

OCORA

Open CCS On-board Reference Architecture

Program Requirements

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Management Summary

OCORA requirements are engineered in a top-down manner. The following levels are defined:

- **"Stakeholder Requirements" (A-Level requirements)**
- **"Program- & Design Requirements" (B-Level requirements)**
- **"System Requirements" (C-Level requirements)**
- **"Building Block Requirements" (D-Level requirements)**

This document intend to hold all **"Program Requirements" (B-Level requirements)**. It will be updated and enriched with return on experience.

OCORA requirements are engineered in Polarion with full traceability.

Revision History

Version	Change Description	Initials	Date of change
1.01	Official version for OCORA Delta Release	RM/TM	30.06.2021
2.0	Official version for OCORA Release R1	RM/TM	26.11.2021

Table of Contents

1	Introduction	6
1.1	Purpose of the document	6
1.2	Applicability of the document	6
1.3	Context of the document	6
1.4	Requirements Engineering Process	7
2	Requirements	8
2.1	Collaboration	8
2.2	Documentation	10
2.3	Planning	12
2.4	Methodology	14
2.5	Tooling	18

References

Reader's note: please be aware that the document ids in square brackets, e.g. [OCORA-BWS01-010], as per the list of referenced documents below, are used throughout this document to indicate the references to external documents. Wherever a reference to a TSI-CCS SUBSET is used, the SUBSET is referenced directly (e.g. SUBSET-026). OCORA always reference to the latest available official version of the SUBSET, unless indicated differently.

[\[OCORA-BWS01-010\] – Release Notes](#)

[\[OCORA-BWS01-020\] – Glossary](#)

[\[OCORA-BWS01-030\] – Question and Answers](#)

[\[OCORA-BWS01-040\] – Feedback Form](#)

[\[OCORA-BWS03-010\] - Introduction to OCORA](#)

[\[OCORA-BWS03-020\] - Guiding Principles](#)

[\[OCORA-BWS04-010\] - Problem Statements](#)

[\[OCORA-BWS08-010\] - Methodology](#)

[\[OCORA-BWS08-020\] - Tooling](#)

[\[OCORA-TWS05-010\] – Requirements – Management Guideline](#)

[\[OCORA-TWS05-020\] – Stakeholder Requirements](#)

[\[OCORA-TWS05-022\] – Design Requirements](#)

[\[OCORA-TWS09-010\] - Testing - Strategy](#)

1 Introduction

1.1 Purpose of the document

The purpose of this document is to provide a collection of all Program Requirements (B-Level requirements) in a structured manner. Please be aware of the Stakeholder Requirements (A-Level requirements) provided in [\[OCORA-TWS05-020\]](#). Also note that Design Requirements are not covered in this document as they are covered in a [\[OCORA-TWS05-022\]](#).

This document is addressed to experts in the CCS domain and to any other person, interested in the OCORA concepts for on-board CCS. The reader is invited to provide feedback to the OCORA collaboration and can, therefore, engage in shaping OCORA. Feedback to this document and to any other OCORA documentation can be given by using the feedback form [\[OCORA-BWS01-040\]](#).

If you are a railway undertaking, you may find useful information to compile tenders for OCORA compliant CCS building blocks, for tendering complete CCS system, or also for CCS replacements for functional upgrades or for life-cycle reasons.

If you are an organisation interested in developing CCS building blocks according to the OCORA standard, information provided in this document can be used as input for your development.

1.2 Applicability of the document

The document is currently considered informative but may become a standard at a later stage for OCORA compliant on-board CCS solutions. Subsequent releases of this document will be developed based on a modular and iterative approach, evolving within the progress of the OCORA collaboration.

1.3 Context of the document

This document is published as part of the OCORA Release R1, together with the documents listed in the release notes [\[OCORA-BWS01-010\]](#). Before reading this document, it is recommended to read the Release Notes [\[OCORA-BWS01-010\]](#). If you are interested in the context and the motivation that drives OCORA we recommend to read the Introduction to OCORA [\[OCORA-BWS03-010\]](#), and the Problem Statements [\[OCORA-BWS04-010\]](#). The reader should also be aware of the Glossary [\[OCORA-BWS01-020\]](#) and the Question and Answers [\[OCORA-BWS01-030\]](#).

1.4 Requirements Engineering Process

This OCORA requirement document is developed, using the Requirements Management Guideline [OCORA-TWS05-010]. The requirements are engineered in a top-down manner:

- As a starting point all **"Stakeholder Requirements"** towards the OCORA initiative (**A-Level requirements**) are captured and formalised.
- In a second step, the **"Program- and Design Requirements"** (**B-Level requirements**) are developed. These requirements define tools, processes, methodologies and design rules to be used within the program and to be considered during the system analysis and the system design/architecture work.
- As a next step, the A- and B-Level requirements are further developed in the MBSE analysis to become **"System Requirements"** (**C-Level requirements**).
- As part of the MBSE architecture work, building blocks are identified taking into account the MBSE analysis (C-Level requirements). All applicable requirements (A-Level, B-Level, and C-Level) are apportioned to the identified building blocks, resulting in **"Building Block Requirements"** (**D-Level requirements**), forming the OCORA tender templates, together with the applicable program & design requirements.

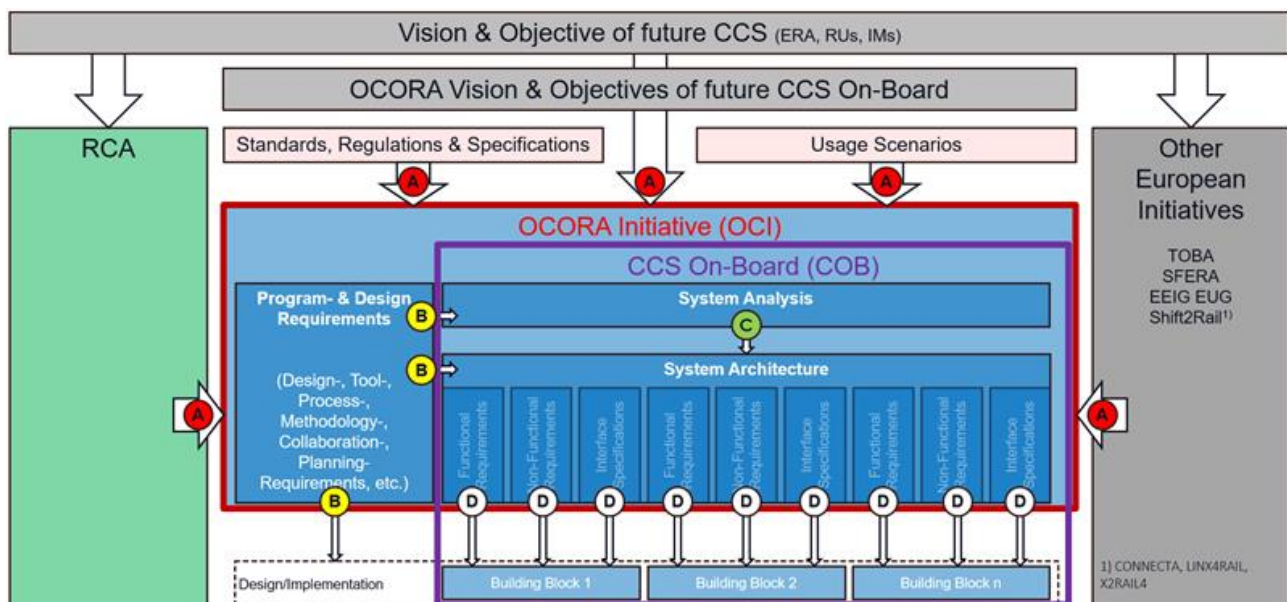


Figure 1 OCORA Requirements Engineering Process

Please note, that the A-Level requirements are applicable to the OCORA Initiative (OCI) while the B- and C-Level requirements are targeted towards the CCS On-Board System (COB) and its architecture. D-Level requirements are applicable to the respective building blocks.

2 Requirements

2.1 Collaboration

OCORA-473, B-Level - Organise collaboration among defined bodies

The OCORA collaboration is organised among the following bodies:

- The Steering Committee is defining the OCORA strategy and allocates funding.
- The Core Team is in charge of the operational management.
- The Workstream Teams are in charge of the development of topic specific content

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To organise the OCORA collaboration
Remark	
Verification Method	Process Review

OCORA-470, B-Level - Split the activities in topic specific workstreams

The OCORA collaboration splits its activities into topic specific workstreams.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To structure the OCORA collaboration.
Remark	
Verification Method	Process Review

OCORA-471, B-Level - Publish content in subsequent releases

The OCORA collaboration publishes its work in subsequent releases.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To provide fast access to OCORA content. • To gain maturity in OCORA content. • To involve the sector early.
Remark	
Verification Method	Process Review

OCORA-472, B-Level - Follow release process

Content is created and reviewed by the workstream team, lead by the workstream leader.

At the internal release date, the workstream leader hand in the content to the Core Team.

The Core Team checks release consistency among a set of documents and performs a final review on the release.

The Steering Committee endorses the release before publication.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To allocate responsibility in the release process
Remark	
Verification Method	Process Review

2.2 Documentation

OCORA-116, B-Level - English as publication language

All OCORA documentation is developed and published in English.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To allow easy access for all interested parties.
Remark	
Verification Method	Process Review

OCORA-580, B-Level - Maintain a documentation plan

All published OCORA documentation can be located in a documentation plan.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To allow easy access for all interested parties.
Remark	
Verification Method	Process Review

OCORA-117, B-Level - Document structure

All OCORA documentation follows a standardised structure.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To facilitate the reading and understanding of the OCORA documentation.
Remark	
Verification Method	Process Review

OCORA-175, B-Level - Glossary

Terms are clearly defined and described, abbreviations explained.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To facilitate the reading and understanding of the OCORA documentation.
Remark	
Verification Method	Process Review

OCORA-456, B-Level - Questions and Answers

Frequently asked Questions are collected and facilitated with Answers.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To facilitate the reading and understanding of the OCORA documentation.
Remark	
Verification Method	Process Review

2.3 Planning

OCORA-474, B-Level - Manage topic specific workstreams

The Core Team decides on starting and ending of topic specific workstreams.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To allocate responsibility in the planning process
Remark	
Verification Method	Process Review

OCORA-583, B-Level - Create and maintain workstream definitions

The workstream team, lead by the workstream leader, proposes a workstream definition for each period of active development.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To clearly define the activities and expected outcome of the next development period.
Remark	
Verification Method	Process Review

OCORA-582, B-Level - Release workstream definitions

The Core Team reviews and releases workstream definitions before the actual development work can start.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To ensure consistency across different workstreams • To ensure compliance with the overall OCORA program goals
Remark	
Verification Method	Process Review

OCORA-482, B-Level - Supervise progress

The Core Team supervises the workstream developments by regular progress review meetings where the workstream leaders reporting current activities, issues and progress and the basis of the workstream definitions.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To be able to fast react on issues from inside and changes required from outside • To be able to manage and steer, especially overarching topics requiring multiple workstreams
Remark	<ul style="list-style-type: none"> • Currently progress reporting is carried out on a bi-weekly basis • Separated among for business- and technical- workstreams
Verification Method	Process Review

2.4 Methodology

This chapter lists the requirements placed on the OCORA Methodology [\[OCORA-BWS08-010\]](#).

As a key collaboration principle, OCORA applies Best-Practice enriched with internal (based on knowledge of OCORA members) and external experience.

OCORA-477, B-Level - Apply OSI model for interface definitions

To clearly define interface specification OCORA applies the OSI model.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • With a modular architecture and required plug and play like exchangeability interface definition becomes a key success factor. • With the introduction of a CCN also the sharing of common layers (e.g. OSI 1. Physical, 2. Data Link, 3. Network, 4. Transport, 5 Session and 6 Presentation) among different subsets are introduces, while the layer 7. Application remains subset specific.
Remark	
Verification Method	Design Review

OCORA-478, B-Level - Use model based system engineering MBSE

To leverage system complexity in the CCS domain OCORA performs model based system engineering, MBSE.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To handle complexity • To enable harmonisation / unification • To ensure consistency • To serve apportionment • To serve with different views, levels and perspectives • To support interactions with other initiatives
Remark	
Verification Method	Process Review

OCORA-479, B-Level - Create deliverables compliant with CENELEC

OCORA creates deliverables compliant with CENELEC EN50126. In focus are the CENELEC Phases 1-5.

1. Concept
2. System Definition
3. Risk Analysis
4. System Requirements
5. Architecture & Apportionment

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> In order to reduce general effort repeatedly spent in specific projects
Remark	
Verification Method	Certification

OCORA-480, B-Level - Define interlinking between MBSE and CENELEC

OCORA defines the interlinking between MBSE and CENELEC

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To define a clear interaction between MBSE and CENELEC To benefit from MBSE regarding leverage of complexity To ensure CENELEC required traceability
Remark	
Verification Method	Design Review

OCORA-586, B-Level - Iteratively follow the defined interlinking between MBSE and CENELEC

OCORA ensures that then defined interlinking between MBSE and CENELEC is followed in an iterative approach.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To keep track of the development of the model as it is being made
Remark	
Verification Method	Design Review

OCORA-481, B-Level - Use Model Based Software Development (MBSD)


OCORA uses model base software development for prototyping and demonstration purposes.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To develop in a model based approach.
Remark	
Verification Method	Process Review

OCORA-1201, B-Level - Define an OCORA Approval process


Modular Safety defines a standardized process for the homologation of equipment's dealing with OCORA requirements. The following elements are addressed (not exhaustive):

- Respect the current NoBo/DeBo/AsBo activities,
- Reassign the roles, tasks and responsibilities of the new "integrators",
- Define assessment bodies' activities related to the compliance to OCORA specifications,
- Reinforced the cross-acceptance criteria to ease the reuse of building blocks in several integrated CCS on-board systems (i.e. based on EN 50506),
- Presents the additional costs and savings related to this new process deployment.

Status	 Draft
Req. Class	Requirement
Rationale	<p>This process aims at rationalizing the costs and efforts and increasing the deployment speed from the future first homologation of OCORA compliant systems through its lifetime (e.g. vehicle retrofit to integrate a new "OCORA" compliant CCS on-board system).</p> <p>This process will be usable for:</p> <ul style="list-style-type: none"> • Manufacturers, • Integrators (i.e. at CCS on-board and vehicle levels), • Railway Undertakings <p>Once a new Vehicle Authorization (i.e. Directive 2018/545) has been provided, future evolutions are handled through the "Evolution management process"</p>
Remark	
Verification Method	Process Review

OCORA-1194, B-Level - Define an OCORA SRAC management process

Modular Safety defines a standardized process for SRAC management to define an efficient dialogue and exchanges between SRAC emitter(s) up to final SRAC implementer(s)


Status	 Draft
Req. Class	Requirement
Rationale	<p>This process comes from a return of experience of the RU (i.e. OCORA members) to improve the SRAC management from today's situation.</p> <p>This process aims at limiting the misunderstandings when covering SRAC that can drive to critical safety failure by reinforcing the communication throughout the SRAC lifecycle.</p> <p>This overall process is tagged "nice to have" because depending of the maturity of RU's/Manufacturers' SRAC process already in place, it may not be relevant to be deployed.</p>
Remark	
Verification Method	Process Review

2.5 Tooling

This chapter lists the requirements placed on OCORA Tooling [\[OCORA-BWS08-020\]](#) .

OCORA-464, B-Level - Use Microsoft Office for general purpose

Use Microsoft Word, Excel, PowerPoint and Project for General Purpose

Status	 Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • Already existing at the OCORA members • Avoid multiple template management
Remark	
Verification Method	Process Review

OCORA-465, B-Level - Use Microsoft Teams for exchange.

Use Microsoft Teams for regular, virtual Exchange

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • Already existing at the OCORA members
Remark	
Verification Method	Process Review

OCORA-466, B-Level - Use GitHub as workspace and internal repository

Use GitHub as project workspace and internal data repository, separated from the external GitHub repository.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • Ensure traceable program management • Ensure traceable document sharing • Ensure traceable prototype development
Remark	https://github.com/openETCS/OCORA
Verification Method	Process Review

OCORA-460, B-Level - Use GitHub as external repository

Use GitHub as external data repository, separated from the internal github repository.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • Compliance with EUPL
Remark	https://github.com/OCORA-Public
Verification Method	Process Review

OCORA-461, B-Level - Use Polarion for requirements management

Use Polarion for requirement engineering and management

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • Usage of best practice tool for CENELEC compliant developments • To ensure traceability in general • To facilitate reviews/publication
Remark	
Verification Method	Process Review

OCORA-463, B-Level - Use SCADE for MBSD

Use SCADE for Model-based Software Development

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • Usage of best practice tool for safety critical developments
Remark	Might be applied for OCORA internal prototyping work.
Verification Method	Process Review

OCORA-467, B-Level - Use Capella plug-in to export modelling artefacts

Use Capella plug-in to export modelling artefacts from Capella to Polarion

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> Complexity can best be handled in a visual modelling tool, while requirements management (incl. traceability), requirement reviewing and clause-by-clause tendering is best practice in a requirements management tool To minimise effort and avoid double work, modelling artefacts can be exported into requirements tool.
Remark	
Verification Method	Process Review

OCORA-462, B-Level - Use Capella for MBSE

Use Capella for Model-based Systems Engineering

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To unify modelling approach. To allow end-to-end modelling with RCA To allow end-to-end modelling with LynX4rail
Remark	
Verification Method	Process Review

RCA and OCORA are both developing their reference architectures based on the Arcadia methodology and are both using the Capella tool for modelling.

OCORA-522, B-Level - One Common Capella Model

The RCA and OCORA Capella models are part of the same overall CCS Capella model.

Status	✓ Approved
Req. Class	Optional Requirement
Rationale	<ul style="list-style-type: none"> • Eliminate efforts for integrating the RCA and OCORA Capella models. • Guarantee consistency between the RCA and OCORA Capella models at all times.
Remark	
Verification Method	Process Review

OCORA-584, B-Level - The OCORA Capella model represents CCS on-board only

The OCORA Capella model describes the on-board part of the overall CCS system.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> • To have a clear separation con concerns between RCA and OCORA
Remark	
Verification Method	Process Review

OCORA-585, B-Level - Maintain interface compatibility between OCORA and RCA Capella models

All interfaces between OCORA and RCA have a one-to-one correspondence.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> To guarantee compatibility
Remark	
Verification Method	Process Review

OCORA-523, B-Level - Capella Model consistency

The OCORA and RCA Capella models remain mutually consistent (e.g. as a library) throughout development.

Status	✓ Approved
Req. Class	Requirement
Rationale	<ul style="list-style-type: none"> Guarantee consistency between the RCA and OCORA Capella models in periodic Intervalls.
Remark	
Verification Method	Process Review