

ECSS Requirements Management System



MBSE 2021



About the presenter



What's your job?

I am a Senior Software Engineer and Project Manager; Ground Segment expert for AIT and OPS projects at RHEA Group

What do you do?

- Apply and Formalize ECSS Standards
- Architecture Design and Software Implementation
- Conceptual Modelling experience with NORMA, BPMN, UML, etc.
- Automatic code generation and interfacing from MBSE.





The Project



PROIECT DESCRIPTION

Who will use the system

This system is expected to be used by

- The ECSS Community
 - Public Users
 - WG Members and Convenors.
 - Secretariat
 - Technical Authorities
 - Steering Board
 - Consulting Experts
 - Ad-hoc communities (e.g. Organizations, Project Teams)
- Ad-hoc communities (e.g. Organizations, Project Teams)
- · External communities with requirement and documentation management needs



PART OF OSMOSE

Models are coordinated with OSMOSE WG

ECSS Revision

Uses examples from ECSS SB and models reviewed by members

Formal Methods

Behaviours are modelled in BPMN. so code can be automatically generated while handled objects are ORM modelled

Which are the key points?

The project brings MBSE to the ECSS Management focused on the performed processes by the ECSS community and the information handled in those processes. Project is divided in two phases:

- Analysis and Specification
 - Formal Specification of the data, processes, behaviours
 - Definition of interfaces and user and system specifications
- Development and Deploy
 - Development of the system according to the specs using automatic code generation from the models and validating the system
 - Import existing data from ECSS repository into ERMS



MBSE used for automatic generation of code, workflows, hmis and specification



OSMoSE and Space System Ontology(SSO)





Conceptual Data Modeling

• Captures the semantics, i.e. the "WHAT"



- Integrates each stakeholder's semantics in a global conceptual model solution
- Supports the exchange between stakeholders by
 - sub-setting the global conceptual model with the needs of each stakeholder, i.e. producing local views
 - enabling exchanges of shared semantics by mapping the stakeholder-specific conceptual views





Conceptual Data Modelling

- Sources → ECSS-D-00B, ECSS Repository, ECSS Steering Board, OSMOSE Models, ECSS Master DB
- Methodology \rightarrow Fact-Based Modelling \rightarrow Object Role Modelling (ORM) Technique \rightarrow NORMA tool

| Represents | Benefits |
|--|--|
| Data Relationships Business Rules Semantic Checks Derivation Rules & some calculations | Automatic Textual verbalization of the model (in natural but formal text) Glossary management of the schema Population of the model Code generation (to logical and physical levels) Diagrams export |
| Working method Define the UoD to be modelled Extract Data Concepts from processes Look for examples in ECSS repository Model in ORM the involved information and cross-check with existing models (if any) Raise questions to ECSS SB Update Model, if needed. Review model with ESA and Cross-check OSMOSE WG Enhance model with metadata (via custom properties) for automatic doc/code generation | |



Conceptual Data Modelling

- Annotation
- Assessment
- Audience
- Change Request
- Change Request Disposition
- Document
- Document Structure
- ✓ ECSS Document States
- DFA
- DFR
- DIA
- DIR
- EARM
- Issue
- Meeting
- NWIP
- Questionnaire
- Work Plan (WP)
- Action
- Report
- Chapter
- Community
- Decision
- DRR



Resulting Models in 34 ORM files:

- ECSS Concepts \rightarrow 36 root concepts
 - Some concepts are merged (e.g., DRR, RID, CR)
- Generic shareable entity and value types cross-UoD
- Refactor the M-ST-40 Foundation Model of OSMoSE WG
 - All ECSS concepts are instances from Foundation model
 - Provide a Version Control Model for OSMoSE aligned with OMG SysML v2. submission
- Conceptual model of the HMI concept
- Conceptual model of a business process workflow





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Process Modelling

- **Goal** \rightarrow Formalization of processes performed for ECSS doc management
- ❑ Sources → ECSS-D-00B & Interviews with ECSS Steering Board
- □ Number of Processes \rightarrow 24 High Level Processes
- Methodology:
 - Analysis of the D-00 Document
 - Cross-check the process diagram (sub-chapter 2) against description (sub-chapter 3)
 - Raise inconsistencies, missing information, ambiguities
 - Model the understanding using BPMN
 - ✓ Identify conceptual data objects and relations → They will have to be modelled in ORM for the model integration
 - \checkmark Model the process with different granularity levels \rightarrow From black box approach to atomic 'tasks'
 - Identify 'repeatable' tasks between processes and define 'reusable' parametric tasks
 - Discuss the model with the ECSS SB
 - Update the model, if needed.
- □ Conceptualize the definition of processes \rightarrow ORM Model of the applicable BPMN Element Subset
- Results
 - 60 Raised CR
 - □ 77 BPMN Models for 24 processes
 - □ Model Sample Population of the Drafting Process in ORM compliant with associated BPMN models

Process Modelling

WGMemberListAp TaskTimeoutExce proved ption

FIUII.

7.5 TM processing, 8.1 Control of TFs, 9.1 Feedback-CR, 9.3 Feedback – Inq board/FF, 11.2.1 CCSDS NWI, 11.3.2 ISO project participation

RHEA

Orthogonal Model Consistency: Link points

Requirement Specification

