only all ECSS members (both organizations and individual members) but also any other European or non-European user. It is noted that around 10,000 users are currently registered in www.ecss.nl website. The E-RMS provides access to each of its registered user according to their roles and privileges. The E-RMS performance requirements take into account this number of current users and potential future users and ensure adequate storage and retrieval access time for concurrent accesses.

E-RMS structure

The E-RMS is currently viewed as a 3-tier application involving a database server, an application server and some web front-ends. The E-RMS is designed for high-availability, with back-up and disaster recovery capabilities. It is foreseen to deploy the E-RMS at ESA, possibly on already existing ESA infrastructures implying compliance with ESA security directives.

Traceability of data source

Beyond the pure ECSS view, ECSS information (e.g. the standard requirements) is used and exchanged in an organisation and project context. A clear traceability between the ECSS information and its use is beneficial to all. The E-RMS deploys

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[3] The current ECSS processes are defined in ECSS-D-00. Some adaptions might be required to comply with the new organisation of the ECSS information offered by the E-RMS.

web online services and import/export facilities for exchanging information with users, but also, as illustrated in Figure 4-2, with other database systems such as an organisation-specific or project specific requirements management systems. As such, the E-RMS needs to assure traceability of information (i.e. feedback) received from these interfacing database systems.
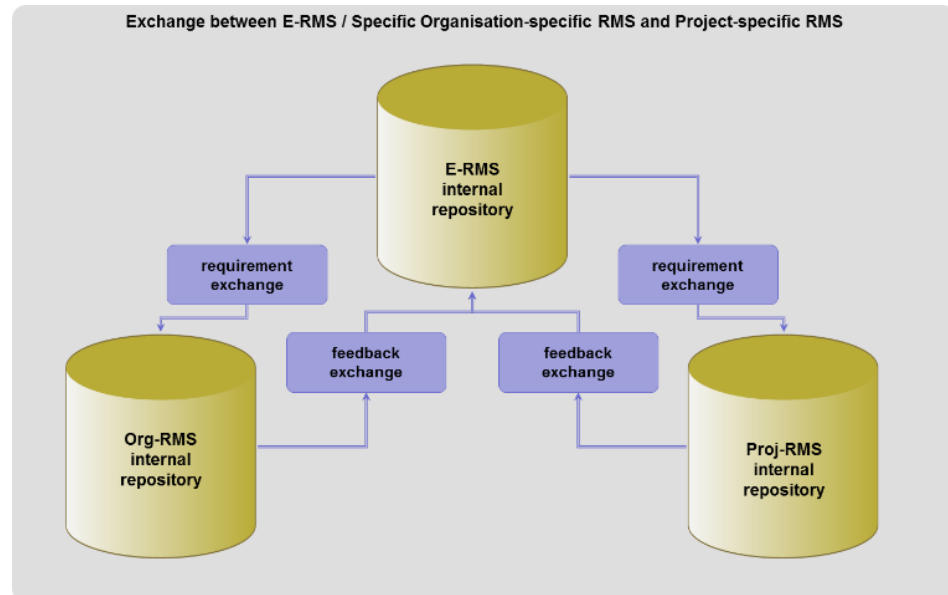

Figure 4-2 The overall RMS context

The E-RMS is a digital database based on a relational data model (refer e.g. to https://en.wikipedia.org/wiki/Relational_database). Such design choice is justified by the main objective of the E-RMS to satisfy all its users,

- providing human machine interfaces, tailored for each user, i.e. according to each user's view of that information,

- providing means to navigate through the ECSS information according to each user's need, e.g. navigation between different publications of a given requirement,

- identifying all documents that refer to a published requirement,

- identifying all requirements contained within a published document,

- identifying all change requests associated to a requirement,

- identifying all requirements impacted by a change request,

- etc.

The E-RMS also provides a low-level open interface, preferably SQL, to interact directly with any data contained within the E-RMS repository.

That design choice is also supported by the long-term objective to be able to reuse the E-RMS system in support of Agencies' and Industry's Project-specific or Product-specific development and operations information systems.

The E-RMS solution plays a key role in the future ECSS operations. It is expected that the E-RMS will support the generation, use and maintenance of at least one future major evolution of the ECSS requirements set, leading to an expected lifetime of at least 15-20 years. For these reasons, it is necessary for the ECSS

organisation to have a requirements management solution that, in addition to being used, operated and maintained, can evolve in a vendor independent way, with the ECSS guidance and support.

4.3.2   Persistency and version control

The lifetime of an ECSS product can be much longer than its promotion into the public domain. An example is an ECSS requirement that, once published, can be used by several space projects resulting to the fact that a decision of ECSS to deprecate that requirement does not automatically imply a change in the ECSS requirements baseline of these projects.

Persistency of the ECSS requirements and their related data is essential for ECSS and its users. To support the required persistency, the E-RMS version-controls its content, as follows:

- The E-RMS logs all transactions that create and update each configuration item. It provides means to rollback any transaction related to a configuration item.

- In addition, the E-RMS provides means to store and access (without any need to process the transaction logs) the current version of any configuration item and each of its released and published versions, each one under the form of a structural element..

    The E-RMS guarantees the persistent storage of any information that is released (e.g. a version of a standard that is released for public review or for approval).

    The E-RMS guarantees the permanent storage of any information that is published (e.g. an issue of a standard) by prohibiting any further modification of that information.

The need for persistency also propagates to the external users and external information systems.

In accordance with the naming and reliability principles specified in ECSS-E-TM-10-23:

- the E-RMS associates:

    — to each configuration item, a user identifier (ECSS_CI_ID) that allows identifying that configuration item independently of any of its releases or publications;

    — to each structural element that is released, another user identifier (ECSS_RSE_ID) that allows identifying that release.

    — to each structural element that is published, another user identifier (ECSS_PSE_ID) that allows identifying that publication.

    The objective of the user identifiers is to offer to the E-RMS users an easy means to refer to the related ECSS information. These user identifiers are constructed in compliance with a naming convention that is configurable. The E-RMS conceptual data model ensures their uniqueness.

- the E-RMS makes also use of "software identifiers (UUID)" that format and generation rules comply with the ISO/IEC 9834-8:2014 universally

unique identifier concept definition[4]. These software identifiers are widely used by the E-RMS. They are generated at the time the information is created. These software identifiers used to identify the related information never change. They are used internally to identify and link information together. They are also used in any exchange with external systems.

In compliance with the interoperability principle specified in ECSS-E-TM-10-23, the E-RMS demands to each external system that it interfaces, to adopt the universally unique identifiers for any data that is exchanged.

4.3.3 Change impact analysis support

The ECSS standards change management process is described in ECSS-D-00.

When a change is brought to an ECSS product, the impact of that change on the different users' needs to be assessed, e.g. whether that change is just editorial or whether it changes the semantic, resulting e.g. to the need to re-validate the related product.

The E-RMS provides support to the impact analysis of any change brought on the ECSS information.

Within the E-RMS conceptual data model, each type of configuration item, i.e. the related structural element type is defined as a set of properties[5]. Each property is associated with a flag that reports on, the role played by that property in the change impact analysis, i.e. whether a change of value for that property implies that the corresponding configuration item has been impacted by an editorial change or a semantic change. The E-RMS makes use of that information to determine the process to initiate as consequence of that change (e.g. for semantic changes, the re-validation process with or without the approval process depending on the nature of the configuration item).

Furthermore, by navigating through the structural element relationships specified in the E-RMS conceptual data model and the nature of each related link, the E-RMS identifies the configuration items (potentially) impacted by the change and the process to initiate as consequence of the propagated impact.

4.4 E-RMS concept of operations

4.4.1 Introduction

The ECSS processes are specified in ECSS-D-00. These processes are based on the today's way ECSS users interact with the ECSS system.

This chapter describes the expected way users will interact with the E-RMS assuming that the current processes would not change with the implementation

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[4] The universally unique identifier (UUID) generated in conformance with the ISO/IEC 9834-8:2014 are 128-bits identifiers that are "guaranteed to be" globally unique. They are suitable as persistent identifiers.

[5] The properties that define the structural elements are either simple value properties or compound properties. A property can either be "existential dependent" of the structural element it refers to (meaning that the existence of the property value is fully dependent of the existence of the corresponding structural element), or be an interface property meaning that it represents a functional link with other structural elements. The E-RMS conceptual data model (refer to E-RMS-CDM) defines all types of structural element together with their existential and interface properties.

of the E-RMS. It is acknowledged that this assumption is not necessarily and mandatorily true, i.e. in case the E-RMS would offer better operating processes, ECSS is ready to revise them.

This description is intended to allow the definition of an appropriate implementation and deployment architecture, and the principles of the human machine interface, in accordance with the today governance principles (roles and responsibilities) underlying the operations.

4.4.2 ECSS System: development

4.4.2.1 ECSS Steering Board (SB)

The SB defines the objective, policy and strategy for the ECSS system, including cooperation with other SDOs.

For that purpose the E-RMS provides support to:

- define, manage and monitor the resources and budget associated to the ECSS work plan,

- manage any links (including agreements) to external SDOs,

- production of minutes of meetings and related action items' and decisions' management.

4.4.2.2 ECSS Technical Authority (TA)

In line with the objectives, policy and strategy defined by the SB, the TA defines, implements and monitors the ECSS work plan and reports to the SB.

For that purpose, the E-RMS provides support:

- to the management of the ECSS work plan,

- to the generation of reports to the SB,

- to the management of new work items,

- to the change request management,

- to the task force terms of references management,

- to the ECSS WG management,

- to the performance of Parallel Assessment,

- to the organisation and management of the Public Review,

- to the verification of the compliance of the standards to the relevant ECSS rules, including quality and consistency with the overall ECSS system,

- to the vote for publication,

- to the notification of publication,

- to the endorsement of documents from other SDO (standard development organisations),

- to the production of minutes of meetings and related action items' and decisions' management.

4.4.2.3   ECSS Executive Secretariat

The executive secretariat ensures the overall administration and operations of the ECSS and related information systems, such as the www.ecss.nl website or the E-RMS.

For that purpose, the E-RMS provides support:

- to the management of user rights and privileges for any ECSS actor/stakeholder,

- to the management of ECSS related processes and associated data (refer to ECSS-D-00),

- to the overall consistency of the ECSS information (e.g. maintaining the ECSS System Architecture (e.g. branch, discipline), the ECSS System Glossary)

- to the assessment of the impact brought be a working group when changing ECSS requirements on the overall ECSS System.

4.4.2.4   ECSS task force (TF)

In line with the terms of reference given by the ECSS TA, each ECSS TF is responsible of a given ECSS task.

For that purpose, the E-RMS provides support:

- to the review and update of the task force terms of reference,

- to the development and submission of the task force reports.

4.4.2.5   ECSS working group (WG)

In line with the terms of reference given by the ECSS TA, each ECSS WG is responsible of the creation or update of a given ECSS product (e.g. standard, handbook).

For that purpose, the E-RMS provides support:

- to the review and update of the working group new work item proposal,

- to the development and submission of the working group reports,

- to the development of the ECSS product in consistency with the overall ECSS system,

- to the use of any applicable change request provided as input to the WG activity, and the implementation disposition of the change request,

- to the use of any applicable DRR provided as input to the WG activity, and the implementation disposition of the DRR.

The E-RMS provides also means to identify the impact(s) that changes, brought on an ECSS product, has on the overall ECSS system.

4.4.2.6   SDO ECSS representative and associated ECSS Mirror WG

The ECSS representative in a standards development organization (SDO), i.e. the ECSS point of contact with that SDO, facilitates the technical communication between ECSS and the standards development organization.

The ECSS point of contact and any associated ECSS mirror WG member access the E-RMS through any computer connected to the internet. They access to the E-RMS to obtain information about parallel, similar, contradicting or other related requirements in ECSS vis-à-vis the requirements defined in other standards.

The E-RMS provides support e.g. to the review of SDO documents, to the production of adoption notices (including maintaining the SDO requirements modified for ECSS). It also provides means to link the ECSS and SDO information of relevance.

4.4.3   ECSS System: utilization

4.4.3.1   Public Users

Public users access the E-RMS through any computer connected to the internet. Through a dedicated human machine interface, they are able:

- to search general information about the ECSS such as ECSS architecture, training material, ECSS points of contact (e.g. the executive secretariat, TA representatives, TA area responsible (TAAR), ECSS Discipline focal point (DiFP)),

- to search and consult published (current or superseded) requirements,

- to raise change requests to current ECSS requirements,

- to receive feedback/replies and results w.r.t. a change request.

To facilitate the functions, the E-RMS provides means to consult the ECSS information, to download e.g. requirements, in different formats compatible with requirements management tools, and sent by email to the user.

4.4.3.2   Utilization of ECSS requirements in Organisations

The organizational entity responsible for internal use of ECSS (or SDO) standards within an industry or an agency consults the ECSS requirements, assesses them and judges their applicability and potential adaptation needs for use within their organisation.

The E-RMS supports this activity by:

- exporting specific sets of requirements,

- supporting the assessment of changes between two (consecutive or not) published versions of any requirement set.

The E-RMS provides means to export ECSS requirements in different formats, i.e. for compatibility with requirements management tools used by the organizations.

More generally, the E-RMS provides means to export all information in an "E-RMS" native format.

To enable feedback from the use of the ECSS requirements, the E-RMS supports:

- the import of the tailored versions by an organization of ECSS requirements,

- the assessment of differences between the ECSS requirements publications and the tailored version by an organization of those requirements.

4.4.3.3   Utilization of ECSS requirements by Eurospace

Eurospace is the umbrella organization of European Space industries. Industrial ECSS members do not appear as individual partners. The representation in ECSS is organised through the Eurospace Standardisation Working Group. That group aims at bringing together industry views and concerns about the standardization processes, to reach consensual industry positions.

The secretary of the Eurospace Standardisation Working Group functions has an additional interface between the ECSS secretariat and industry for the following tasks:

- distribution of all information coming down from the ECSS secretariat to the industrial partners (Eurospace members),

- collection and harmonization of industry inputs,

- delivery of a consolidated set of industry inputs to the ECSS secretariat.

The Eurospace standardization working group ensures that the ECSS requirements required by industry are complete, comprehensive and consistent.

For this function, the E-RMS provides support for an effective communication between industry and ECSS. It also offers means to maintain Eurospace information for which access rights are controlled by the Eurospace secretariat.

4.4.3.4   Utilization of ECSS requirements in Projects

The development and operations of space systems requires the cooperation of many organizations (agencies and Industry, organized in hierarchies of customers and suppliers) all working together to provide a product that satisfies the top-level customer's needs (refer to ECSS-S-ST-00).

Taking into account the requirements from their customers and those from their organization, each actor involved in a space project consults the ECSS requirements, assesses them and judges their applicability and potential need for adaptation / tailoring for use in their domain of responsibilities. They also identify those requirements of contractual relevance for their suppliers.

The E-RMS supports the space projects by providing means:

- to select the sets of ECSS published requirements of relevance for the project, with the possibility to save the selected sets for later use, and export them for integration with the requirements management tools used by the project;

- to support the classification of these requirements to the products to develop;

- to support the assessment of any deviations (e.g. modification, deletion, addition) to any customer requirements.

The E-RMS guarantees the persistency of all ECSS requirements used by the projects.

The E-RMS provides also means to manage the entire set of requirements that apply to the project as a whole, taking into account the customer-supplier relationships. This allows, for example, reporting any deviation from the ECSS requirements at any level.

4.4.4 Organisation's requirements

Requirements laid down for the operation of an organization which are not related to a (space) project are typically held in company standards, organizational notes or directives, entity manuals, process handbooks or similar documents. These documents are usually managed in Business Management Systems (BMS) or Company Management Systems (CMS), usually in electronic databases. For this purpose, the E-RMS shall provide interfaces for exchange with these systems.

4.4.5 Project's requirements

4.4.5.1 Introduction

Each space project development can be seen as an "extended enterprise" organised in a complete chain of customer-supplier relationships whereby customers and suppliers may belong to the same organization or different ones.

The ECSS standards are usually introduced by the top-level customer (or its representing entity in charge of the project development) and rendered applicable taking into account the mission needs. Through the customer/supplier chain, each customer verifies whether the applicable standards (possibly tailored by their higher-level customer) apply to their lower level suppliers taking into account e.g. the criticality of the supplier's product to develop. The E-RMS provides support:

- to the reporting of each product tailoring activities output under the form of the ECSS Applicability Requirement Matrix (EARM), and

- to the reporting of the product compliance assessment output.

4.4.5.2 Customer: product-specific system requirements development

The engineering entity of a customer accesses the E-RMS through any computer linked to the internet. The E-RMS supports the engineering team to develop product requirements at each level of the product tree by tailoring the requirements from the higher level. It is noted that the ECSS requirements can be introduced at any level in the product tree, if not part of the higher-level requirements. The E-RMS supports:

- the creation of a specific product workspace,

- the initial population with the higher level requirements,

- the selection of product relevant requirements, including justifications in case of e.g. removal or modification of higher level requirements,

- the addition of product specific requirements,

- the capture of validation data related to the product requirements specifications (e.g. analyses, models, justifications…),

- the publication (data exchange) of requirements specification towards supplier.

4.4.5.3   Supplier: product-specific technical specification

ECSS standards, handbooks or technical memoranda are typically being called up in a business agreement between customer and supplier as applicable or reference documents. However, the main driving requirements for the development of a product are held in technical specifications (e.g. in a satellite requirements document), which define the key design and performance requirements of that product, including the required verification method(s).

Since ECSS requirements become applicable via the business agreement (contract) in addition to the aforementioned key design and performance requirements, it would be interesting to hold <u>all</u> requirements that are applicable for the development and operation of a specific product in <u>one</u> database, i.e. the E-RMS.

For this purpose, every member of that specific product team shall access the E-RMS through any computer linked to the internet or an organisation's intranet with access control managed by that organization.

The handling of a technical specification requires some additional processes and features to those of ECSS, which are listed below.

Typical functions on the E-RMS w.r.t. handling of a technical specification (beyond the ones listed already for handling of ECSS requirements) are:

- management of the statement of compliance to a requirement,

- management of Requests for Deviations (RfD) and their status,

- management of Requests for Waivers (RfW) and their status,

- management of the verification status,

- effectivity management in case of product lines / serial productions.

Actions taken during this process include:

- creation of proposal workspace,

- initial population with all customer requirements, maintaining the universally unique identifiers,

- addition of supplier specific (high level) requirements,

- capture of information related to the solution answering to each requirement (e.g. analyses, models, design, justification…),

- publication (data exchange) of compliance information towards customer.

4.5　Constraints and Assumptions

Between these organizations, manifold and variable information technology security protocols might be in place, sometimes affecting proper execution of functions of the system, e.g. automatic email relay in the system or plugin execution in the browser.

5
User Requirements

5.1   Introduction

5.1.1   Universally unique identifiers

The "universally unique identifier" concept specified in ISO/IEC 9834-8:2014 is widely used by the E-RMS. Those identifiers never change. Uniquely identifying the objects (e.g. the configuration items, the structural elements) managed by the E-RMS, they are used:

- to seek the objects,

- to link them together in internal to E-RMS relationships,

- in each exchange with the external users, to guarantee the continuity of the links with external systems.

Within the E-RMS, there is no duplication of information. The E-RMS complies with the relational database normalization[6] rules to avoid data redundancy and ensure data integrity. The E-RMS is free of insertion, update and deletion anomalies.

5.1.2   Configuration items and structural elements

The E-RMS provides the capability to store and maintain any information required and produced by ECSS. That information is structured and organised under the form of "configuration items".

As stated in clause 4.3.1, each configuration item corresponds to a subset of the information considered by the users of relevance to handle as a coherent whole and to be treated as a single entity by the E-RMS configuration management. Each version of a configuration item is, for the E-RMS, a structural element.

The E-RMS handles different types of configuration items and therefore different types of structural elements organised in hierarchies. The first level of structural element types are:

- acronym,

- concept,

- record,

- container.

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[6] refer to https://en.wikipedia.org/wiki/Database_normalization

An acronym is a short alias of a long or compound name. Usually, for the compound names, it is formed from the initial letters of the words that form those names. An acronym can replace its corresponding name in a piece of writing. The E-RMS structural element of type "acronym" provides the acronym (e.g. "ECSS") and its meaning, i.e. the represented sequence of words (e.g. "European cooperation for space standardization").

A concept, i.e. an E-RMS structural element of type "concept", is identified by the preferred term used to refer to it (e.g. "space system"). It is defined by a concept definition that is, a sequence of words that can replace the term in any related piece of writing (e.g. "system that contains at least a space, a ground or a launch segment").

A record, i.e. an E-RMS structural element of type "record", represents a distinct section of a piece of writing, usually dealing with a single theme. Each record is of a given E-RMS record type. Examples of types of E-RMS records of ECSS interest are:

- paragraphs such as "informative paragraph" or persuasive paragraphs such as "requirement", "recommendation" and "permission"

- "action",

- "change request",

- "product-specific request for deviation",

- "product-specific request for waiver",

- "product-specific tailoring record"

- "minute of meeting".

A container, i.e. an E-RMS structural element of type "container", groups information related to a subject, i.e. the subject addressed by that container. A container links, together, any number of E-RMS structural elements including other containers. A container can be seen as a "logical hierarchy[7]" of (lower level) structural elements and related definitions. A container can for example represent:

- a standard including all related information (e.g. the released and published versions of the standard, the related document review reports, the related change requests, etc.),

- a standard that is published, i.e. including all descriptive and prescriptive material of that publication, or

- a chapter within that publication.

In addition to the universally unique identifiers used by the E-RMS that can be cumbersome for human interaction, the configuration items and their structural elements can also be uniquely identified by end-user identifiers. These identifiers can be constructed by concatenation of end-user relative identifiers as described hereafter:

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[7] A container can be logically viewed as a hierarchy. The logical-only nature of such hierarchy is caused by the fact that within the E-RMS, there is no existential dependency between structural elements. For example, a requirement can be claimed to "belong to" a container (e.g. a standard) but in the E-RMS, this does not prohibit that same requirement to "belong to" another container (e.g. a product requirement specification or another standard).

- Each container that is not logically included to any upper level container is uniquely identified by an end-user identifier that is unique within the E-RMS.

- Each structural element that is logically and directly belonging to a parent container is uniquely identified by combining the absolute end-user identifier of that direct container and the position of that structural element in that container.

Such identifying mechanism implies that a structural element can have several end-user identifiers according to the possibility offered by the E-RMS to participate to more than one container hierarchy.

Examples of types of E-RMS containers of ECSS interest are:

- documents such as "ECSS standard", "ECSS handbook", "ECSS technical memorandum",

- "glossary",

- "chapter",

- "meeting",

- "terms of reference",

- "document requirements definition (DRD)"

- "product",

- "ECSS pre-tailoring guideline",

- "product-specific tailoring feedback".

It is foreseen that, in future, the E-RMS could be augmented by requirements to support enterprise-specific or product-specific requirements managements. Examples for potential extensions are:

- structural elements such as:

    — verification information,

    — non-conformance,

- containers such as:

    — documents such as "Product system requirements specification", "Product technical specification", "Product verification control document",

    — "statement of compliance",

    — "verification matrix".

5.1.3   Development priorities

Requirements within this user requirements document are expressed using a generic terminology. In order to guide the E-RMS development effort, priorities have been defined for the requirements' implementation as follows:

a.   to provide all low level E-RMS functions (i.e. those independent of the E-RMS data model) and those E-RMS functions (including handling of all related structural element types) required to support the production and

maintenance of what is currently held in ECSS standards and handbooks. The first priority implies compliance to:

1.   all requirements from clause 5.2 to clause 5.8,

2.   clause 5.9 requirements d, f, g, k, l, m and n ,and

3.   all requirements from clause 5.10.

b.   to provide the remaining E-RMS functions required by ECSS, i.e. system administration processes and processes related to interactions with other standards development organizations. This second objective implies compliance to:

1.   clause 5.9 requirements a, b, e, h, i, j, o, p, q, r and s.

c.   to integrate the E-RMS to the ECSS websites for operational use.

As mentioned in clause 4.3.1, reusing the E-RMS for building project-specific information systems is foreseen.

5.2   E-RMS users

a.   The E-RMS shall fully control the access of information contained within the E-RMS by registration means of its users.
    NOTE   Fully control includes registration but also E-RMS functionality access according to the rights of each user, registering of each "write" transaction performed by each user, etc.

b.   The E-RMS shall provide the capability to register each user together with related administrative data such as:

1.   surname and first names,

2.   name of the employing company,

3.   email address of the user,

4.   phone number of the user,

5.   username and password,

6.   preferred language.
    NOTE   Registration and management of users can be implemented using the lightweight directory access protocol, i.e. LDAP[8].

c.   The E-RMS shall associate to each registered user a globally unique identifier that uniquely identifies the user and any of its registered transactions within the E-RMS system.

d.   The E-RMS shall register the creation date of each user registration.

e.   The E-RMS shall provide the capability to remove the E-RMS access of registered user.

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[8] For the lightweight directory access protocol (LDAP), refer to IETF-RFC-4511. See also:
https://en.wikipedia.org/wiki/Lightweight_Directory_Access_Protocol.

NOTE   This only refers to the access. The definitions of a user and all its related information remain in the E-RMS for overall consistency purposes. A user, whose access is removed, has no active role in any E-RMS community (refer to clause 5.3).

f.   The E-RMS shall provide means to each registered user to maintain its administrative data.

5.3   E-RMS communities, roles and privileges

a.   The E-RMS shall provide means to define and maintain any number of E-RMS community types.

NOTE   Defining an E-RMS community type includes specifying those types of information (type of structural elements) that communities of that type has access to (read, read and write), the roles that members of communities of that type can have with associated privileges.

b.   The E-RMS shall provide means to define and manage any number of E-RMS privileges.

NOTE   Defining an E-RMS privilege implies:

- identifying the E-RMS functions that users who have that privilege can execute,
- identifying the rights that users who have that privilege can have on structural elements that are owned by other users.

Such associations are managed, i.e. created and maintained, by those users that have the required privileges.

c.   The E-RMS shall provide means to define and manage any number of E-RMS roles.

NOTE 1   Defining an E-RMS role implies:

- selecting the set of E-RMS privileges that users playing that role have,
- selecting the set of E-RMS roles that users playing that role have.

NOTE 2   The E-RMS roles of ECSS interest (called, in this URD, the ECSS roles) are, for example:

- convenor of an ECSS community,
- member of an ECSS community,
- secretary of an ECSS community,
- observer of an ECSS community,
- technical authority area responsible,
- executive secretary,
- expert.

d.   For each ECSS community type, the E-RMS shall provide means to define any number of associated privileges and roles.

e.   The E-RMS shall provide means to manage any number of E-RMS communities of any type.

f.   The E-RMS shall be configured by default with the following ECSS community types:

   1.   "ECSS Steering Board",

   2.   "ECSS Technical Authority",

   3.   "ECSS Executive Secretariat",

   4.   "ECSS public users".

   5.   "ECSS Task Force",

   6.   "ECSS Working Group",

   7.   "ECSS Mirror Working Group",

   8.   "ECSS Network of Experts",

   9.   "ad-hoc community".
       NOTE   An ad-hoc community can, for example, represents the participants to a meeting and be associated with the container that "collects" all information shared and produced during that meeting..

g.   The E-RMS shall provide the capability to constrain the maximum number of community of any E-RMS community type.
       NOTE   For example, several communities of type "ECSS Task Force" can co-exist, however only one community of the following E-RMS community type exists at any time:
       • "ECSS Steering Board",
       • "ECSS Technical Authority",
       • "ECSS Executive Secretariat",
       • "ECSS public users".

h.   The E-RMS shall provide means to register any number of users to any E-RMS community and associate to each of these users the roles that they play in that community.

i.   The E-RMS shall automatically associate each registered user to the "ECSS public users" community.
       NOTE 1   For the registration of new users, refer to requirement 5.2b.
       NOTE 2   The ECSS public users' community offers read access to all ECSS published standards, handbooks and technical memoranda.

j.   For each registered user who ceases its participation to an ECSS community, the E-RMS shall provide means to declare the participation cancellation date of that user to that community.

k.   The E-RMS shall remove the access to the E-RMS to those users who cease participating to the ECSS public users' community.

NOTE   Ceasing participating to the ECSS public users' community implies the ceased participation to any other ECSS community.

5.4   Long term storage and retrieval

a.   The E-RMS shall provide the capability to structure and store all ECSS information without any limitation in size or duration.

b.   The E-RMS shall provide the capability to retrieve any stored information under the forms required by this user requirements specification.

5.5   Versioning

a.   The E-RMS shall provide version control at the level of each structural element.
NOTE   The E-RMS records and controls the evolution of any structural element including its references with other structural elements.

b.   The E-RMS shall provide the capability to store and maintain any version of any structural element.
NOTE   The structural element versions are either minor versions or major versions. Minor versions of a structural element are only accessible by the members of the E-RMS community in charge of drafting that structural element. Major versions are produced by releasing the current draft version of a structural element e.g. for providing visibility to other users. When the authorisation to publish a released version of a structural element is obtained (e.g. for an ECSS standard, when the ECSS technical authority approve that version), that released version becomes a published version.

c.   The E-RMS shall record each modifying transaction that creates, updates or removes any structural element.
NOTE 1 A transaction to update a structural element implies some changes in one or more property values of that structural element. Each update transaction creates a new minor version for that structural element.

NOTE 2 Removing a structural element does mean that the structural element is taken away, set aside but kept in existence.

d.   The E-RMS shall associate to each structural element modifying transaction:

1.   the time at which the transaction has occurred,

2.   the user that has committed that transaction and in which role,

3.   the property's values that have been modified by that transaction,

4.	the property's values resulting from that transaction.

e.	The E-RMS shall provide support to any review of any version of any structural element.

>	NOTE 1	For example, such support can be provided by offering means to annotate a property of a structural element or another annotation.

>	NOTE 2	During a public review of an ECSS standard, that support is associated to the ECSS public review process specified in requirement 5.9f. The ECSS change request process, refer to requirement 5.9l, is another mean to implement such support.

f.	The E-RMS shall provide the capability to attach a justification to each creation, modification and removal of any structural element.

g.	The E-RMS shall provide the capability to attach a justification to each creation, modification and removal of any group of structural element.

h.	The E-RMS shall provide the capability to link the structural element that implies modifying another structural element or group of structural elements, to that other structural element or group of structural elements.

>	NOTE	A structural element that implies modifying other structural elements is for example a change request or a discrepancy review report. All links are specified in the E-RMS conceptual data model (refer to E-RMS-CDM).

i.	The E-RMS shall provide the capability to release any structural element.

>	NOTE 1	The E-RMS ensures immediate access (meaning without having to process any transactions' logs) to any released version of a structural element. Each released version has its own universally unique identifier that can be consistently used by any internal user to refer to that structural element released version. Modifying a released structural element is a "logical modification" and implies "cloning" that released structural element prior to its modification.

>	NOTE 2	Releasing a structural element implies releasing any structural element that are logically belonging to that structural element.

j.	The E-RMS shall provide the capability to modify logically any released structural element.

>	NOTE 1	Directly modifying a released structural element is not allowed due to the persistency characteristics of the E-RMS information, refer e.g. to clause 4.3.2.

>	NOTE 2	Logically modifying a structural element results in:
>	- creating a new structural element by duplication of the released structural element,
>	- registering that new structural element as the consecutive version (working version) of the released structural element,

- marking the previous release of that structural element "under revision",
- once that structural element new version is released, marking that previous release "superseded".

NOTE 3　Structural elements created due to the need to modify logically a released structural element are logically addressing the same structural element.

k.　The E-RMS shall associate to each structural element release, the reason for that release.

NOTE　Reasons for releases examples are "for working group review", "for public review", "for approval by ECSS technical authority" (refer to ECSS-D-00).

l.　The E-RMS shall provide the capability to publish any structural element that has been released.

NOTE 1　Publishing a released structural element means that it is ready for operational use, i.e. it is baselined. The E-RMS ensures the permanent storage and access of any published structural element. The universally unique identifier of a published structural element (i.e. the universally unique identifier of the corresponding released) can be used consistently and permanently by any internal or external user to refer to that structural element published version.

NOTE 2　Publishing a structural element implies publishing any structural element that are logically belonging to that structural element.

m.　The E-RMS shall provide the capability to rollback any transaction that occurred on each structural element that is not published, in any order.

n.　The E-RMS shall provide the capability to delete any structural element that has never been released.

NOTE　This requirement provides the capability for example for a community to discuss an issue, i.e. creating a structural element, and erase it if considered inadequate for release or publication. Contrarily to removing that implies that the removed structural element is kept in existence in the E-RMS, deleting a structural element renders it non-existent.

o.　The E-RMS shall provide the capability to identify and navigate through each change between any two different releases of any structural element.

p.　The E-RMS shall provide the capability to generate a change record report between any two different releases of any structural element in accordance to the change record reporting interface specification.

NOTE　Refer to E-RMS-CR-Report-ICD.

q.　The E-RMS shall provide the capability to identify and navigate through each change between the last release of any structural element and the current working version of that structural element.

r. The E-RMS shall provide a response time of maximum one second to produce any change record report between any two different releases of any structural elements.

5.6   Software problem reporting

a. The E-RMS shall provide means to report and manage any problem encountered with the E-RMS software.

> NOTE   For that purpose, the human machine interface integrates means to issue e.g. emails automating the identification of the scope in which the problem occurs.

5.7   E-RMS human machine interfaces

a. The E-RMS shall provide worldwide access via its human machine interface to any of its E-RMS users according to their roles and privileges.

b. The E-RMS shall provide a multi-language human machine interface.

> NOTE 1 This requirement cover all items shown including any user documentation such as hints, helps, and error messages.

> NOTE 2 The default language of the E-RMS's human machine interface is English.

c. The E-RMS shall provide means to create, by configuration, all language-specific items of any required human machine interface's language.

> NOTE   In its first form, the E-RMS-CDM only addresses the needs for an English human machine interface and population. It is foreseen that future version of the E-RMS conceptual data model will provide the means for a multi-language human machine interface and population.

d. The E-RMS shall provide the capability to create and maintain any structural element using human machine interfaces.

> NOTE 1 Within the E-RMS, structural elements are made of sets of properties expressed using simple data types such as character strings, bit patterns (e.g. images), language-based data types such as mathematical formula, internationalized resource identifiers[9], compound data types such as figures, tables, refer to E-RMS-CDM.

> NOTE 2 The conceptual data model of the E-RMS provides a full specification of the different types of structural elements under the form a network of information. Each type of structural element is represented as a subset of that network of information made of

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[9] For the internationalized resource identifiers (IRI), refer to IETF-RFC-3987
see also: https://en.wikipedia.org/wiki/Internationalized_Resource_Identifier.

relations that express "existential dependencies" to that type and other relations that express "external interfaces" linking together the different types of structural elements. The human machine interfaces allows navigating through all existential dependencies and all external interfaces in accordance with the E-RMS roles and privileges.

e. The E-RMS shall provide the capability to create and maintain data type constraints associated to any property of any structural element.

> NOTE Such constraint, if not already specified in the data model, could check that a requirement statement cannot contain "it shall be possible".

f. The E-RMS human machine interfaces shall provide the capability to navigate through all existential dependencies and external interfaces.

> NOTE Navigation is context dependent and supported by graphical objects.

g. The E-RMS shall provide a human machine interface's response time of maximum two seconds for any retrieval operations related to structural elements that are in working state.

> NOTE Working state means that the structural element is under maintenance, i.e. a structural element that has not yet been released, or a released structural element that is under logical modification.

h. The E-RMS shall provide a human machine interface's response time of maximum two seconds for any structural element update operations related to structural elements.

i. The E-RMS shall provide a human machine interface's response time of maximum two seconds for any retrieval operations related to structural elements that are published.

j. The E-RMS shall provide an online help that is context dependent.

k. The human machine interfaces of the E-RMS shall provide means to interact with all functions of the E-RMS.

> NOTE 1 This implies that there is no need for any other mechanism to access and maintain any E-RMS data.

> NOTE 2 As specified in requirement 5.7a, the access to each function provided by the E-RMS is controlled by the E-RMS roles and privileges.

l. The human machine interfaces of the E-RMS shall provide standardized mark-up editing facilities to enable:

1. the formatting of data fields,

2. the consistent edition and formatted visualisation of those data fields through the human machine interfaces,

3. the transformation of these formatted data fields as required by each external interface protocol.

NOTE For item 3, the external interface protocols are the export facilities specified in clause 5.8.3 and the import facilities specified in clause 5.8.4.

m. The E-RMS shall provide the capability to create and maintain any workflow using human machine interfaces.

n. The workflow definition capability provided by the E-RMS shall cover all processes as defined in ECSS-D-00.

o. The E-RMS shall provide support to the execution of any workflows.

p. The human machine interfaces of the E-RMS shall provide means to send context specific emails to any E-RMS user or group of E-RMS users.

NOTE 1 A group of users can be, for example, all users of a community, all users playing a role in a given community, or all users playing the same role in any community of a given type.

NOTE 2 An example of a context specific email is an email sent to each ECSS technical authority asking to authorize the public review of a published structural element.

q. For each type of context specific email, the E-RMS shall provide means to create and manage the default text to issue with any email of that type.

r. For each type of context specific email, the E-RMS shall issue within the email, the internationalized resource identifier of the E-RMS context of relevance.

NOTE 1 An example of an E-RMS context of relevance is the published structural element sent to the ECSS technical authority asking to authorize its public review.

NOTE 2 For the internationalized resource identifiers, refer to E-RMS-CDM. See also 5.7d and IETF-RFC-3987.

s. The human machine interfaces of the E-RMS shall provide means to search, to retrieve and to visualise any information that has been stored within its data repository.

t. The human machine interfaces of the E-RMS shall provide means to navigate through any information stored within its data repository according to the logical hierarchies of that information and through each specified link.

NOTE For the logical hierarchies and the specified links, refer to E-RMS-CDM.

5.8 Electronic data exchange interfaces

5.8.1 Exchanged files storage and retrieval

a. The E-RMS shall provide the capability to store within its data repository any document that is imported together with related administrative data.

NOTE   This capability guarantees the storage (for potential retrieval at later stage) of any import file in their original format and content.

b.   The E-RMS shall provide the capability to store within its data repository any document that is exported together with related administrative data.

NOTE   This capability optimizes the E-RMS behaviour, e.g. avoiding the regeneration of documents that have already been generated in a previous export.

c.   The E-RMS shall provide the capability to retrieve and export any document that is stored within the data repository.

5.8.2   Native interfaces

a.   The E-RMS shall provide means to export any structural element under the form of data files that structure complies with the E-RMS native interface control document.

NOTE   Refer to E-RMS-Native-ICD.

b.   The E-RMS shall guarantee a response time of maximum ten seconds to export any structural element in the E-RMS-Native-ICD format.

NOTE   For a large structural element to export example, refer to ECSS-E-ST-70-41C.

c.   The E-RMS shall provide means to import any information contained in data files that structure and content comply with the E-RMS native interface control document.

NOTE   Refer to E-RMS-Native-ICD.

d.   The E-RMS shall guarantee a response time of maximum twenty seconds to import any structural element in the E-RMS-Native-ICD format.

NOTE   For a large structural element to import example, refer to ECSS-E-ST-70-41C.

e.   The E-RMS shall provide, to each E-RMS user according to their roles and privileges, means to select a structural element or a group of structural elements to export.

5.8.3   External interfaces – exporting facility

a.   The E-RMS shall provide means to export the content of any of DOORS interest structural element to DOORS in accordance to the E-RMS to DOORS mapping specification.

NOTE   Refer to E-RMS-Doors-ICD.

b.   The E-RMS shall provide means to export the content of any structural element to data files that comply with the OMG Requirement Interchange Standard in accordance to the E-RMS to ReqIF mapping specification.

NOTE   Refer to E-RMS-ReqIF-ICD.

c.   The E-RMS shall provide means to export the content of any structural element to an MS Excel spreadsheet in accordance to the E-RMS to MS Excel mapping specification.

NOTE   Refer to E-RMS-Excel-ICD.

d.   The E-RMS shall provide means to export the content of any structural element to a MS Word document in accordance to the E-RMS to MS Word document mapping specification.

NOTE   Refer to E-RMS-Word-ICD.

e.   The E-RMS shall provide means to generate reports associated to any type of structural elements based on user-defined templates.

f.   The E-RMS shall provide means to create and manage any number of user-defined templates.

g.   The E-RMS shall guarantee a response time of maximum twenty seconds to export any structural element in:

1.   the E-RMS-Doors-ICD format,

2.   the E-RMS-ReqIF-ICD format,

3.   the E-RMS-Excel-ICD format,

4.   the E-RMS-Word-ICD format.

NOTE   For a large structural element to export example, refer to ECSS-E-ST-70-41C.

5.8.4   External interfaces – importing facility

a.   The E-RMS shall provide means to import the content of a MS Word document that structure and content comply with the MS Word to E-RMS mapping specification.

NOTE   Refer to E-RMS-Word-ICD.

b.   The E-RMS shall provide means to import the content of an MS Excel spreadsheet that structure and content comply with the MS Excel to E-RMS mapping specification.

NOTE   Refer to E-RMS-Excel-ICD.

c.   The E-RMS shall provide means to import the content of DOORS modules that structure and content comply with the DOORS to E-RMS mapping specification.

NOTE   Refer to E-RMS-Doors-ICD.

d.   The E-RMS shall provide means to import the content of an OMG requirement interchange format document that structure and content comply with the ReqIF to E-RMS mapping specification.

NOTE   Refer to E-RMS-ReqIF-ICD.

e.   The E-RMS shall guarantee a response time of maximum thirty seconds to import any structural element contained within a file that format complies with:

1.   the E-RMS-Doors-ICD,

2.   the E-RMS-ReqIF-ICD,

3.   the E-RMS-Excel-ICD.

f.   The E-RMS shall guarantee a response time of maximum sixty seconds to import any structural element contained within a file that format complies with the E-RMS-Word-ICD format.

NOTE   For a large structural element to export example, refer to ECSS-E-ST-70-41C.

g.   The E-RMS shall provide, to each E-RMS user according to their roles and privileges, means to import any number of structural elements.

5.9   ECSS processes

a.   The E-RMS shall provide full support to the ECSS new work item proposal process.
NOTE   For the ECSS new work item proposal process, refer to ECSS-D-00.

b.   The E-RMS shall provide full support to the ECSS work plan establishment process.
NOTE   For the ECSS work plan establishment process, refer to ECSS-D-00.

c.   The E-RMS shall provide full support to the ECSS member document conversion to ECSS process.
NOTE   For the ECSS member document conversion to ECSS process, refer to ECSS-D-00.

d.   The E-RMS shall provide full support to the ECSS drafting process.
NOTE   For the ECSS drafting process, refer to ECSS-D-00.

e.   The E-RMS shall provide full support to the ECSS parallel assessment process.
NOTE   For the ECSS parallel assessment process, refer to ECSS-D-00.

f.   The E-RMS shall provide full support to the ECSS public review process.
NOTE   For the ECSS public review process, refer to ECSS-D-00.

g.   The E-RMS shall provide full support to the ECSS publication process.
NOTE   For the ECSS publication process, refer to ECSS-D-00.

h.   The E-RMS shall provide full support to the ECSS technical memorandum process.
NOTE   For the ECSS technical memorandum process, refer to ECSS-D-00.

i.   The E-RMS shall provide full support to the use of documents from other SDOs in the ECSS system process.

NOTE 1 For the use of documents from other SDOs in the ECSS system process, refer to ECSS-D-00.

NOTE 2 Non-ECSS documents, e.g. ISO standards, cannot be imported within the E-RMS due to constraints such as copyrights. The E-RMS provides the capability to cite (parts of) these documents, mandatorily including the source reference (including version).

j.   The E-RMS shall provide full support to the ECSS task force control process.

NOTE   For the ECSS task force control process, refer to ECSS-D-00.

k.   The E-RMS shall provide full support to the ECSS working group control process.

NOTE   For the ECSS working group control process, refer to ECSS-D-00.

l.   The E-RMS shall provide full support to the ECSS change request process.

NOTE   For the ECSS change request process, refer to ECSS-D-00.

m.   The E-RMS shall provide full support to the ECSS applicable requirement matrix process.

NOTE   For the ECSS applicable requirement matrix process, refer to ECSS-D-00.

n.   The E-RMS shall provide full support to the ECSS review board and lessons learned process.

NOTE   For the ECSS review board and lessons learned process, refer to ECSS-D-00.

o.   The E-RMS shall provide full support to the ECSS system maintenance feedback process.

NOTE   For the ECSS system maintenance feedback process, refer to ECSS-D-00.

p.   The E-RMS shall provide full support to the ECSS-ESCC coordination process.

NOTE   For the ECSS-ESCC coordination process, refer to ECSS-D-00.

q.   The E-RMS shall provide full support to the ECSS-CCSDS process.

NOTE   For the ECSS-CCSDS process, refer to ECSS-D-00.

r.   The E-RMS shall provide full support to the ECSS-ISO process.

NOTE   For the ECSS-ISO process, refer to ECSS-D-00.

s.   The E-RMS shall provide full support to the ECSS-CEN process.

NOTE   For the ECSS-CEN process, refer to ECSS-D-00.

5.10 Collaborative and concurrent access

a.   The E-RMS shall provide concurrent read access to all E-RMS users according to their roles and privileges.

b.   The E-RMS shall provide the capability to access E-RMS structural elements for modification in a mutually exclusive way at elementary level.

NOTE   The elementary level in which the mutually exclusive modifications are made, depends on the structural element type definition (refer to E-RMS-CDM). Each structural element type is defined as a set of elementary properties being either atomic or compound.

c. The E-RMS shall provide the capability to lock any E-RMS structural elements for modification in accordance with their modification characteristics.

>   NOTE   The capability to modify a structural element or any of its property depends on the structural element type definition (refer to E-RMS-CDM).

d. The E-RMS shall provide the capability to unlock any E-RMS structural elements that are locked.

>   NOTE   Unlocking an E-RMS structural element can be performed by other users than the one having locked that structural element.

e. The E-RMS shall provide the capability to any user or group of users, to create and maintain one or more structural elements.

>   NOTE 1 Such capability provides means e.g. to product developers to create their own requirements, to link them to ECSS requirements or to duplicate them for full integration in the resulting product specification.

>   NOTE 2 This capability implies the capability to duplicate any structural elements or the parts of interest.

f. The E-RMS shall provide the capability to any user or group of users, to create one or more containers logically made of structural elements and type of structural elements of change notification interest.

>   NOTE 1 These containers are of type "change notification interest".

>   NOTE 2 By change notification interest, it is meant that the user or group of users wish the E-RMS to notify them when:
>   - the related structural elements change;
>   - structural elements of related types of structural elements change.

>   NOTE 3 Such capability can be implemented by enabling users to create communities of a related community type and associating related roles and privileges.

g. The E-RMS shall provide to the capability to specify the notification frequency associated to each container of type "change notification interest".

h. The E-RMS shall provide the capability to issue the change notifications to all users in accordance with their declared change notification interest.

5.11 Design constraints

a. The default language to use consistently through the overall E-RMS software and related documentation is English.

b. The E-RMS should be based on a relational database management system.

c.

d. The E-RMS shall provide a low-level open interface to interact directly with any data contained within the E-RMS repository.

NOTE   Such low-level open interface, preferably SQL, is for
use by E-RMS software developers.