# OCORA

**Open CCS On-board Reference Architecture**

## Alliances



Document ID: OCORA-BWS07-010

Version: 4.11

Date: 01.12.2022

# Revision history

| Version | Change Description | Initial | Date of change |
|---|---|---|---|
| 0.01 | First draft | JBS | 26.10.2020 |
| 0.02 | ▪ Final draft adapted in final review | JBS | 27.11.2020 |
| 1.00 | Official version for OCORA Gamma Release | RM | 04.12.2020 |
| 1.10 | ▪ Preparation for Delta Release | RM | 27.05.2021 |
| 1.90 | ▪ Minimal adjustments, version ready for review | JBS | 17.06.2021 |
| 2.00 | Official version for OCORA Delta Release | RM | 25.06.2021 |
| 2.01 | ▪ Preparation for release 1 | JBS | 08.11.2021 |
| 2.02 | ▪ Comments from DBS | DBS | 25.11.2021 |
| 3.00 | Official version for OCORA Release R1 | JBS | 03.12.2021 |
| 4.00 | Decoupled document from a specific OCORA release | RM | 15.06.2022 |
| 4.10 | Update alliance relation with X2-Rail-4, EUG LWG, LinX4Rail, EU-Rail System- & Innovation-Pillar | RM | 09.11.2022 |
| 4.11 | Update after coreteam review | RM | 01.12.2022 |

# Table of contents



# Table of figures



# Table of tables

# References

Reader's note: please be aware that the numbers in square brackets, e.g. [1], as per the list of referenced documents below, is 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.


[1] OCORA-BWS01-010 – Release Notes

[2] OCORA-BWS01-020 – Glossary

[3] OCORA-BWS01-030 – Question and Answers

[4] OCORA-BWS01-040 – Feedback Form

[5] OCORA-BWS03-010 – Introduction to OCORA

[6] OCORA-BWS04-010 – Problem Statements

[7] OCORA-TWS01-030 – System Architecture

# 1 Introduction

## 1.1 Purpose of the document

This document focuses on OCORA organisational and technical interfaces with other sector organisations and initiatives.

OCORA liaisons and alliances with other sector organisations are necessary to find common understanding and complementarity at expert, corporate and institutional level. OCORA will indeed become an effective open architecture reference it the collaboration support alignment between sector initatives.

This document aims to provide the reader:

- An overview of OCORA collaboration with other entities (e.g. sector projects or associations).
- Details on why those collaborations contribute to OCORA value creation, what are the collaboration elements and how they allow to find common understanding and complementarity on a sector scale.
- Perspectives on how the OCORA collaborative approach is intended to be scaled.

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 [4].

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

If you are an organization interested in developing on-board 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. Subsequent releases of this document will be developed, evolving within the progress of the OCORA collaboration.

## 1.3 Context of the document

This document is published as part of the OCORA Release, together with the documents listed in the Release Notes [1]. Before reading this document, it is recommended to read the Release Notes [1]. If you are interested in the context and the motivation that drives OCORA we recommend to read the Introduction to OCORA [5], and the Problem Statements [6]. The reader should also be aware of the Glossary [2] and the Question and Answers [3].

# 2 Overview of OCORA collaborations with other groups

OCORA covers only the onboard part of the overall control-command and signalling infrastructure needed for a safe and automatic railway operation (Automatic Train Protection, ATP and Automatic Train Operation, ATO). A good integration in the overall CCS environment is therefore essential and requests a good collaboration and liaison with related activities, in particular with the following:

- RCA (Reference CCS Architecture), EUG (ERMTS Users Group) and EULYNX
- Localization: EUG working group "Localization"
- FRMCS: UIC working group “Telecom On-Board Architecture”
- ERA: Topical Working Group train architecture through Community of European Railway, CER CCS SG
- S2R (Shift2Rail): X2-Rail-4, LinX4Rail
- EU-Rail: System-Pillar and Innovation-Pillar

Prior to OCORA Release R1, alignment was done with RCA, FRMCS, and EUG. As a result, it can be said that a common view is shared, and the identified Problem Statements are aligned. Collaborative meetings and joint alignment groups are in progress to reach a pragmatic and efficient cooperation as it has started and continued in Shift2Rail through the LinX4Rail and X2-Rail-4 and as it has started to continue in the EU Rail: System-Pillar and Innovation-Pillar.

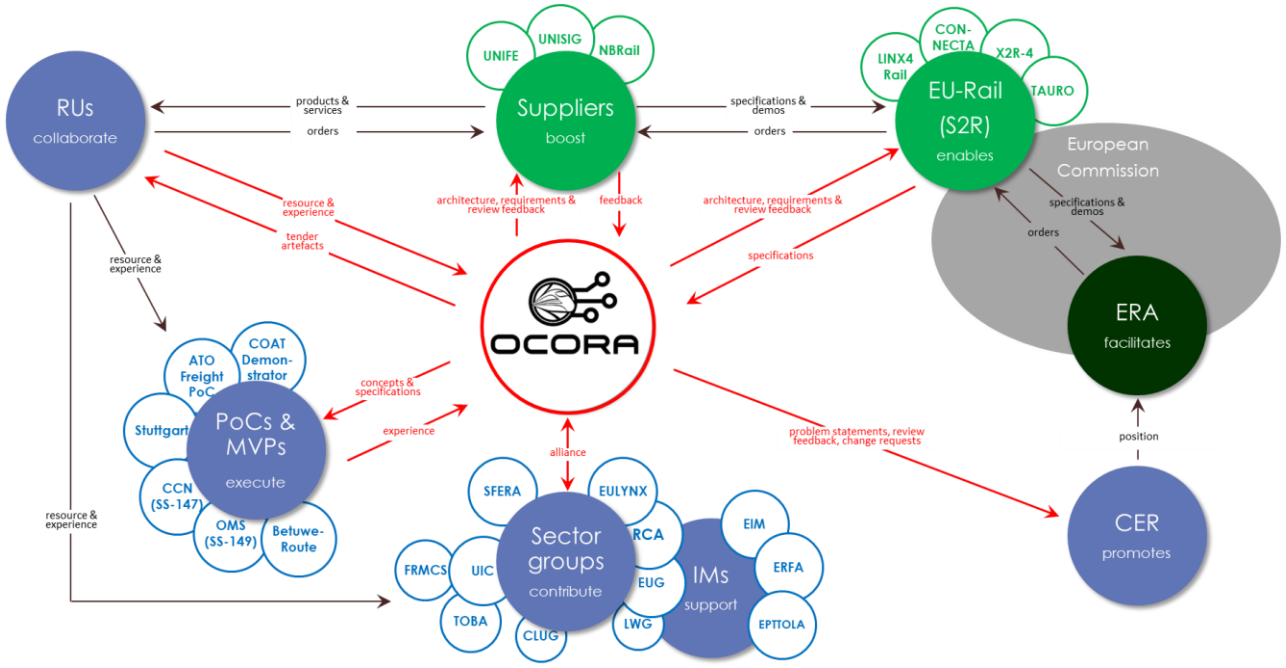


**Figure 1** high level OCORA stakeholder environment

OCORA partners target complementarity between sector activities. OCORA can gain support and provide support through collaboration with other sector groups:

- Sector groups driven by operators can contribute to the definition of OCORA external interfaces, in particular for components of mutual interest
- CER as representative body is a forum to position OCORA deliverables into the regulatory environment
- ERA will support the market uptake of OCORA compliant solutions with optimised acceptance based on optimized rules
- EU Rail is the place for industry dialogue and partnering activities (e.g. model, PoC, demonstrator, prototype, MVP…) and harmonization of the architectural approaches
- Proactive contributions from suppliers will boost OOCRA results. Manufacturers experience is essential for achieving informed architectural decisions.

# 3 Description of OCORA collaborations with other groups

## 3.1 Regulatory and institutional domain interest groups

### 3.1.1 Community of European Railways (CER)

OCORA input for future TSI revisions are channelled through CER. OCORA Coreteam members act on behalf of CER as speakers in CER working groups and groups where user input is infused through CER, such as the ERA Topical Working Groups. CER is of paramount importance to OCORA to provide a voice for the OCORA collaboration in the European theatre and to inform and involve colleague railways in the progress and activities of OCORA. OCORA intends to support and reinforce wherever necessary the role of CER as the voice of European railways and will continue to provide resources to enable CER to act in an effective way in the European arena.

### 3.1.2 ERMTS Users Group (EUG)

EUG is the technical body gathering ERTMS users and leading specialised expert working group on TSI specification. OCORA input for the TSI revision 2022 is coordinated with EUG in order not to duplicate activities (e.g. localisation) while keeping consistency on a CCS system scale (e.g. enable alignment with RCA). EUG RU platform is an opportunity to inform and involve colleague railways in the progress and activities of OCORA.

OCORA is liaising with EUG-EULYNX collaboration for RCA in order to achieve convergent and synergetic approaches to system architecture, functional modelling and technologies for CCS. Liaison organised with RCA initiative aims to:

- Maintain the system coherence between the on-board and trackside subsystems
- Exchange strategic, communication and planning
- Develop identified joint topics

EUG Localization working group (LWG) is a group of experts. The mission of LWG is to settle common railways requirements on the expected behaviour of a localisation system in an ERTMS, RCA and OCORA environment to tackle current criticalities and possible future needs and to explore innovative solutions to fulfil such requirements in a cost effective way. Interoperability issues will be talked with priority because candidate to be part of the TSI CCS. Architectural issues will be anyway in the scope of the working group.

Midterm OCORA expects that the EUG LWG activities will be transferred into EU-Rail, allowing a harmonized project management plan.

### 3.1.3 Union internationale des chemins de fer (UIC)

UIC is a technical body for the railway operating community. In the CCS domain, their contribution to design future radio communication systems is essential for ERTMS enhancement. OCORA is interfaced with the activities of the group of experts involved in the definition of telecom onboard architecture. No formal liaison is today defined for synchronising the groups but the coordination is managed on an expert level, thus enabling consistence, synergies and complementarity between the two initiatives.

### 3.1.4 European Rail ISAC (ER-ISAC)

OCORA is also collaborating on the topic cyber security with ER-ISAC. The ER-ISAC is a non-profit organization, hosted/sponsored by UIC, that provides a central resource for gathering information on cyber threats as well as allowing a two-way sharing of information between the private and the public sector about root causes, incidents and threats, as well as sharing experience, knowledge and analysis. The liaison between OCORA and ER-ISAC is to share information, analyse new threat and find common awareness and contributions on cybersecurity domain.

## 3.2 Industry interest groups

Various industry actor can bring valuable experience benefitting to OCORA. Rolling stock as well as CCS OBU manufacturers but also NoBos and Independent labs can bring valuable contributions on OCORA definition and demonstration.

OCORA is the opportunity to define a pragmatic path for new and promising market. With its open architecture and iterative releases, OCORA offers the possibility for a constructive dialogue with the industry on the concrete solutions, that are needed to meet OCORA objectives and create wealth for the industry.

### 3.2.1 Union Industry of Signalling (UNISIG)

As holder of ERTMS specification subset, UNISIG collaboration is an asset to progress fast on a sectoral move on the CCS OBU architecture. UNISIG organisation (membership, working groups) and access to knowledge (return of experience on solutions, market forecast) would facilitate OCORA development. Feedbacks and contributions from UNISIG are therefore of key interest for OCORA.

The OCORA releases provide a description on how a CCS OBU architecture should be. Steps are taken for building a common vision with UNISIG on how OCORA will help building relevant material tender templates for procuring CCS onboard configurations and implementing them in existing or new build trains.

### 3.2.2 Union des Industries Ferroviaires Européenne (UNIFE)

As the representative body for European supply industry, UNIFE is the association that can facilitate consensus building within EU industry, help disseminating and promote OCORA results as well as support through constructive input. Technology provider, rolling stock suppliers, CCS component manufacturers, many UNIFE members would have benefit to follow and contribute to OCORA.

OCORA proposes design objectives and requirements and exploratory elements on how new industrial solutions for a digital CCS fitted in existing and future trains. While OCORA will continue to acknowledge UNIFE position, close collaborations with the industry will be set up (e.g. System-Pillar) to get input for and dialogue for an optimised economic model and collect proposals to refine the architecture definition and intermediate solutions supporting migration.

## 3.3 Sector development organizations

The Europe's Rail Joint Undertaking is seen by OCORA as a key opportunity to scale and boost this industry dialogue, as part of the System-Pillar, as well as develop collaboration and co-finance the demonstration of solutions as part of the Innovation-Pillar.

### 3.3.1 S2R – X2Rail-4 - Architecture

The activities started in Shift2Rail for defining an architecture for the railway system is fed by OCORA. First development allowed to have an architecture release consistent with OCORA design principles and complementary to OCORA descriptions. Close collaboration is to continue over the long run, in order to ensure that fleet owner needs and requirements are well captured and fairly understood by the European supply industry.

Midterm OCORA expects that the X2Rail-4 activities will be transferred into EU-Rail, allowing a harmonized project management plan.

### 3.3.2 S2R – LinX4Rail – convergence and complementarity between projects

Through Shift2Rail LinX4Rail project, an acknowledgement mechanism is defined to be able to capture the outcome of sector initiative for enhancing and reshaping ongoing Shift2Rail project. In this frame, discussions have started between OCORA and IP1-Connecta project in order to align perspectives and technical solutions for the long term convergence between CCS and TCMS bus technologies. This collaboration allows to find better synergies between the initiatives and converging approaches for standardisation and also future TSI revision.

Midterm OCORA expects that the LinX4Rail activities will be transferred into EU-Rail, allowing a harmonized project management plan.

### 3.3.3 Europe's Rail Joint Undertaking (EU-Rail)

While S2R has already facilitated first sector discussions on OCORA proposal (e.g. through LinX4Rail project) and start to provide support to OCORA, the Europe's Rail Joint Undertaking (EU-Rail) is the opportunity to intensify and accelerate industry resolutions of OCORA problem statement [6] and proposals.

The System-Pillar is foreseen as a process that will allow sector alignment for the market uptake and migration towards new modular CCS onboard solutions. To meet this purpose, it will help OCORA to define, demonstrate and disseminate specification and engineering tools and methodology that will facilitate deployment and industrialisation. An important enabler for the adoption of those specifications, methods and tools will be to find common understanding on new business cases involving modularity. A value added would be to accelerate standardisation and improve regulations.

The Innovation-Pillar is foreseen as a R&I delivery mechanism allowing to develop technical enablers and demonstrators up to TRL9. The innovation pillar will be a workbench for preparing OCORA demonstrators but also to increase technical and deployment readiness of OCORA.

In 2021 and 2022, OCORA members have been actively collaborating with the candidate founding members of EU-RAIL in order to ensure that the EU-RAIL Master Plan and the Multi-Annual Work Programs (MAWP) of the EU-RAIL Innovation Pillar Flagship Areas will address OCORA challenges. OCORA technical proposals are now acknowledged and should be used as reference for future activities in the EU-RAIL.

# 4 State of play OCORA liaisons

| Sector interest group | Collaboration area | Liaison in place |
|---|---|---|
| CCS SG (CER) | Preparing TSI 2022 revision<br>Setting sector governance for CCS architecture | OCORA experts sharing achievements for endorsement |
| TWG Train Modular Architecture (ERA) | Sounding TSI-CCS 2022 On-board preparation | OCORA experts present as CER speakers |
| RCA (EUG+EULYNX) | Functional decomposition<br>Performance requirements (including interoperability)<br>Computing platform<br>Modular safety | Setting up of a coordination group<br>Joint working groups have started |
| FRMCS (UIC) | On-board telecommunication architecture<br>Safe Communication capabilities<br>Migration from GSM-R | Coordination done through experts involved in both initiatives. |
| Localisation WG (EUG) | Mission requirement for onboard localisation<br>Interface for localisation peripherals | Coordination done through experts involved in both initiatives. |
| LinX4Rail (Shift2Rail) | TCMS interface<br>Common sector business objectives<br>Rail system architecture definition and governance | Alignment and collaboration ongoing |
| X2Rail-4 (Shift2Rail) | ATO Architecture | Alignment and collaboration ongoing |
| Europe's Rail Joint Undertaking (EU-Rail) | Coordinate acknowledgement and review | System-Pillar: Pool of experts nominated<br>Innovation-Pillar: Projects proposals present |

**Table 1** State of play OCORA liaisons