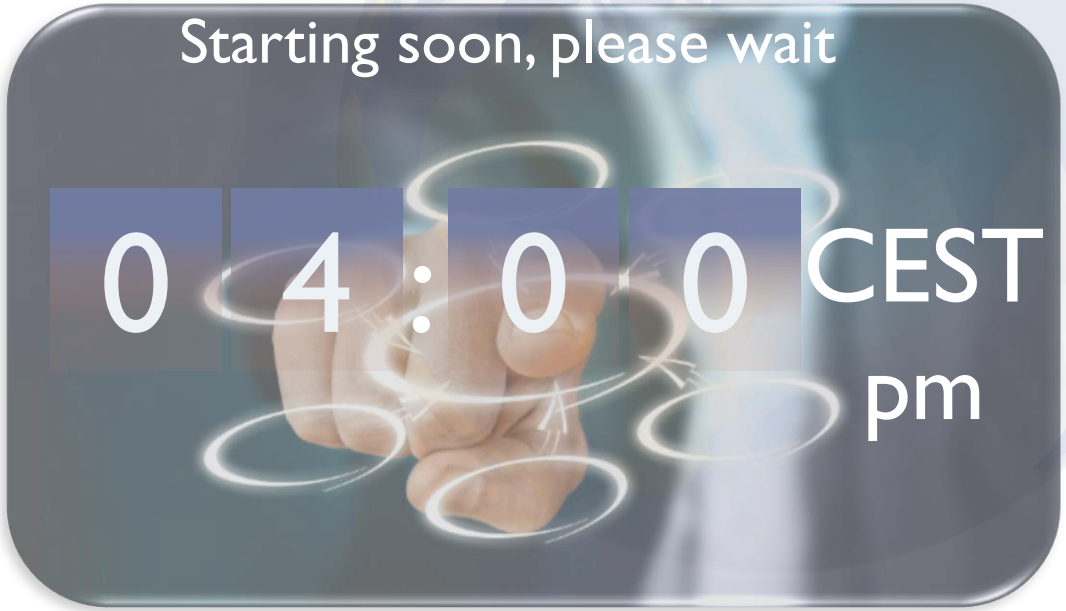
Introduction: Webinar rules

ECSS Drafting Rules



- Webinar rules:
  - You'll be muted all along the Webinar
  - There's a chatting box to ask your questions or send your comments when you want
  - Please address these comments and questions to the user "The REUSE Company" and not to the presenter directly
  - If you have any technical issue please use this chatting box, or mail us at: support@reusecompany.com
  - The Webinar will be recorded. A link to the recording will be sent to you in few days

ECSS Drafting Rules

The best way to write standards and other documents based on the ESA rules

José M. Fuentes
The REUSE Company
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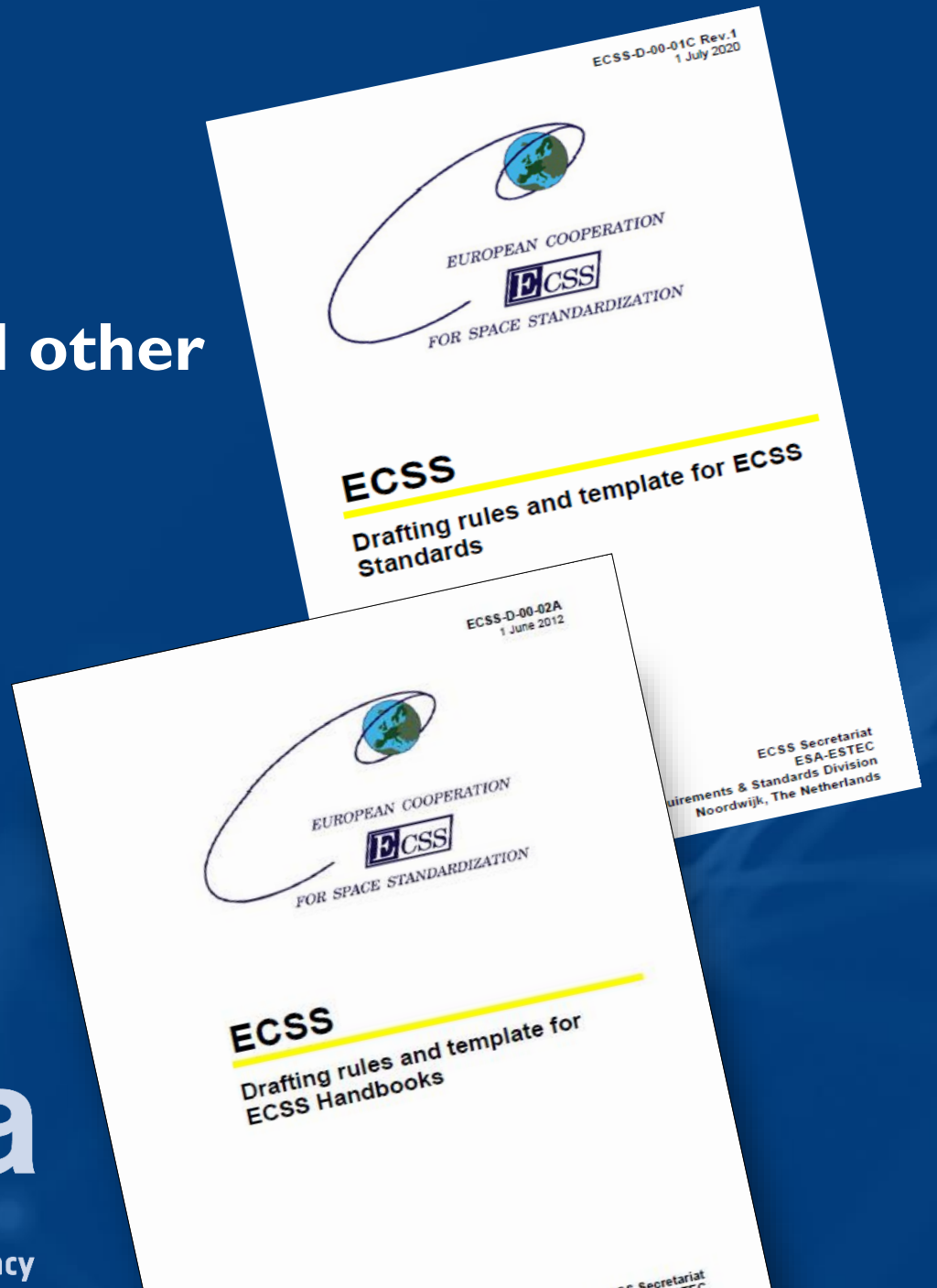
THE REUSE COMPANY

esa
European Space Agency



Contents

- Introduction to The REUSE Company and the speakers
- Brief introduction to the ECSS
- The ECSS Drafting Rules
- Mapping the rules into a knowledge library
- Possible uses cases
- Live demo
- Q&A

Introduction to The REUSE Company

01 The company was established in **1999**

As a spin-off of a University in Madrid - Spain

02 **System + Software Engineers**

Smart combination between Company staff and R&D from Academia

03 **Headquarters:** Madrid (Spain)

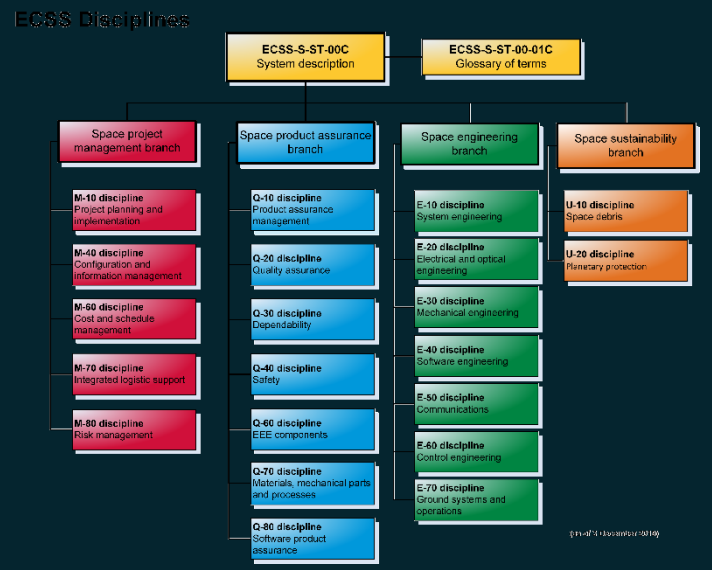
International offices: Stockholm (Sweden) Tokyo (Japan) Delegation

04 To provide a **knowledge centric** approach to leverage system engineering activities in our customers

The presenters

José M. Fuentes

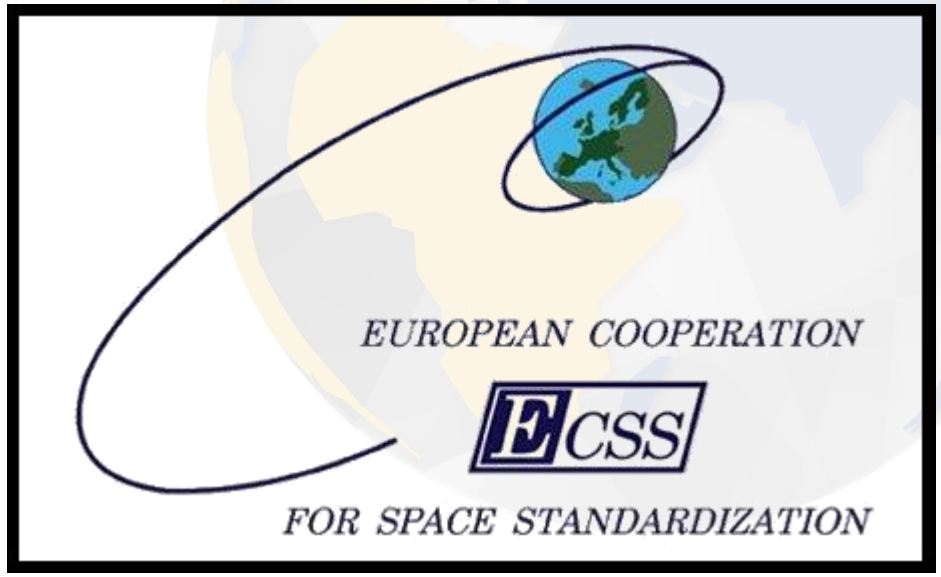
- **Current position:** Chief Operating Officer at The REUSE Company
- Product manager of the Systems Engineering Suite tools during the last 5 years
- INCOSE CSEP Certified
- Graduated in the INCOSE Institute for Technical Leadership
- Member of the board of AEIS – the Spanish chapter of INCOSE
- Active contributor to the INCOSE Guide for Writing Requirements



Brief introduction to the ECSS

What is the ECSS

- *European Cooperation for Space Standardization (ECSS): ecss.nl*
- *founded in 1996 as an initiative established to develop a coherent, single set of user-friendly standards for use in all European space activities,*
- *thus providing the European space community with an integrated set of space-specific standards*



agenzia spaziale italiana

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

DLR

esa European Space Agency

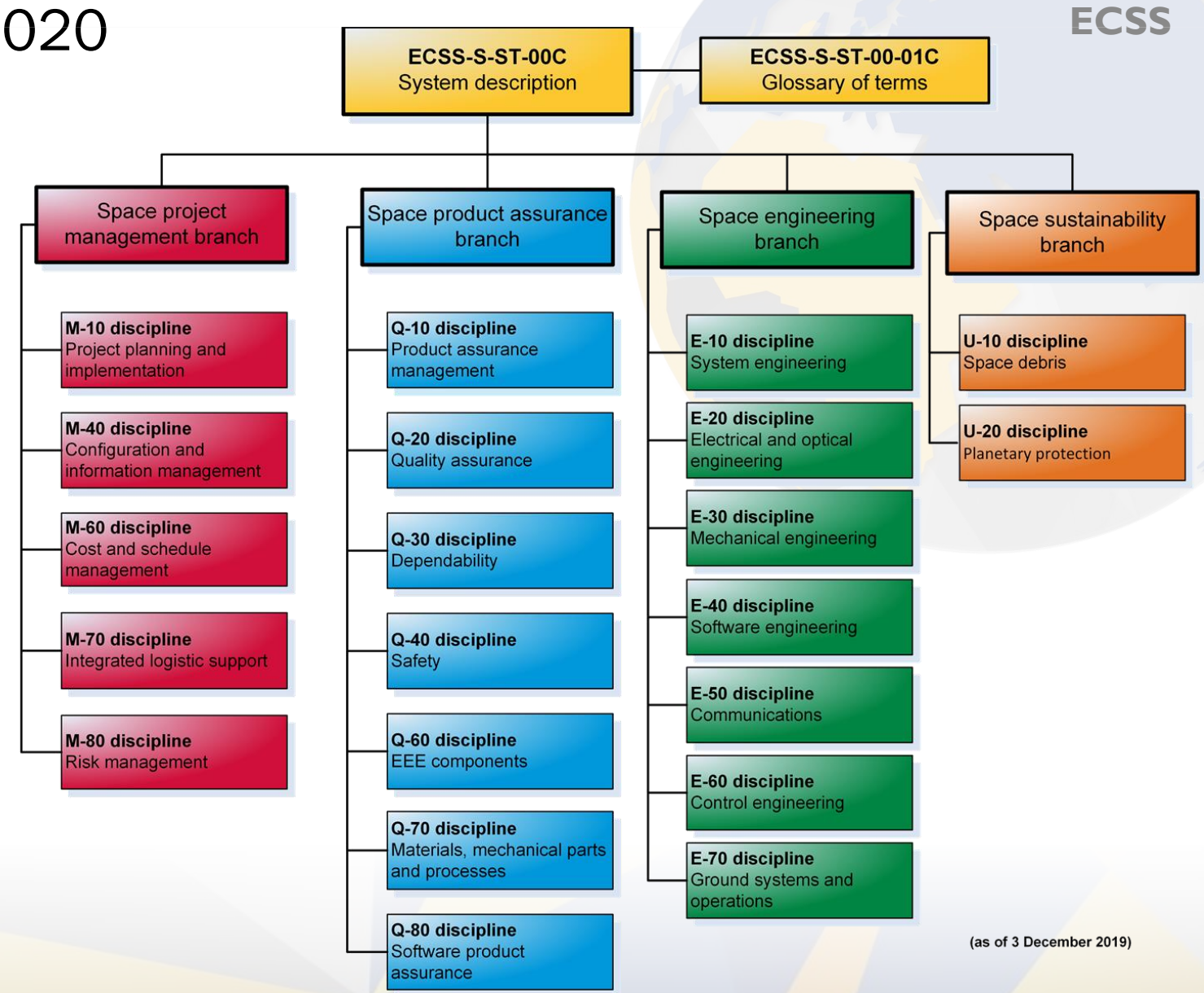
Netherlands Space Office

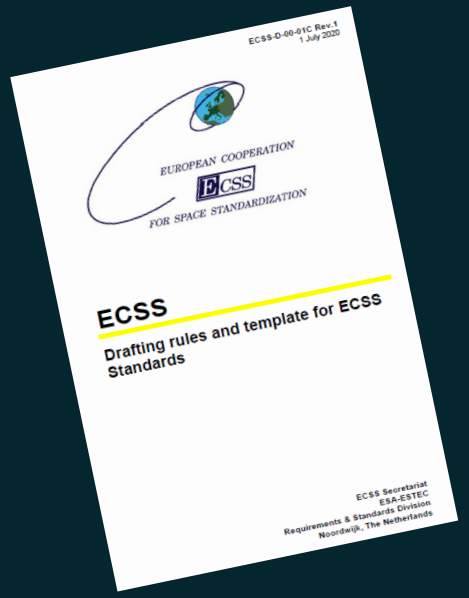
Norsk Romsenter NORWEGIAN SPACE CENTRE

UK SPACE AGENCY

What is the ECSS

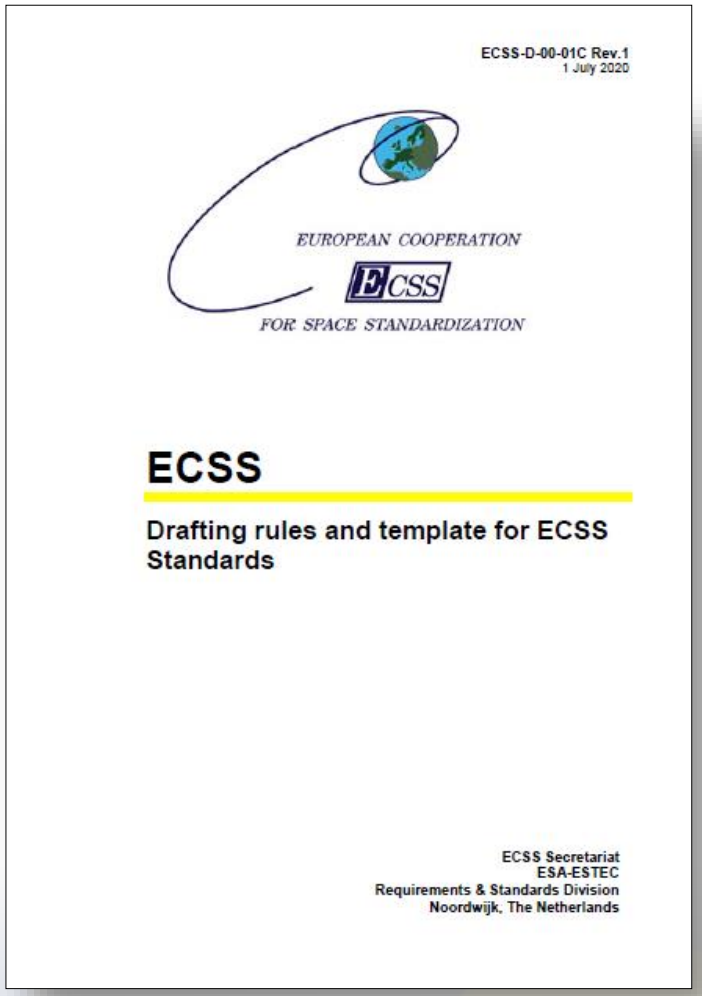
- Standards, Handbooks and Technical Memoranda
- Glossary of terms
- 4 technical disciplines

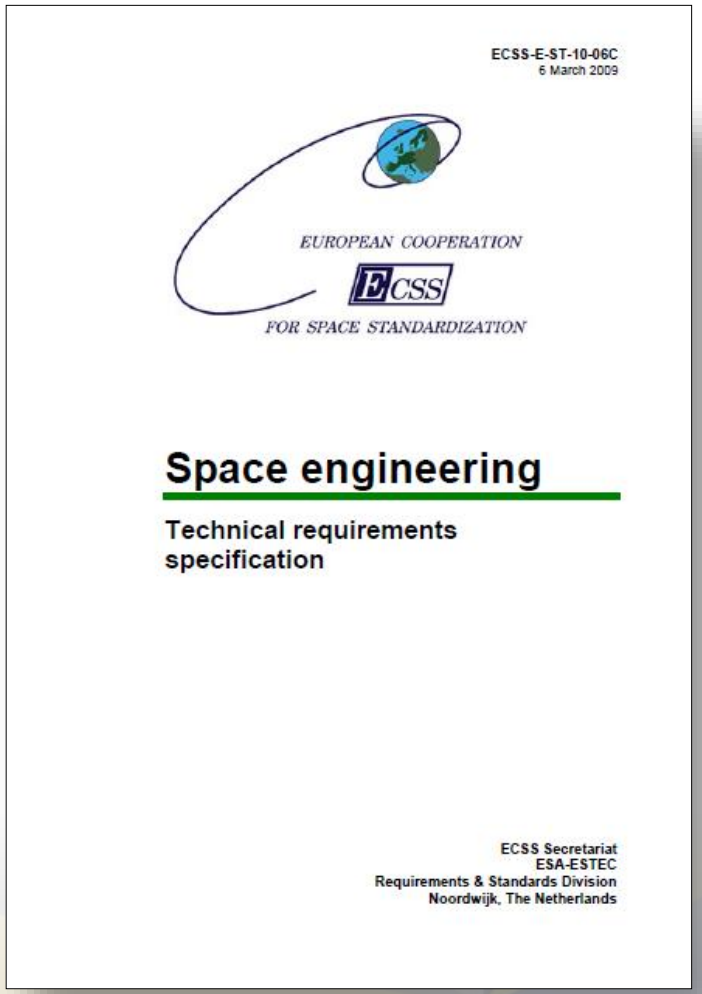


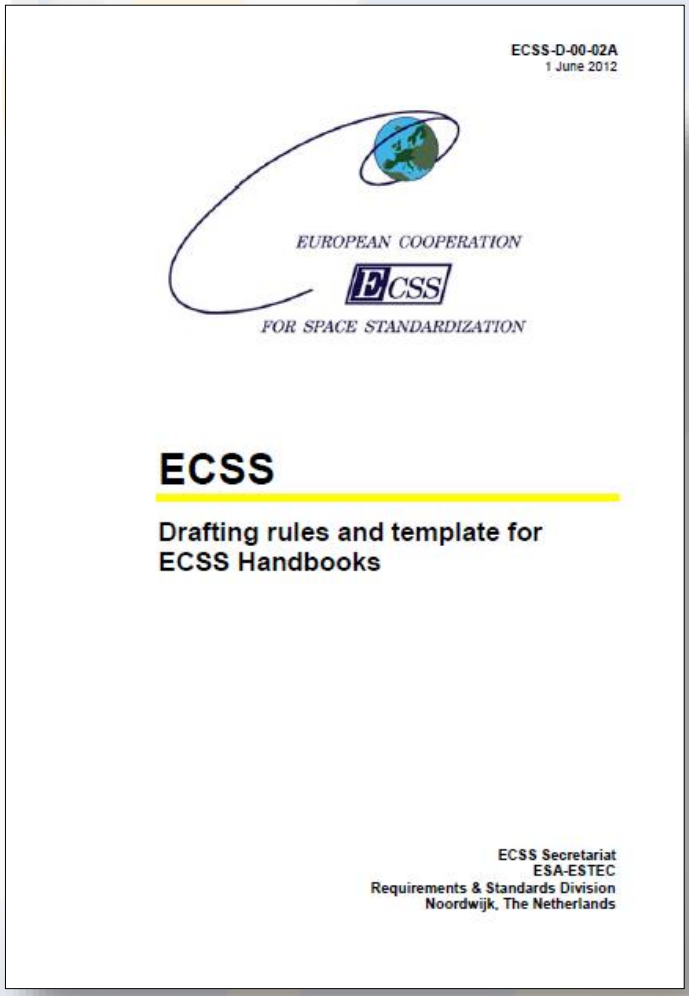


Introduction to the Drafting rules

ECSS Drafting rules

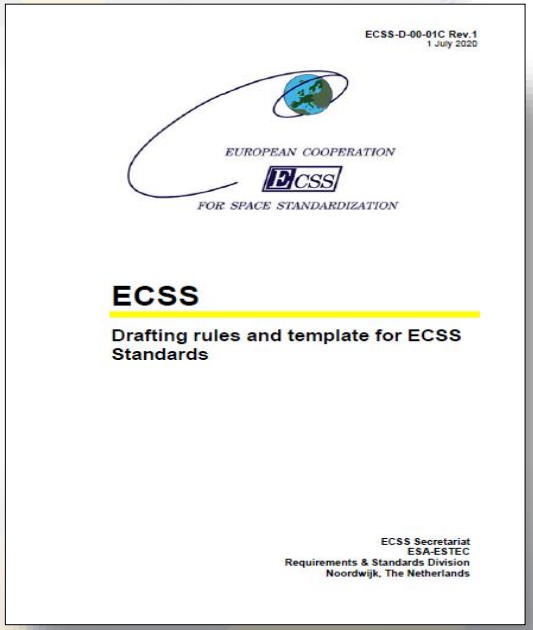






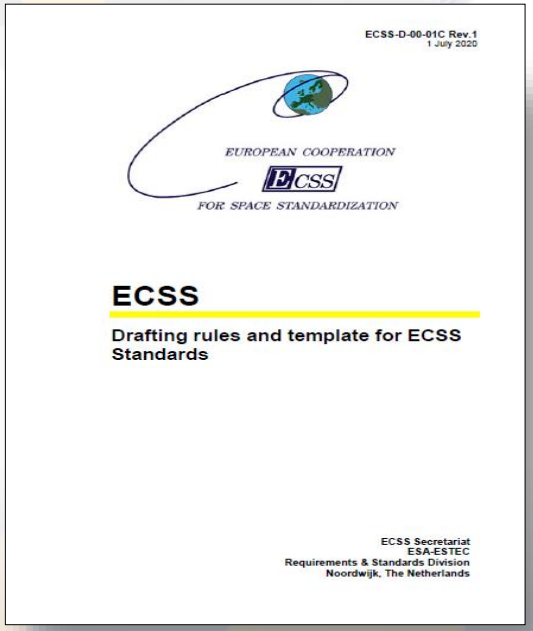
ECSS Drafting rules for ECSS Standards

- ECSS "Standard" defining the requirements to be followed by any ECSS standard documentation : **ECSS-D-00-01C (20 May 2014; rev.1 1 July 2020)**
- It is not a standard in itself but was drafted following the rules it is presenting!
- The document tackles the following aspects:
  - ❑ Terms & definitions
  - ❑ Principles on how to structure and organized the standards
  - ❑ Requirements
  - ❑ Annexes (non-verifiable requirements, checklist of terms…)



ECSS Drafting rules for ECSS Standards: examples of rules

- Detection of the correct verbal tense
- Structure or an individual normative clause/requirement
- References:
  - Invalid external references
  - References to superseded standards
  - Incomplete references
- Invalid numbers decimal numbers
- Units:
  - Always in the decimal system
  - Always following numbers…
- Tolerances:
  - Proper format
  - Within the given limits
- Vague and non-verifiable
- Subjective clauses



ECSS Drafting rules: SMART parsing

5.1.3.4 Designation of annexes

a. Annexes shall be designated using capital letters of the Latin alphabet, beginning with A, after the word "Annex".

b. The character of the annex (normative or informative) shall appear in parenthesis.

5.2.3 Characteristics of a requirement

a. Requirements shall be clear, i.e. drafted in such way that can be understood by an expert who has not participated in the drafting of the standard.

b. Requirements shall be unambiguous, i.e. drafted in such a way that can be interpreted only in one way.

c. Requirements shall be concise, i.e. formulated in such a way that is not verbose or bombastic.

NOTE The following is an example of a verbose requirement:
"Under no circumstance, action A shall be performed".
The correct formulation is:
"Action A shall not be performed".
In both cases the contractual obligation is exactly the same, but in the second case the sentence is simpler and more direct.

So, how can we detect non-concise requirements while still allowing parenthesis to designate annexes?

We'll need a SMART parsing tool!

Texts in brackets made requirements non-concise

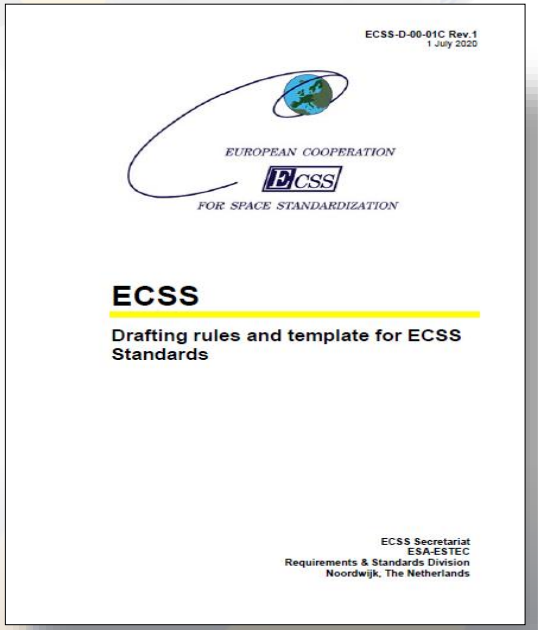
ECSS Drafting rules for ECSS Standards: structure of an ECSS standard

	Change log Table of Contents Introduction
1. 2 3 4 5 …. Last Clause: Annex A,B.. …. Annex N,…	Scope Normative references Terminology and nomenclature Principles Requirements …. Pre-tailoring matrix per product type and project phase Normative annexes (DRDs) …. Informative annexes
	Bibliography

Preliminary sections

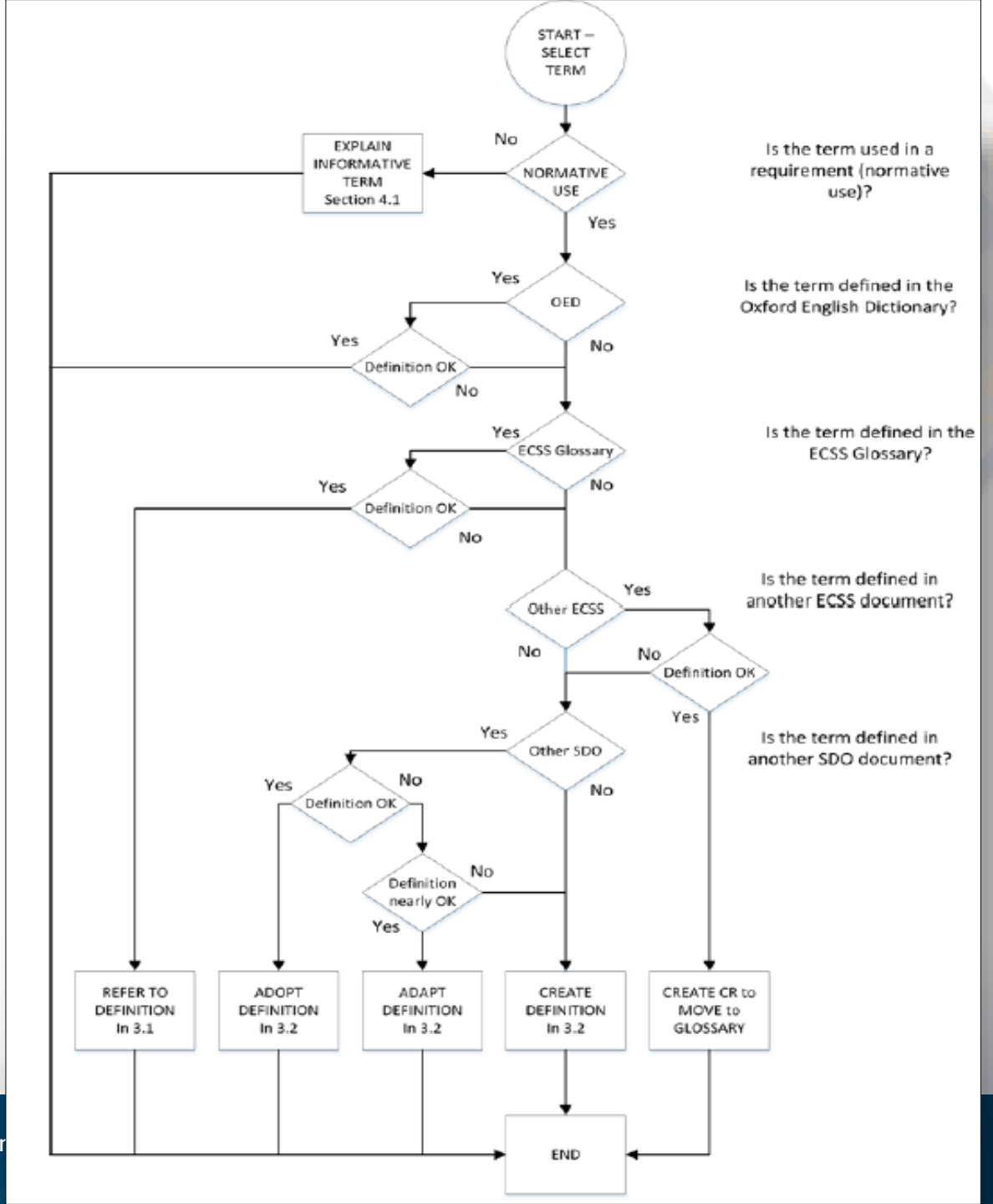
Level 0 Clauses (including Annexes)

Final section



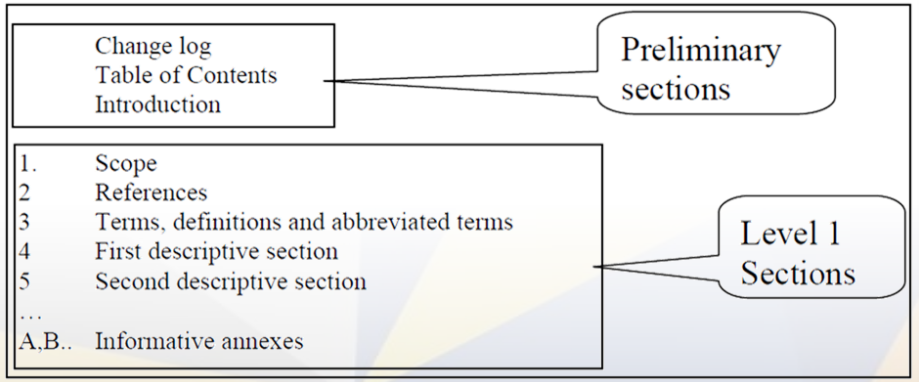
ECSS Drafting rules of Standards : Logical flow

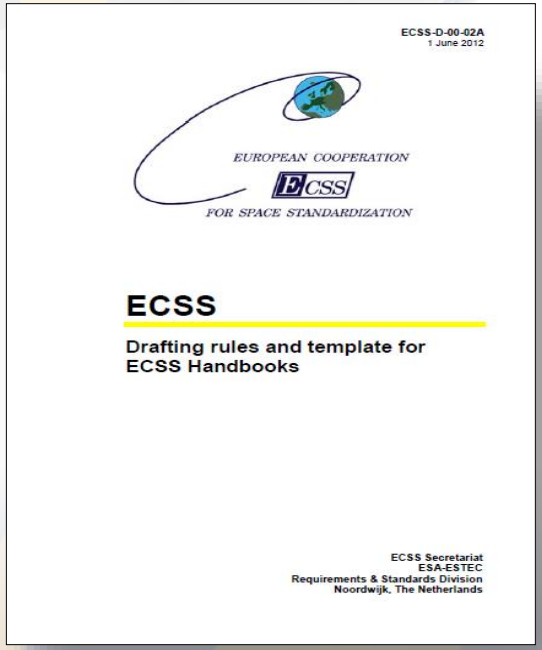
- Added in revision 1 of the standard (July 2020) - **Annex E**.
- Defines how and when a new term shall be included in the glossary.



ECSS Drafting rules for ECSS Handbooks

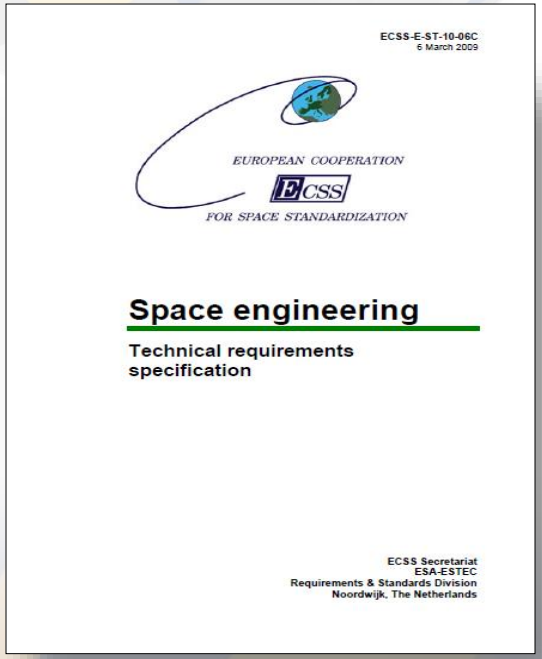
- ECSS "Standard" defining the requirements to be followed by any ECSS handbooks : **ECSS-D-00-02A (1 June 2012)**
- The document tackles the following aspects:
  - Terms & definitions
  - Principles for drafting a handbook
  - Requirements for drafting handbooks
- The set of drafting rules is a subset of the ones defined for standards
- Defines the structure for an ECSS Handbook





ECSS standard for Technical Requirements specification

- ECSS Standard defining the rules to be followed by technical requirements specifications : **ECSS-E-ST-10-06C (6 March 2009)**
- The document tackles the following aspects:
  - ❑ Terms & definitions
  - ❑ Purpose and description of technical requirements specification
  - ❑ Process for establishing technical requirements specification
  - ❑ Technical requirements types
  - ❑ Requirements for technical requirements specifications.



ECSS standard for Technical Requirements specification

- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009)**

8.2.1 Performance

8.2.2 Justification

8.2.3 Configuration management and traceability

8.2.4 Ambiguity

8.2.5 Uniqueness

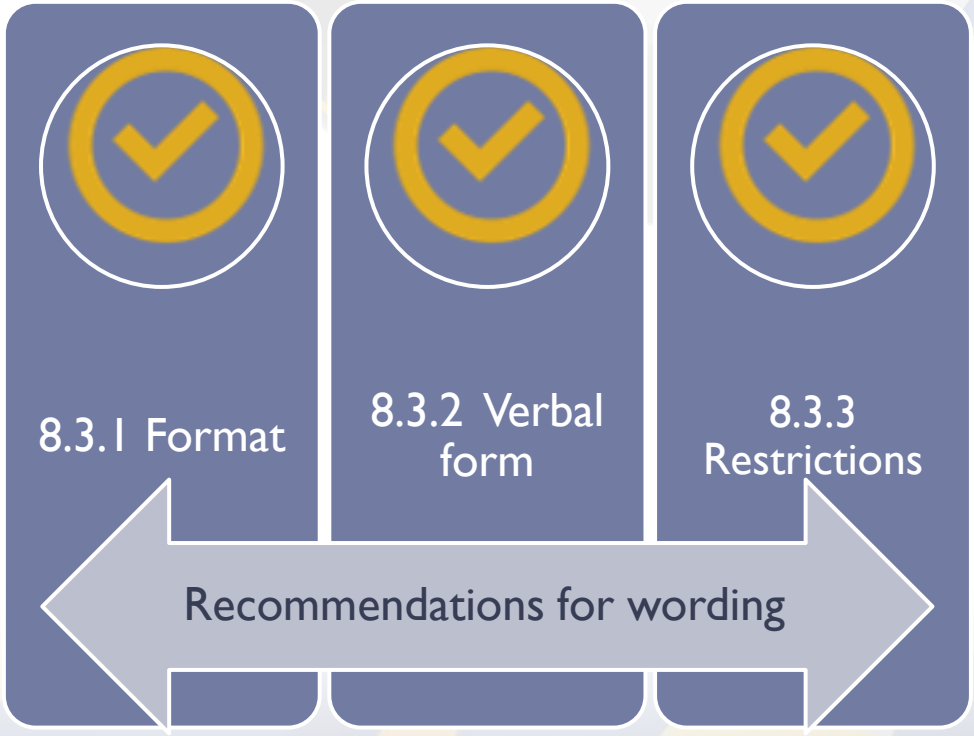
8.2.6 Identifiability

8.2.7 Singularity

8.2.8 Completeness

8.2.9 Verification

8.2.10 Tolerance

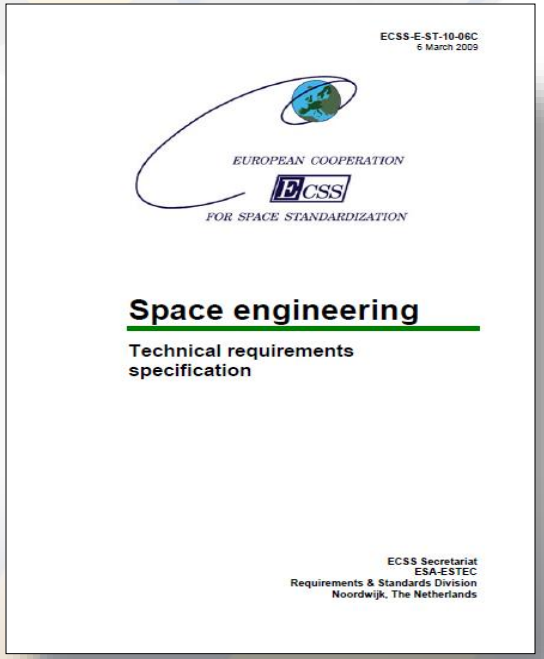


ECSS standard for Technical Requirements specification

- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009)**
- **Issues:**
  - The definition of the Quality rules in this standard is very abstract

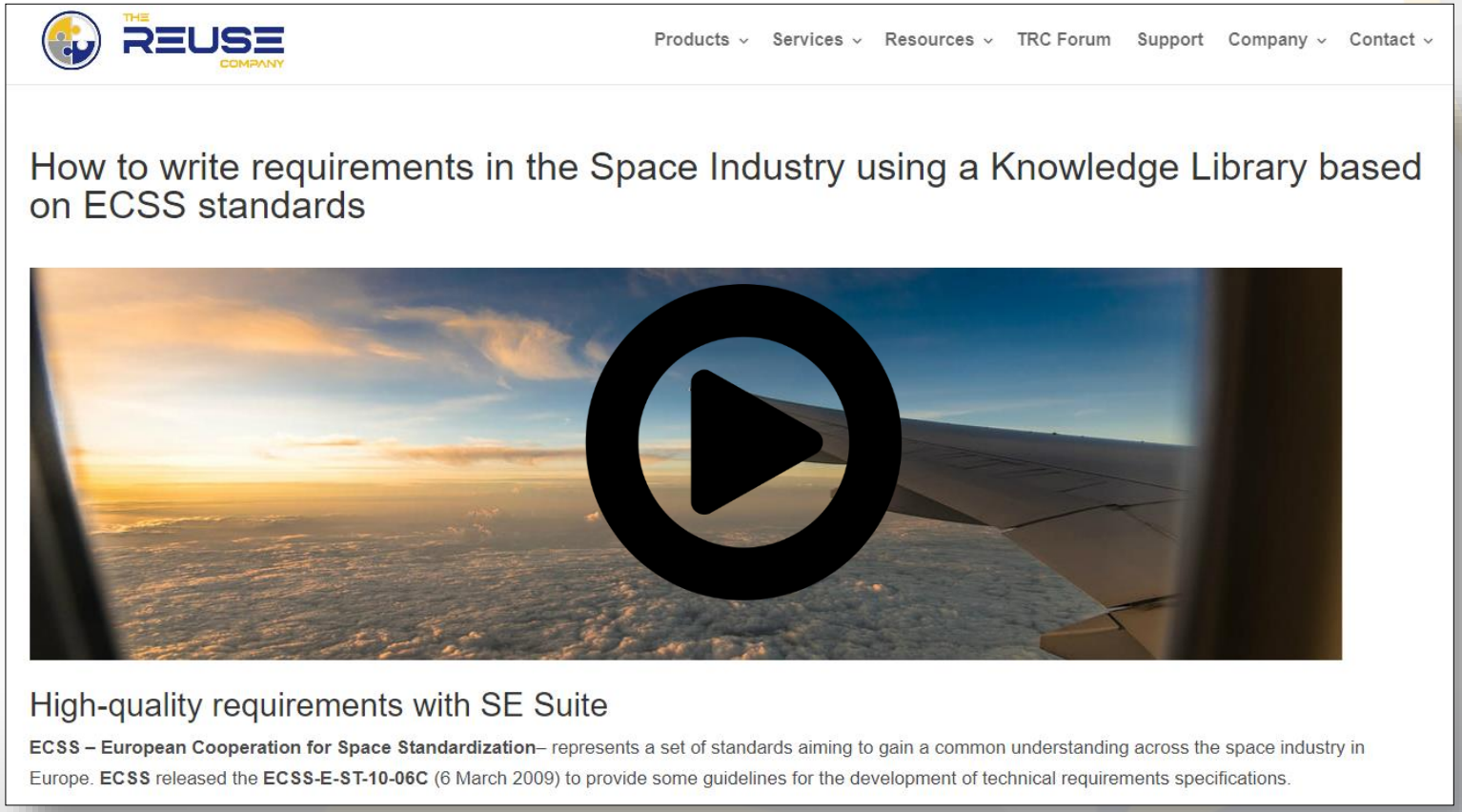
> **8.2.4 Ambiguity**
>
> a. The technical requirements shall be unambiguous.
>
> **8.2.5 Uniqueness**
>
> a. Each technical requirement shall be unique.

- **Solution:**
  - Mixed with the rules in the INCOSE Guide and other standards for Writing Requirements



ECSS standard for Technical Requirements specification

- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009)**



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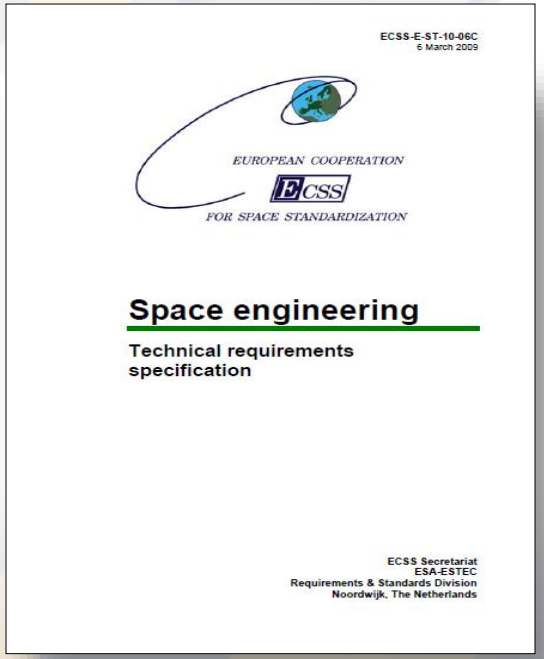
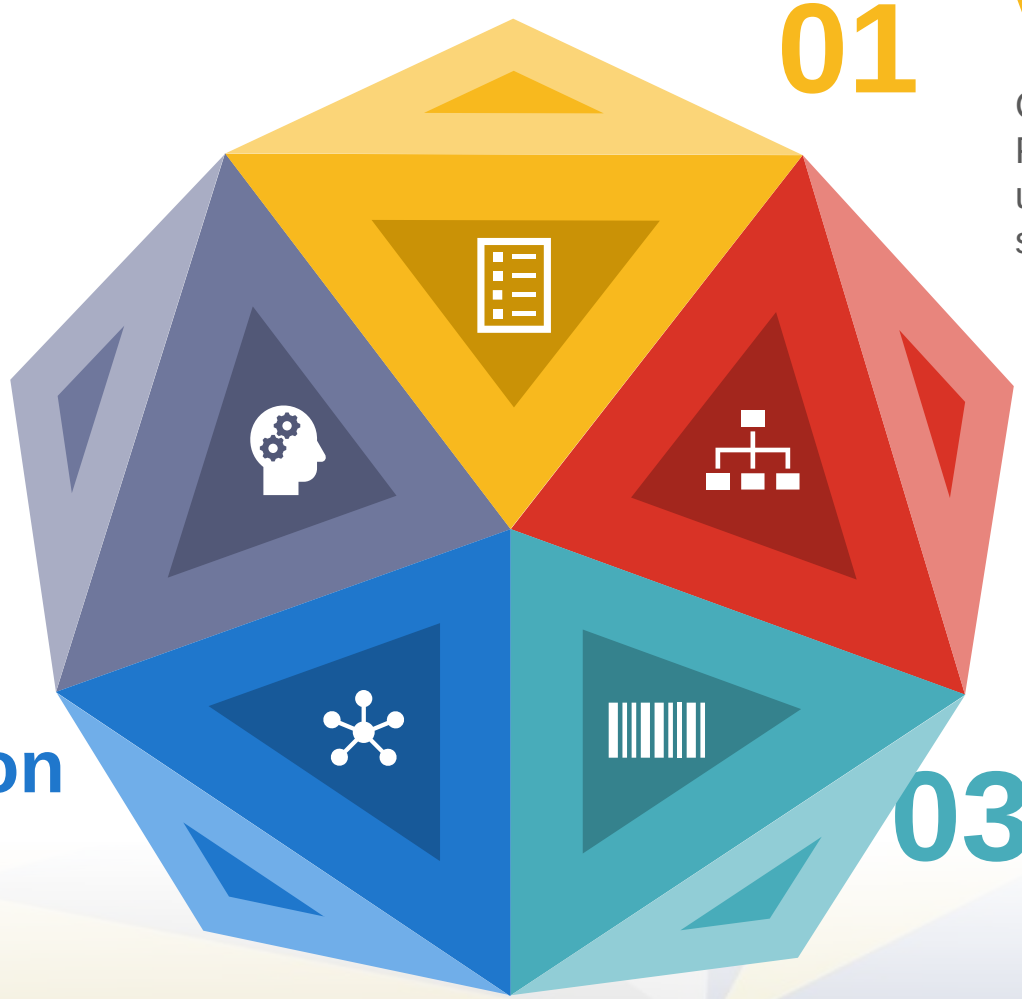


Mapping drafting rules in a Knowledge library

What is a Knowledge Base



01 Vocabulary/Glossary

Controlled Organizational and Project Vocabulary for a common understanding among stakeholders

02 SCM/Architectures

Capture the system architectures represented in views and models. Stablish relationships among system and system elements, and among other system entities. Classifying information by meaning, nature…

03 Patterns

Representing a set of agreed-upon templates (grammars) to create and maintain consistent textual artifacts

04 Formalization

Representation of assets semantic through SRL – System Representation Language

05 Reasoning

A combination of rules, and actions to infer information from valuable assets and to control the behavioural part of the knowledge library

Knowledge Libraries

Domain specific ⟵ ⟶ Common English

Vocabulary

Shuttle | Columbia | Discovery

System | Operate | Temperature | Environment | Pressure

shall | The | of | at | Lower

Architectures - Conceptual model

Temperature → "Operation Range " → [-260ºC , +1600ºC]

System

Shuttle

Fuselage | Wing | Landing gear | Columbia | Discovery

<Action>

Work

Operate

Environment

Temperature | Pressure

"Greater than (>) "

Patterns

<System> | Shall | <Action> | At | «Minimum» | <Environment> | Of | NUMBER | MEASUREMENT UNIT

Formalization

The Columbia shall be able to operate at a minimum temperature of 10º K → Temperature → "Greater than (>)" → -263,15 | ºC

Reasoning

If NUMBER Lower than (<) -260º ºC Or NUMBER Greater than (>) +1600º ºC → ✗

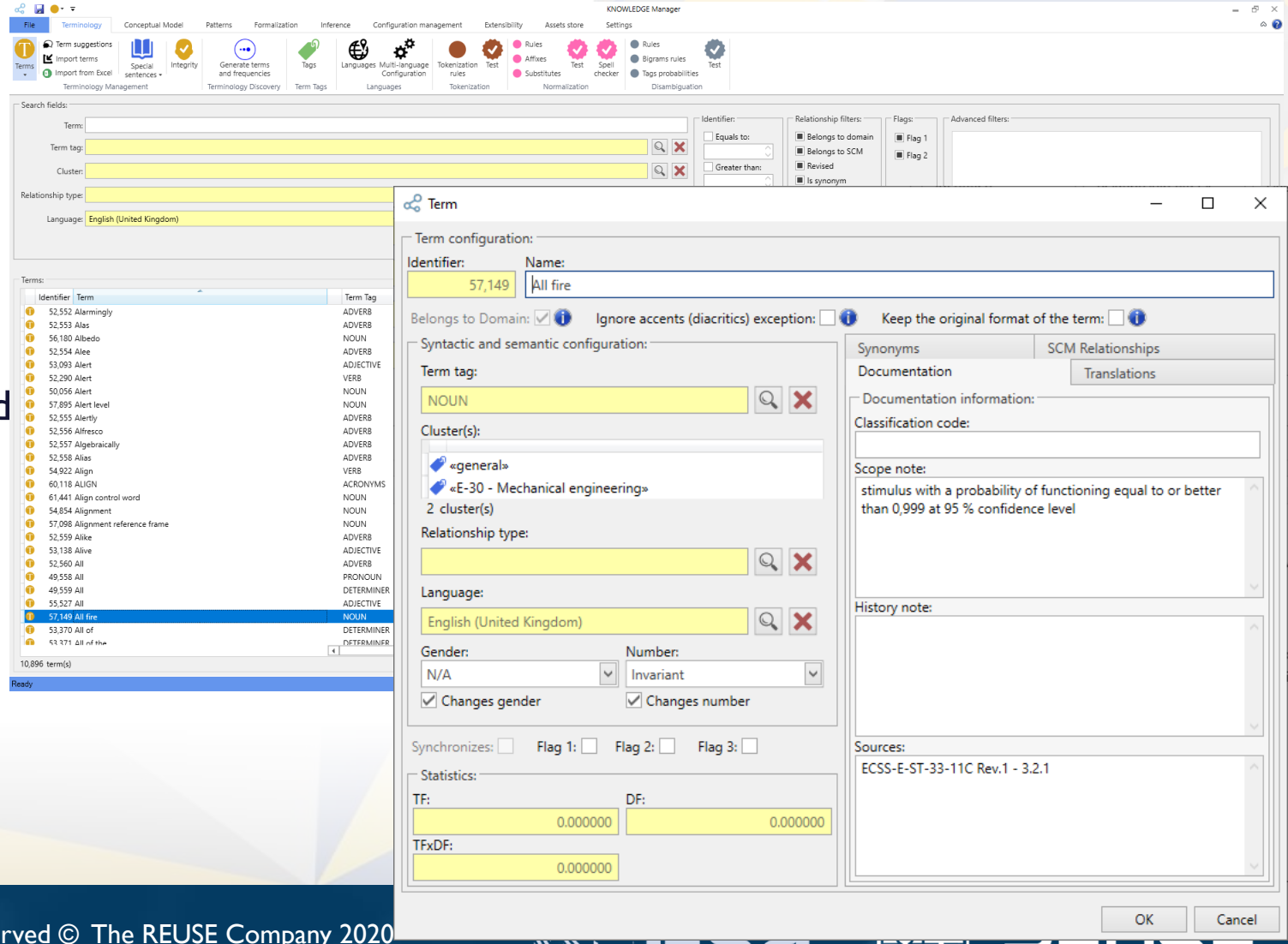
esa THE REUSE COMPANY

What is a Knowledge Library

- A combination of Knowledge items,
  - of different nature,
  - at different levels of abstraction
- Representing a specific business domain or **area of knowledge**
- With the aim of improving the way projects are managed, including:
  - the promotion of the principle: **quality** *right the first time,*
  - enabling semantic search portals to archive and retrieve assets,
  - thus providing tools to **reuse** assets at different level,
  - and reducing **time** to market,
  - improving the way engineers generate (**author**) new assets,
  - enhancing the way items are inspected and **verified,**
  - Enabling real **interoperability** mechanisms and services,
  - reducing **time** to elaborate documents, systems and projects.

ECSS Glossary

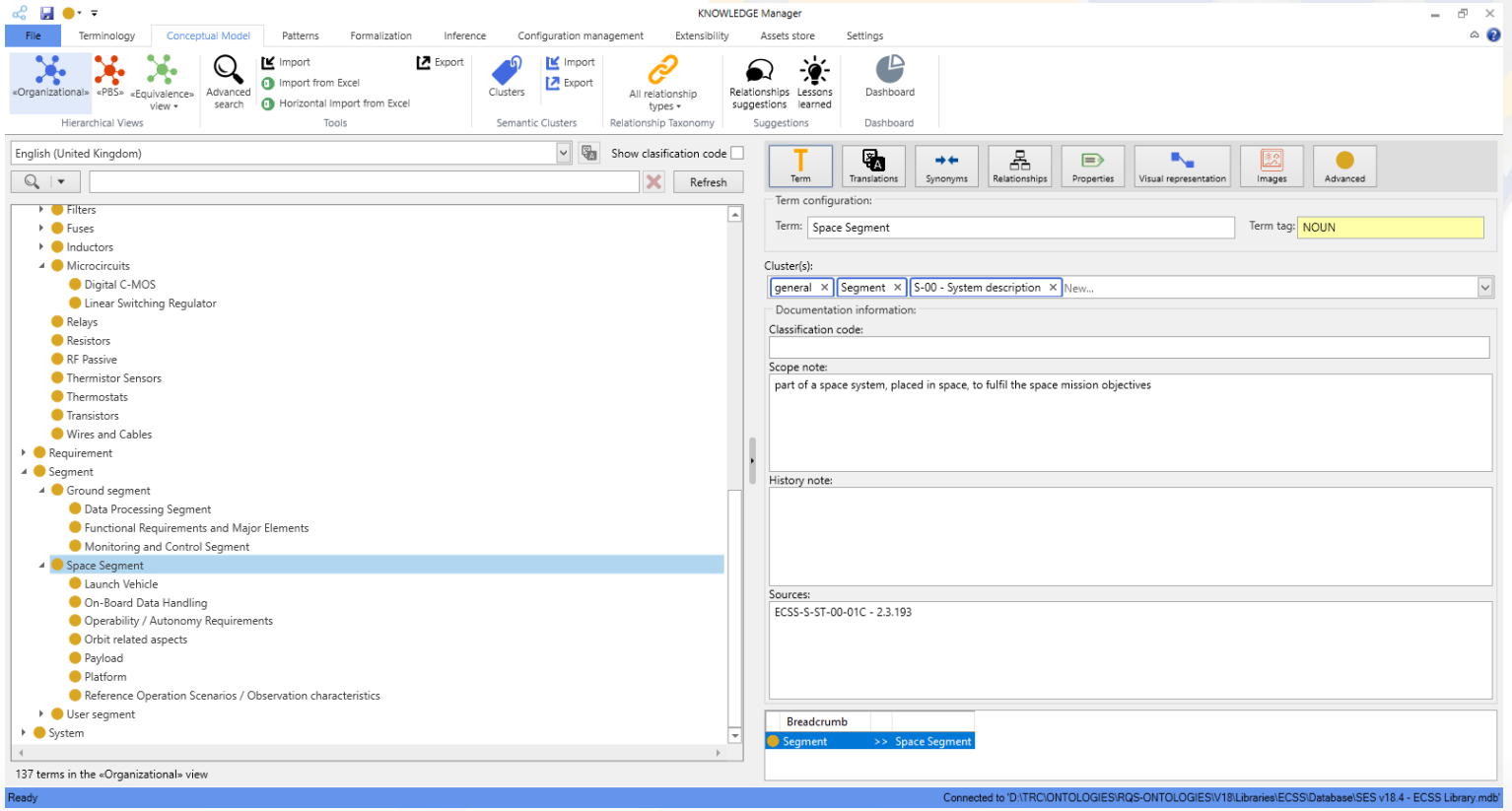
- **ECSS-S-ST-00-01C – Glossary of terms (1 October 2012)**
- This document controls the definition of all common terms used in the European Cooperation for Space Standardization (ECSS) Standards System. Terms specific to a particular ECSS Standard are defined in that standard.



- **Provides a consistent way to name and understand all the concepts across the industry**
- **The system can highlight and link references to these entries in the body of the documents**

Taxonomy of terms and other relationships

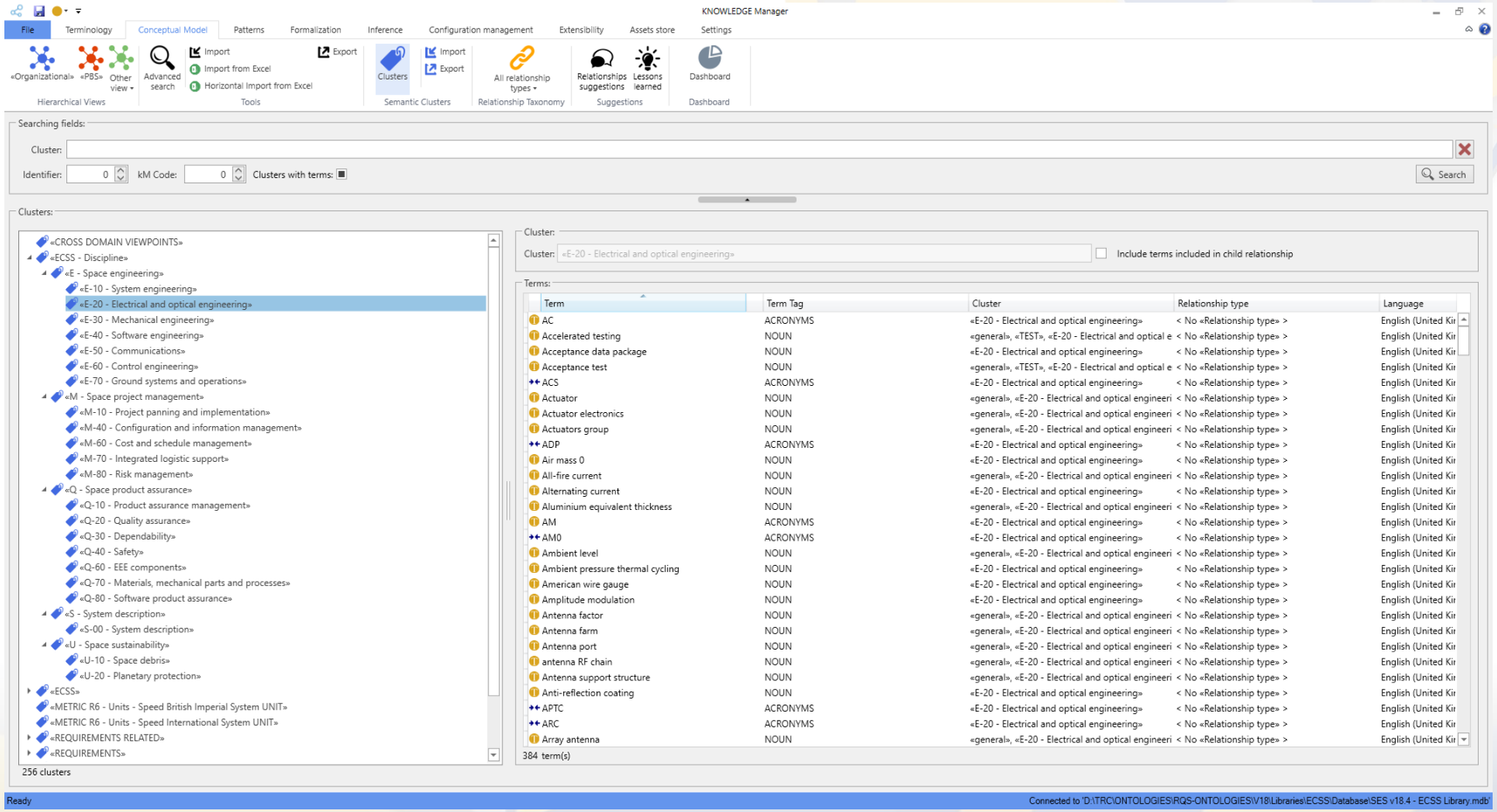
- Based on the glossary standard, and some other standards
- Represented as relationships in the Knowledge Library
- **Provides means to propagate queries in further reuse stages or just for information retrieval**



Clustering the terms of the glossary

- **Clustering:** according to the semantic (nature of meaning) of the terms in the library

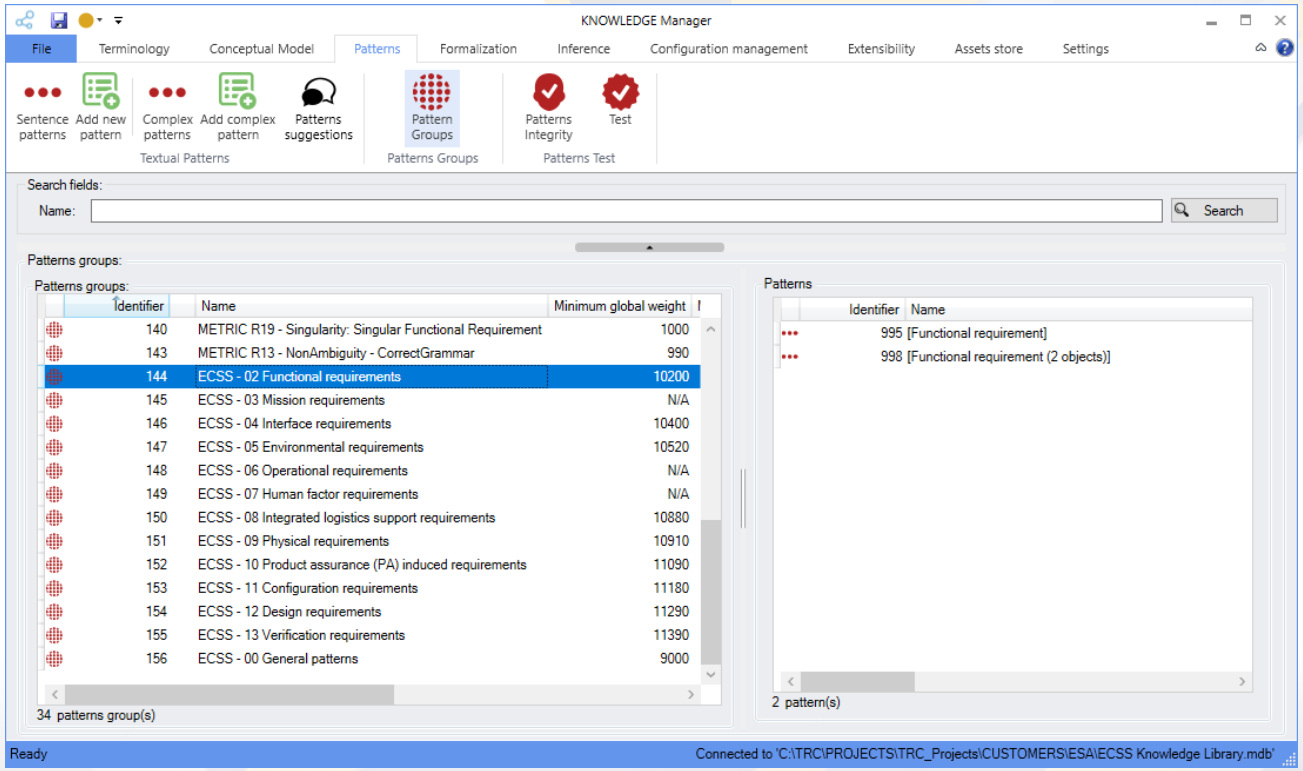
- **Provides means to fit the textual paterns and help authors while the write requirements or other types of textual assets**



Taxonomy of types of requirements

- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009)**
  - This Standard provides an overview of the purposes and positions of the technical requirements specification, defines the different types of requirements, and defines requirements on the TS and on its requirements.
  - This Standard is applicable to all types of space systems, all product elements, and projects.

- **Provides a reference during the requirements authoring phase**



Requirements patterns

- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009)**
  - This Standard provides an overview of the purposes and positions of the technical requirements specification, defines the different types of requirements, and defines requirements on the TS and on its requirements.
  - This Standard is applicable to all types of space systems, all product elements, and projects.

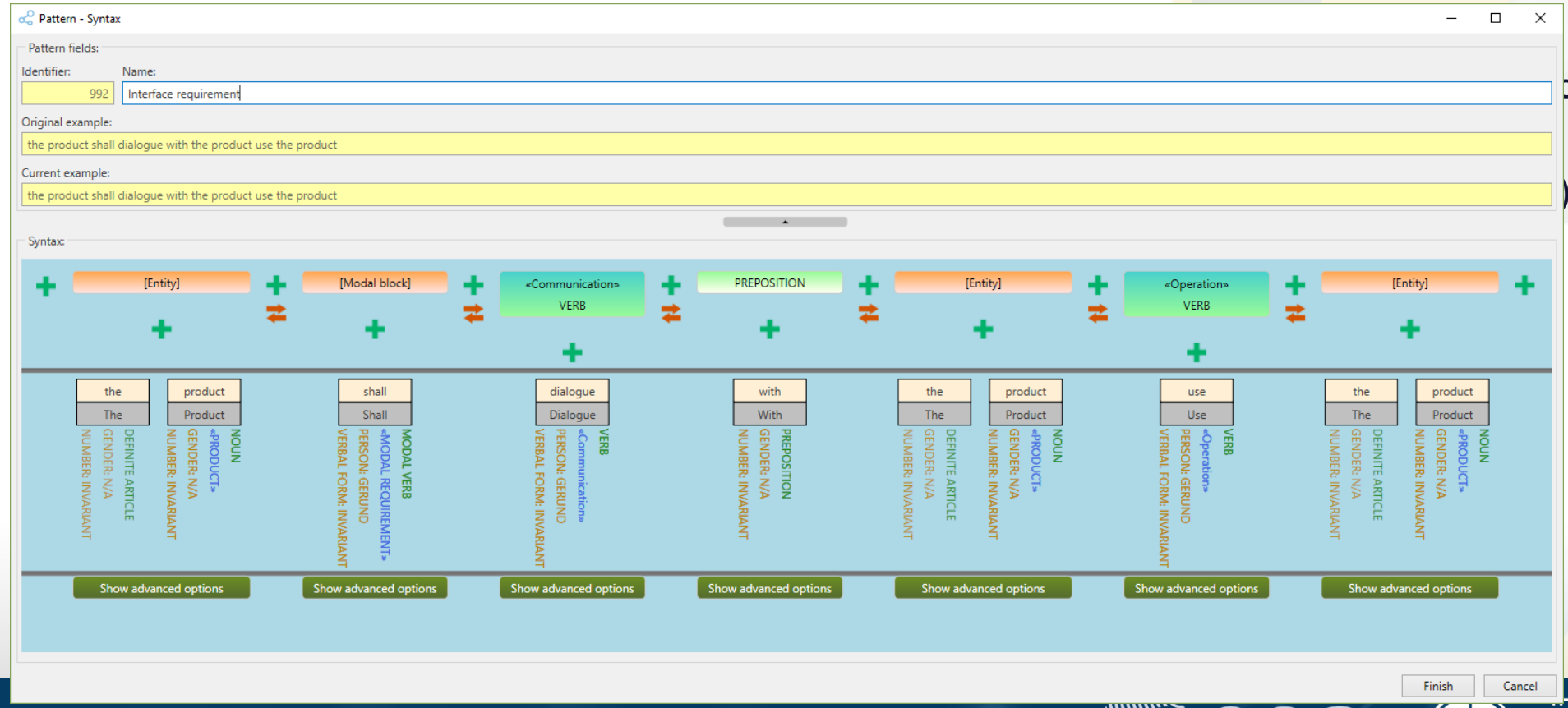
- **Provide a reference during the requirements authoring phase**
- **Allows an automatic parsing of textual and unstructured documents**
- **Some specific patterns allow:**
  - **Automatic extraction of properties: consistency checking**
  - **Automatic generation of models: SysML, ORM (Object Role Modeling)…**

Requirements patterns

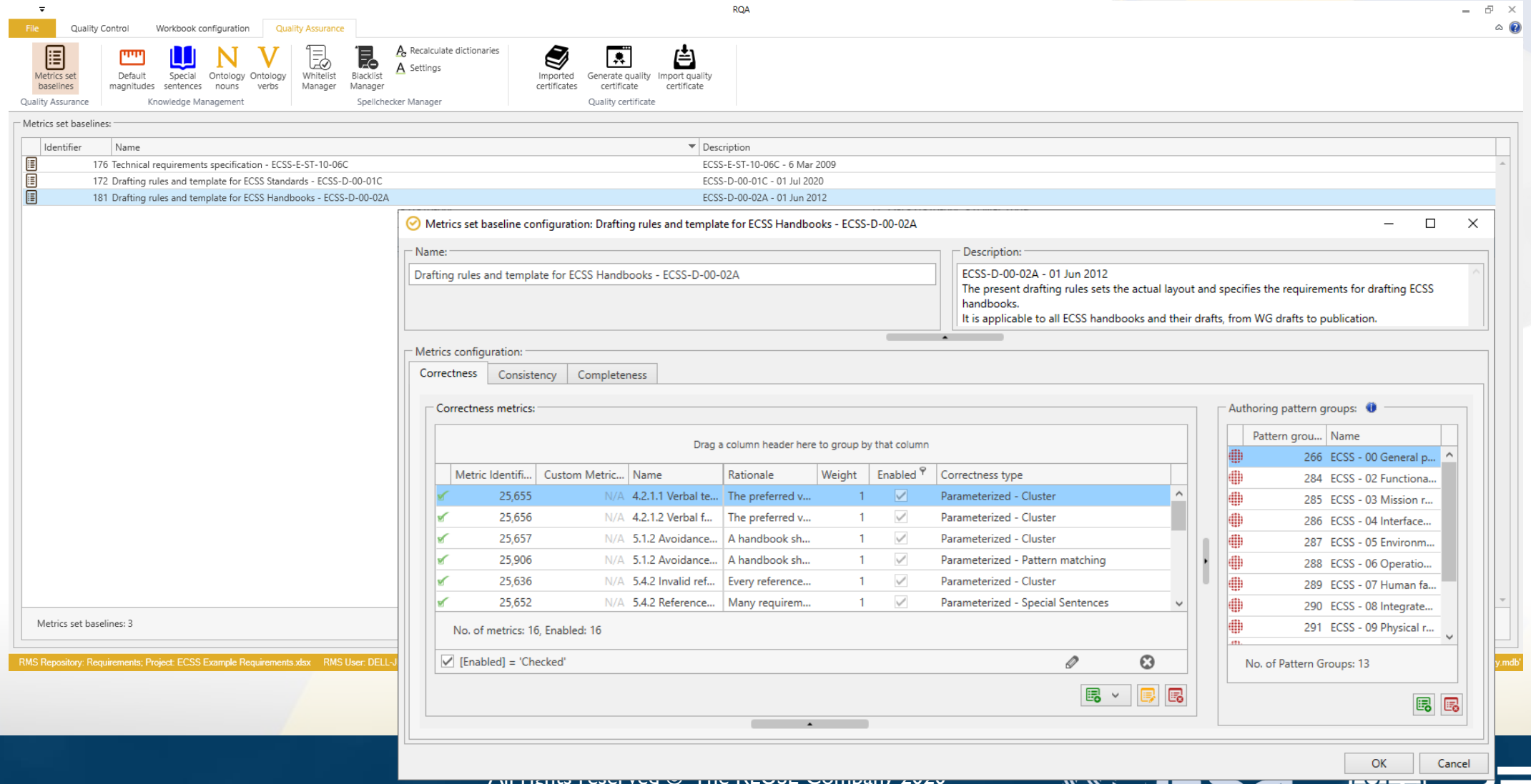
- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009):**
  - **Example of requirement pattern: Interface requirement**
    - <Entity> <Modal> <Communication/VERB> <Entity> <Operation_VERB> <Entity>
    - Requirements related to the interconnection or relationship characteristics between the product and other items.
    - NOTE 1 This includes different types of interfaces (e.g. physical, thermal, electrical, and protocol).
    - Example: "The product shall dialogue with the ground segment using telemetry"

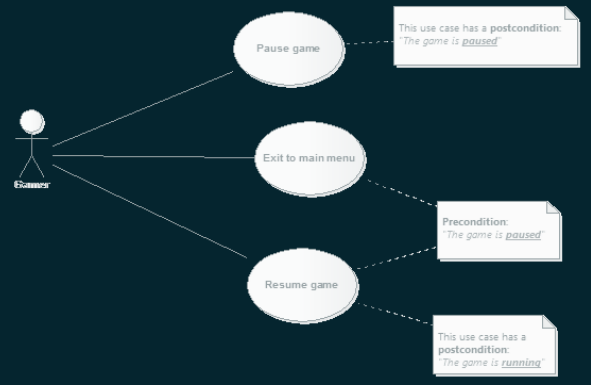
Requirements patterns

- **ECSS-E-ST-10-06C – Technical requirements specification (6 March 2009):**
  - **Example of requirement pattern: Interface requirement**



Quality rules

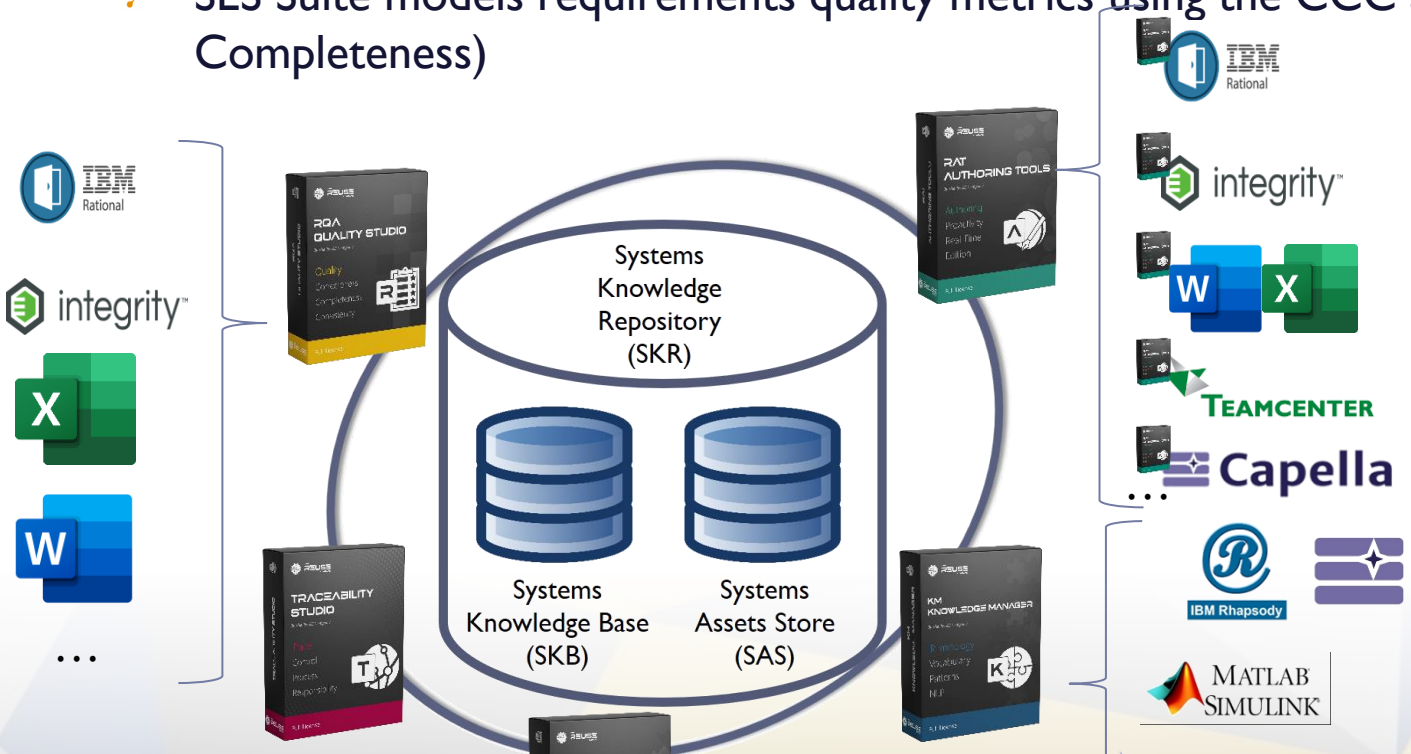




Proposed use cases

Related use cases: the SES Suite

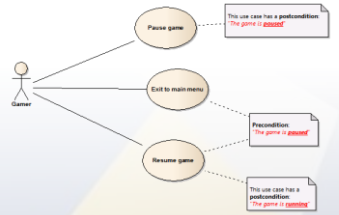
- The Systems Engineering Suite tackles requirements quality management by offering a set of tools and processes
- Automatic measurement of requirements quality metric
- Support to Requirements Authoring
- SES Suite models requirements quality metrics using the CCC approach (Correctness, Consistency and Completeness)



- **RQA / V&V Studio:** to setup, check and manage the quality of a requirements specification
- **Rich Authoring Tool (RAT):** to assist authors while they are creating or editing requirements
- **Knowledge Manager (KM):** to manage knowledge around a requirements specification: dictionaries, glossaries, concept maps, knowledge models, ontologies, patterns…
- **TRACEABILITY Studio:** to link together all the different types of artifacts managed with the rest of the tools

Related use cases

- Real-time checking of the drafting rules on MS Word. RAT plugin 
- Pattern-Based authoring on MS Word. RAT plugin 
- Suggestion of new terms for the vocabulary from the authoring tools. RAT or RQA 
- Inspection of a document + reporting based on the drafting rules. RQA 
- Automatic extraction of new vocabulary from an existing specification/standard/handbook. RQA 
- Requirements extraction from unstructured sources. RAT 
- Document inspection on DOORS. RQA 
- Document editing on DOORS. RAT plugin 
- Traceability management. TRACEABILITY Studio 



Main

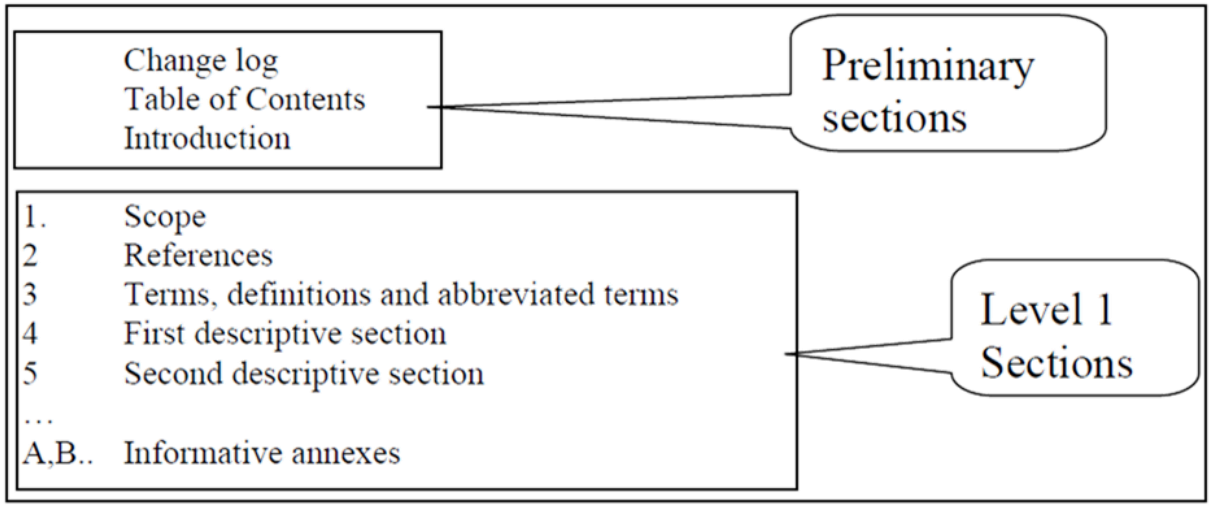
Conclusions

Main conclusions

- A knowledge base has been created, covering the 5 layers of the ontology
- This library is already available at:
  - https://www.reusecompany.com/ecss-knowledge-library
- The SES Suite covers all the use cases described

Next steps: analyse the structure of the document

- The structure of the document could be analysed:



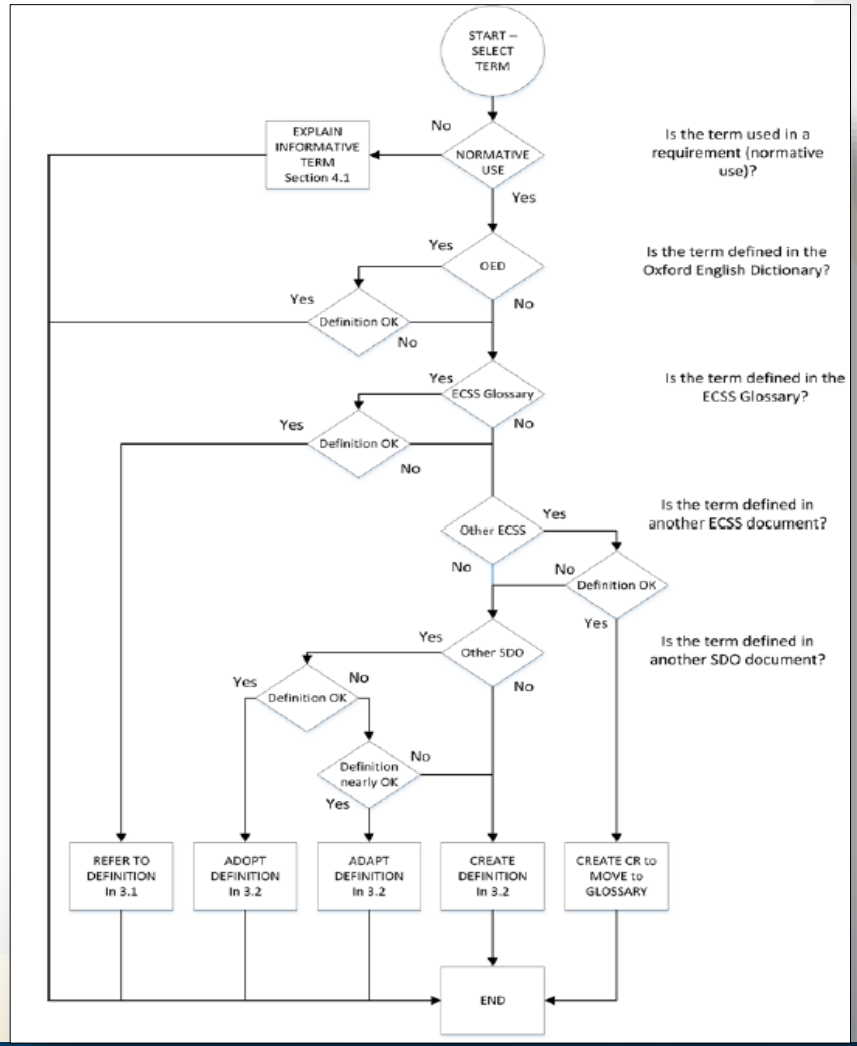
- This might include:
  - Detection normative beyond level 5, of hanging and superfluous clauses
  - Detection of footnotes
  - Normative annexes shall precede any other annex, followed by informative annexes

Next steps: analyse other contents of the document

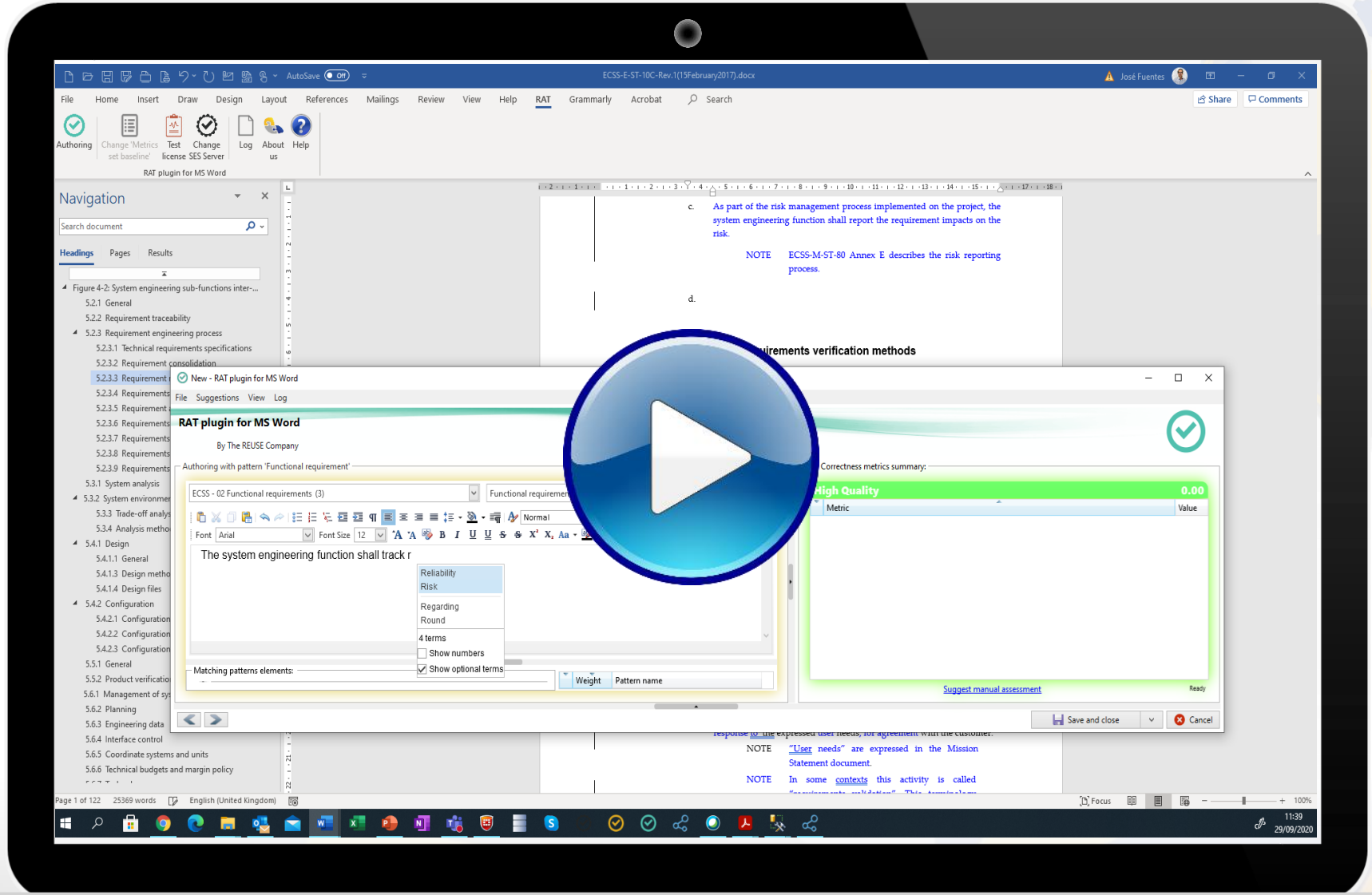
- IDs of the requirements:
  - The ID is well-formed
  - The ID is unique
  - …
- Notes
- Captions

Next steps: full implementation of Annex E - Flow

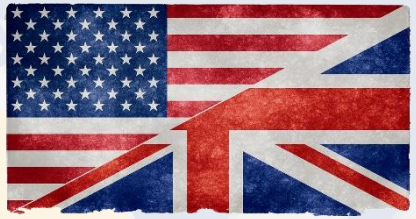
- From the current terminology suggestion mechanism..
- … to a full implementation



Live demo




Q&A



Next webinar

- **EARS – Easy Approach to Requirements Syntax: a practical approach**
- System requirements are usually written in unconstrained natural language (NL), which is inherently imprecise. Often, requirements authors are not trained in how to write requirements. During system development, requirements problems propagate to lower levels. This creates unnecessary volatility and risk, impacting programme schedule and cost.
- The Easy Approach to Requirements Syntax (EARS) is a mechanism to gently constrain NL requirements. The EARS patterns provide a lightweight, structured guidance that enable authors to write high quality textual requirements. EARS reduces or even eliminates common problems found in NL requirements.
- This webinar will give an overview of the key concepts of EARS and provide examples of EARS requirements.
- The practical block will show how the *RAT – Authoring Tools* has implemented the EARS patterns, making it possible to integrate in any Requirements Management System

Dates:

- 20th and 22nd October 2020

Next webinar

- **Kom igång med högkvalitativ kravgranskning för effektivare projektarbete**
- Krav med låg kvalitet en av de främsta orsakerna som leder till misslyckade projekt och studier visar på att så mycket som 15% av ett projekts totala kostnad har härledas till undermålig eller konstant föränderlig kravbild. Oklara och tvetydiga krav, motstridiga krav eller inkonsekventa **kravspecifikationer** är bara några exempel på de dussintals fel som är mycket vanliga i alla projekt.
- Detta webinar introducerar verktyg för att tidigt upptäcka dessa problemkällor och visar på en uppsättning grundläggande tekniker för att övervinna dem och enkelt **skriva krav med hög kvalitet**. Alla dessa grundläggande aspekter av kravkvalitet täcks med en standardinstallation av verktygen RQA – Quality Studio och RAT – Authoring Tools. Du kan gå från en kravbild med en massa felaktigheter till en **komplett kravbild med få överlapp, motstridigheter eller rena felaktigheter på mycket kort tid och med minimal arbetsinsats**. Det bästa av allt är kanske ändå att du sedan kan återbruka din kunskap och slipper därmed göra om dina misstag i efterföljande projekt.

Dates:

- October, 13th 2020


Q&A

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