











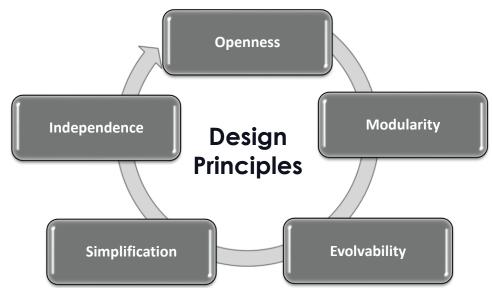
Program Slide Deck

# OCORA Release R6 - OnePager



OCORA, the "Open CCS On-board Reference Architecture" initiative, whose signatory founding Members are NS, SNCF, DB, SBB and ÖBB, has reached a next important milestone with the **Release R6** of the specifications of the OCORA architecture.

OCORA aims to reduce life-cycle costs and facilitate the introduction of innovation and digital technologies beyond the current proprietary interfaces, by establishing a modular, upgradeable, reliable and secure CCS on-board architecture.





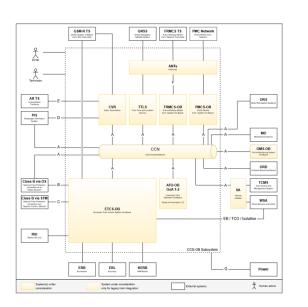






# **Founding Members**

The OCORA Release R6 includes sector feedback, especially from the exchange with EU-Rail's System Pillar. It defines the OCORA position for the System & Innovation Pillar and provides a glimpse into harmonized technical CCS onboard requirements that serve as input for OCORA's **EuroSpec initiative**. Finally, the results of the first PoC on the new Train-Display System Concept round up the Release.





OCORA deliverables are published under the European Union Public **License** (EUPL) and are consequently available for all stakeholders.



# Program Slide Deck











### Content

- Problem Statements
- Key Principles
- OCORA History
- Roadmap
- Migration
- Strategic Initiatives
- Alliances
- Release Overview
- Methodology & Tooling
- Economic Model
- Sector Dialogue
- EuroSpec Working Group: Control-Command and Signalling



# Problem Statements - Current ETCS On-board solutions...











- 1. are built on incomplete, not fully standardized, and sometimes ambiguous specifications;
- 2. do not have a reasonable total cost of ownership;
- 3. are difficult to be integrated into existing vehicles;
- 4. are costly and time consuming to adapt/change/update/upgrade:
  - In case of patching and error corrections in non-SIL and SIL areas (e.g. cyber- security patching);
  - In case of baseline upgrades (e.g. ETCS baseline 2 to 3);
  - In case of functional enhancements (e.g. adding ATO);
  - > In case of adaptation to new technologies (e.g. upgrade to FRMCS);
- 5. do not respect different life-cycles profiles of the different vehicle-based constituents (e.g. vehicle vs. ETCS vs. connectivity);
- 6. are difficult to maintain (e.g. monitoring, diagnosis, configuration, and maintenance possibilities very limited no remote functionality);
- are lacking built-in cyber security;
- 8. are performing below expected quality levels.

#### In addition:

- The benefit of ETCS On-board only pays off, if the ERTMS rollout progresses in Europe on large scale.
- The ETCS On-board functions as such also need some improvements (e.g. braking curve, odometry accuracy, etc.) to serve current operational needs.
- Difficult, expensive and time consuming ETCS On-board fitments in general, are delaying national deployment plans, impacting trackside investments, and postponing ERTMS rollouts.



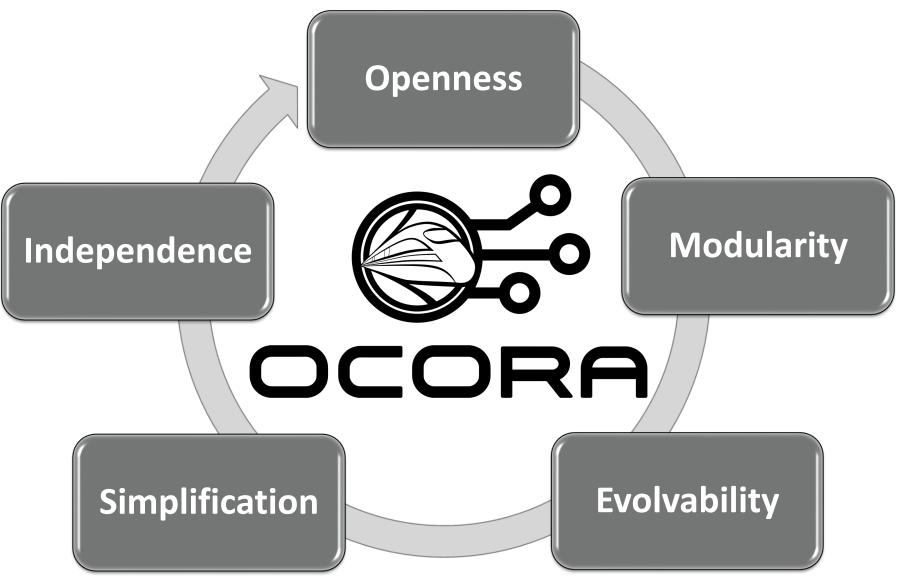














# OCORA - History











#### OCORA IS...

... open cooperation

... a set of public specifications

.. for the On-Board CCS

#### OCORA IS NOT...

... a representative Body/Organisation

... a product

... for trackside CCS

March 2019

- •Memorandum of Understanding 5 founding members (NS, SNCF, SBB, ÖBB, DB)
- •OCORA is a collaborative platform gathering engineering resources working on ERTMS and beyond

October 2019

- •OCORA Governance in place, with an active Steering Committee
- •Open to railway companies willing to contribute to the collaboration

07/2021

- •OCORA Releases Alpha, Beta, Gamma and Delta, first publications
- •From the Who, the How and the Why, over first sector dialogue till TSI-2022 inputs

December 2021

- •OCORA Release R1, updated CCS on-board description, including Sector / Industry feedback
- Prepares for Europe's Rail Joint Undertakings and TSI-2023 input.

December 2022

- •OCORA Release R2, & R3 updated CCS on-board description, including industry feedback from System-Pillar Ramp Up
- •Serves as input for EU-Rail System- & Innovation-Pillar.
- •Add operational input for EU-Rail and provided the concept on Configuration Management

2023

- •OCORA Release R4, & R5 updated CCS on-board description
- •defining the OCORA position for System- & Innovation-Pillar and the next steps towards harmonized tender artefacts
- First Results from SS-149 Proof of Concept

March

•Renewal of Memorandum of Understanding - 5 founding members (NS, SNCF, SBB, ÖBB, DB)

- •OCORA Release R6 updated CCS on-board description based on sector feedback
- •defining the OCORA position for System- & Innovation-Pillar, a first draft of harmonized tender artefacts and
- the results of the first PoC on the Train-Display System Concept



# Road Map

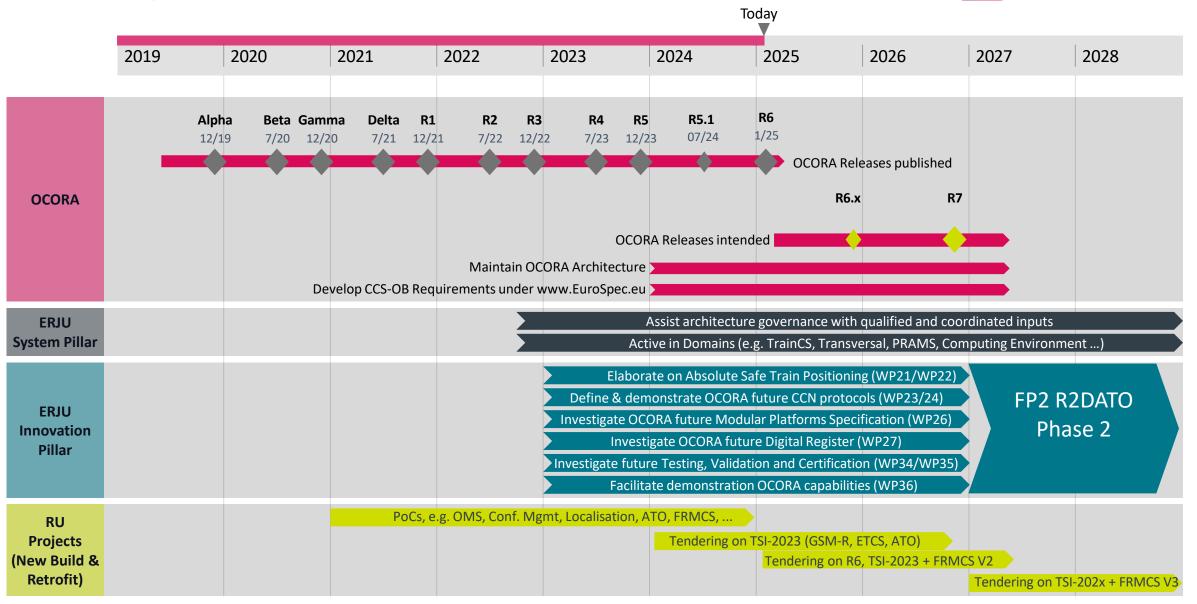














# Migration

# (3)









# Stepwise Approach

#### 1. Legacy situation

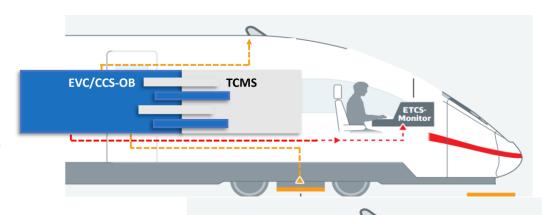
- Monolithic CCS (Command, Control & Signalling).
- EVC/CCS-OB tightly integrated with TCMS.
- CCS-OB replacements requires understanding of individual, manufacturer specific TCMS.

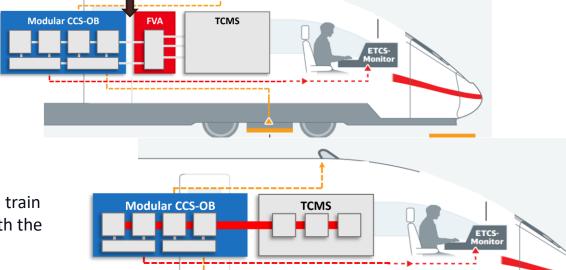
#### 2. TSI 2023 + OCORA Functional Vehicle Adapter

- Modular, upgradeable CCS-OB architecture.
- CCS-OB communicates with TCMS via standardized interfaces (SS-119, SS-139, SS-147). Non-compliant TCMSs are adapted to the standardized interfaces through a Functional Vehicle Adapter (FVA).
- CCS-OB upgrades/replacements do not require a detailed understanding of the TCMS systems anymore.

#### 3. OCORA Long Term perspective

- Comprehensive next-gen Communication Network for connecting all train control and safety systems (TCMS and CCS). TCMSs are compliant with the standardized interfaces. The need for an FVA vanishes.
- Separation of HW and SW via Computing Platform.





Standardized Interfaces (SS-119, SS-139, SS-147)













OCORA proposes to focus on two strategic initiatives – influencing from the design to implementation:

Ensure onboard modularity in accordance with our needs & design principles



Harmonize technical requirements for procurement













### **Ensure OCORA modularity**

- Achieve CCS on-board module interchangeability via EU-Rail (incl. modular safety concept)
- Drive supporting activities e.g. for migration, certification, demonstrator projects
- Contribute to Cost Benefit Analysis to justify modular choices
- Push enablers for onboard deployments e.g. one common bus & vehicle adapter

### **Deliver harmonized CCS onboard procurement requirements**

- Initial focus new train procurements, then retrofit/upgrades
- Structured according to OCORA building blocks
- Including PRAMSS requirements





# Alliances











# Ongoing OCORA liaisons

Sector interest group	Collaboration area	Liaison in place
CCS SG (CER)	Preparing TSI revisions Setting sector governance for CCS architecture	OCORA experts sharing achievements for endorsement
FRMCS (UIC)	On-board telecommunication architecture Safe and secure communication capabilities Migration from GSM-R	Coordination done through experts involved in both initiatives.
Localisation WG (EUG)	Mission requirement for onboard localisation Interface for localisation peripherals	Coordination done through experts involved in both initiatives.
Europe's Rail Joint Undertaking (EU-Rail)	Active contributions, coordinate acknowledgement and review	System Pillar: Pool of experts Innovation Pillar: Proposals and Projects

OCORA assumes that a frequent, well-structured and open, unbiased exchange of views and ideas with its suppliers is fundamental to initiate customer oriented product and service development. Formalised liaisons with suppliers and industry interest groups (e.g. UNIFE/UNISIG) are therefore a sensible objective for OCORA collaboration.



# Release Overview









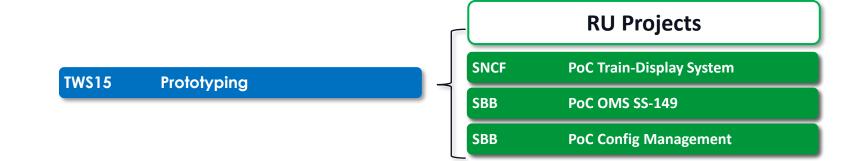


OCORA Business and Technical Workstreams, Work Packages and RU Projects

# **Business Workstreams BWS01 Core Team BWS03-4 Introduction and Problem Statements BWS06 Business Objectivs, Economic Model**



**Architecture Work Packages CCS-OB Architecture WP00 WP05 VETS-OB Architecture** 





# **Release Overview**



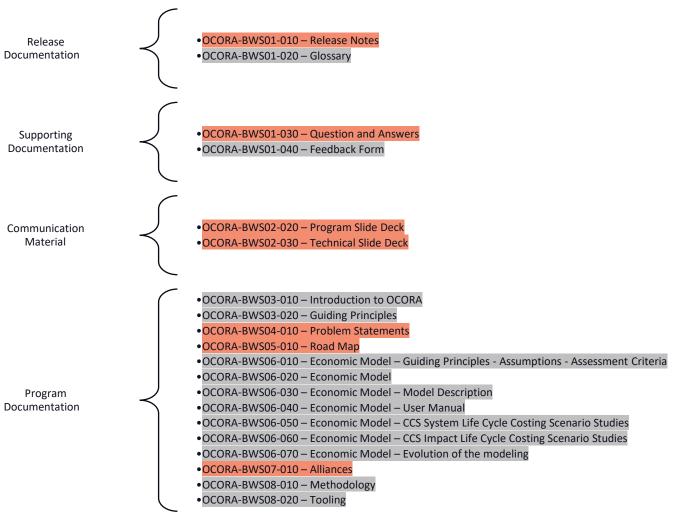








# Program Content



#### **Release Highlights Program Documents are:**

- Updated Communication Material
- Updated Road Map
- Updated Alliances document

#### **Color Legend:**

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New document or document with significantly new/additional content.

#### Doc. Title

Updated document with major enhancements

#### Doc. Title

Unchanged content only with minor improvements



### **Release Overview**

#### **Technical Content**

Technical Documentation

- •OCORA-TWS01-010 Design Requirements
- OCORA-TWS01-020 Operational & System Analysis
- •OCORA-TWS01-025 Modularisation Roadmap Proposal
- •OCORA-TWS01-030 System Architecture
- OCORA-TWS01-035 CCS On-Board (CCS-OB) Architecture
- OCORA-TWS01-040 Capella Modelling
- •OCORA-TWS01-041 MBSE Modelling Guidelines
- •OCORA-TWS01-050 Capella Model Export
- •OCORA-TWS01-100 Localisation On-Board (LOC-OB) Introduction
- •OCORA-TWS01-101 Localisation On-Board (LOC-OB) Requirements (incl. EUG 22E126 LOC-OB System Definition & Operational Context and EUG 22E135 LOC-OB Risk Analysis
- •OCORA-TWS01-112 Automated Train Protection On-Board (ATP-OB) MLM Interface Analysis
- OCORA-TWS01-201 Train Display System Concept
- OCORA-TWS01-202 Train Display System Specificatio
- OCORA-TWS01-210 Train Display System SS-121 Modelling Report
- OCORA-TWS01-220 Train Display System PoC Concept
- OCORA-TWS01-221 Train Display System PoC Result
- OCORA-TWS01-222:4 Train Display System PoC Use Cases 1:3
- •OCORA-TWS01-250 Synchronisation Concept Train Operation Data
- •OCORA-TWS01-301 Virtual ETCS Transponder Service Discussion Paper
- •OCORA-TWS02-010 CCS Communication Network Evaluation
- OCORA-TWS02-020 CCS Communication Network Proof of Concept (PoC)
- OCORA-TWS02-030 Addendum to SUBSET-147 (CCN) CCS Consist Network
- •OCORA-TWS02-031 Addendum to SUBSET-147 (TTLS) Train Time and Location Service
- •OCORA-TWS03-010 SCP Whitepaper Computing Platform for Railway Applications
- OCORA-TWS03-020 SCP High-Level Requirements
- OCORA-TWS03-030 SCP Specification of the PI API between Application and Platform
- OCORA-TWS04-010 Functional Vehicle Adapter Introduction
- OCORA-TWS04-011 Functional Vehicle Adapter Requirements
- OCORA-TWS04-012 TCMS Standard Communication Interface Specification
- OCORA-TWS04-015 OCORA Addendum to SUBSET-119
- OCORA-TWS04-016 OCORA Addendum to SUBSET-139
- OCORA-TWS04-020 Generic Vehicle Adapter Requirement Specification
- OCORA-TWS04-021 Generic Vehicle Adapter Mapping Table Templat
- OCORA-TWS05-010 Requirements Management Guideline
- OCORA-TWS05-020 Stakeholder Requirements
- OCORA-TWS05-021 Program Requirements
- OCORA-TWS05-030 CCS-OB Procurement Technical Requirement
- OCORA-TWS07-010 RAMS Modular Safety Strategy
- OCORA-TWS07-020 RAMS Evolution Management
- •OCORA-TWS07-030 RAMS SRAC/AC Management
- •OCORA-TWS07-040 RAMS Optimised Approval Process
- OCONA-1 W307-040 NAIWIS Optimised Approval Fro
- OCORA-TWS07-050 RAMS RAM Strategy
- OCORA-TWS07-060 Configuration Management Concept
- OCORA-TWS07-100 CENELEC Phase 1 Concept
- •OCORA-TWS07-202 QRAMSS Plan
- OCORA-TWS07-203 RAMSS Policy
- •OCORA-TWS08-010 MDCM-OB Introduction
- OCORA-TWS08-030 MDCM-OB SRS
- •OCORA-TWS15-040 CCS-OB Retrofit Guideline for Projects
- •OCORA-TWS15-050 PoC OMS SS-149 Concept
- OCORA-TWS15-051 PoC OMS SS-149 Results
- OCORA-TWS15-060 PoC Configuration Management Concept
- OCORA-TWS15-061 PoC Configuration Management Results



- Results of PoC Train Display System
- Updated Addendums for SS-147, incl. Time Synchronization

**⇔** SBB CFF FFS

- Updated Addendums for SS-119 and SS-139. based on TSI-2023 incl. recommendations for a product approach
- First draft of harmonized technical CCS on-board requirements that serve as input for EuroSpec work
- Final results of PoC OMS SS-149
- Final results of PoC Configuration Management

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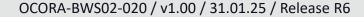
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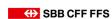




# Methodology & Tooling











### Methodology:

- OCORA is developing based on topical workstreams
- OCORA is releasing upon the needs of its members
- OCORA makes a use of Best Practice
- OCORA uses the OSI model for interface specifications
- OCORA is using Model Based System Engineering based on Arcadia methodology
- OCORA deliverables are in compliance with the CENELEC phases
- OCORA deliverables are following the V cycle

### Tooling:

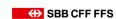
- OCORA uses MsTeams for telcos
- OCORA uses a public repository for publications: <a href="https://github.com/OCORA-Public">https://github.com/OCORA-Public</a>
- OCORA uses an internal repository for work in progress
- OCORA uses Polarion for requirements engineering and management
- OCORA uses Capella for Model Based System Engineering



# **Economic Model**



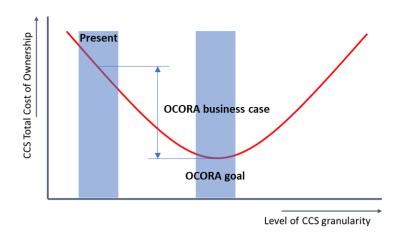


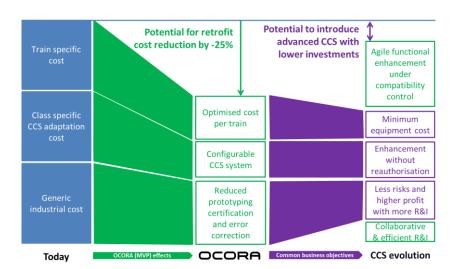






An economic model to discuss the optimal level of granularity

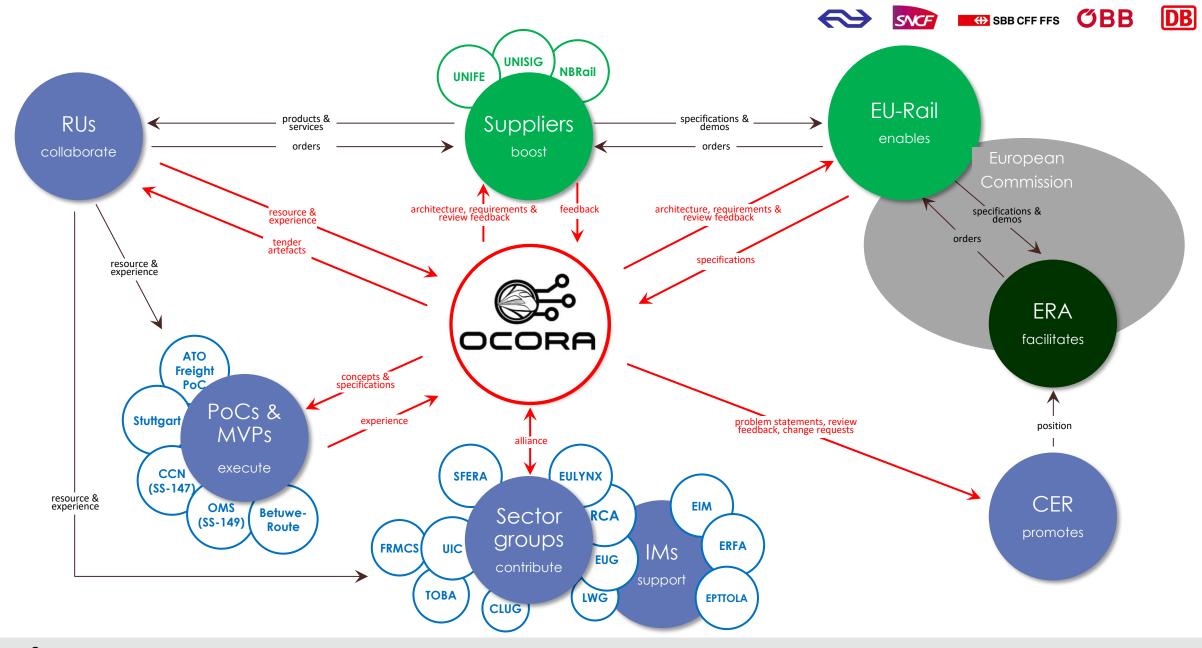




The development of the OCORA economic model, intends to provide tools for:

- Getting a clear view on the economic driver for the modularization of the on-board. To this end the model focus on 3 cost categories:
  - Generic industrial cost for developing certified CCS onboard sub systems.
  - Cost for authorising operation with a new CCS configuration in a class of vehicle
  - Train specific cost for fitting or upgrading CCS building blocks
- Studying the impact of technology life cycle on the total cost of ownership.
   To this end scenario are defined for comparison purpose:
  - Today's situation with slow deployment and small project size, based on reference values derived from EC studies on ERTMS.
  - OCORA MVP scenario to model the economic impact of the modularisation of CCS onboard architecture
  - CCS evolution scenarios allowing to investigate impact of larger market, enhanced functionalities and accelerated upgrade scheme
- Optimising the contribution of OCORA breakthrough to common business objectives. An open dialogue with the industry creates mutual benefit.







#### Introduction DB OCORA Approach **OCORA** Results for Tenders Sector ERA, UNISIG/Unife, EU-Rail, S2R (LINX4Rail, CONNECTA, X2Rail-4, Tauro), EUG-LWG, UIC (FRMCS, TOBA), SFERA Sector work (EU Rail) **Legal Framework Harmonised CCS-OB Agreed CCS-OB** architecture proposal TSI-CCS, TSI-LOC&PAS, etc. architecture for future TSIs (EU Rail) Standards (e.g. EN, UIC, IEEE) TSI relevant **Agreed CCS-OB Harmonised CCS-OB** specifications **System Pillar Documents** requirement proposals for future TSIs (EU Rail) Harmonised TSI-CCS addendum TSI-CCS addendum proposals **EuroSpec** TSI relevant **Harmonised CCS-OB** tender artefacts **Harmonized Referenz** Reference Architecture EuroSpec Reflection in Sector (UNISIG, Suppliers) **Architecture for Tenders** Harmonized CCS-OB Reference for Tenders Architecture



Non

**Harmonised CCS-OB** 

Requirements for

**Tenders** 

OCORA TSI-CCS addendum

Harmonized CCS-OB Requirements

(functionality + PRAMSS)

**Harmonized Requirements** 

for Tenders

# EuroSpec **Control-Command and Signalling Working Group**

Introduction

Motivation – Benefits – Scope







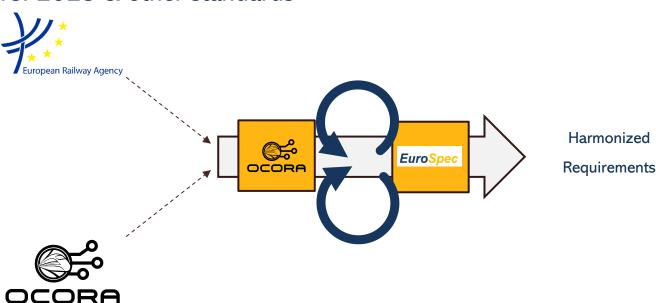


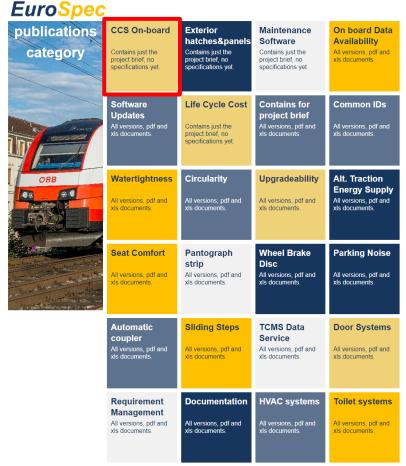




# OCORA and EuroSpec have joint their forces for CCS-OB requirements

TSI 2023 & other standards









Reference architecture &

requirements









# Reason for cooperation of OCORA & EuroSpec

- OCORA has the objective to define requirements for procurements
  - To ensure that the OCORA work considered in the TSI can be used in procurements
  - To ensure that OCORA work not considered (yet) in the TSI can be used in procurements
- Same vision and objectives
  - To align train operator's needs to reduce the whole life cycle cost of the train, shorten the delivery time and speed up the innovation cycle and the deployment of innovations.
- **Use of already existing framework** 
  - EuroSpec is an established platform, enabling discussion of requirements with the railway industry.
  - EuroSpec requirements are already used in procurements.
- Fill a gap in the EuroSpec publication catalogue
  - EuroSpec is currently not covering CCS On-Board requirements.













# Harmonized requirements increase the attractiveness of railways

- Harmonized requirements help the RUs to simplify the procurement
  - This leads to reduced costs for preparing the requirements.
- Harmonized requirements help the industry to simplify the offering
  - This leads to reduced costs for the offering.
- Harmonized requirements help the industry to reduce product variety
  - This leads to less development and maintenance efforts.
- Harmonized requirements help the RUs to operate more standardised vehicles
  - This leads, in a long term, to less operational costs (documentation, training, maintenance, etc.).





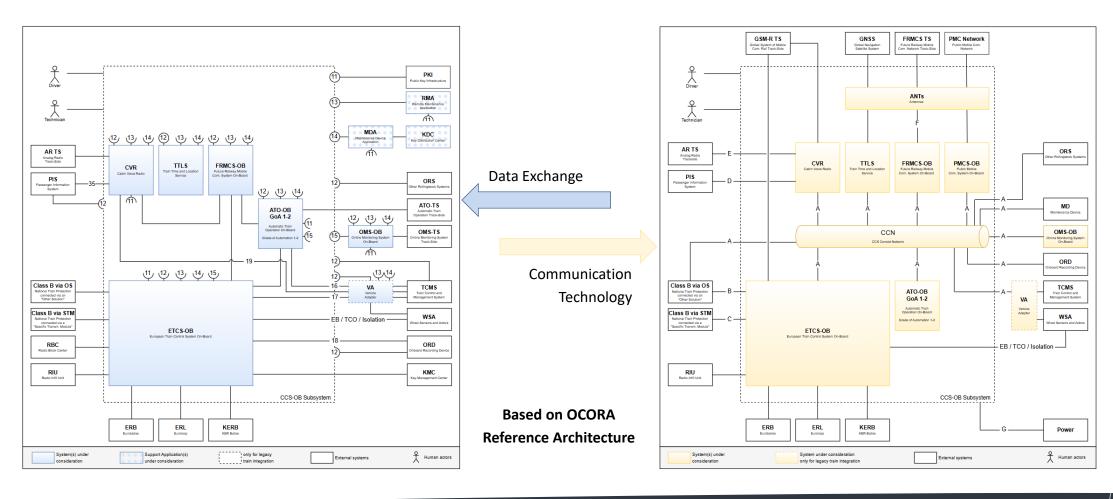








# **EuroSpec CCS-OB reference architecture**







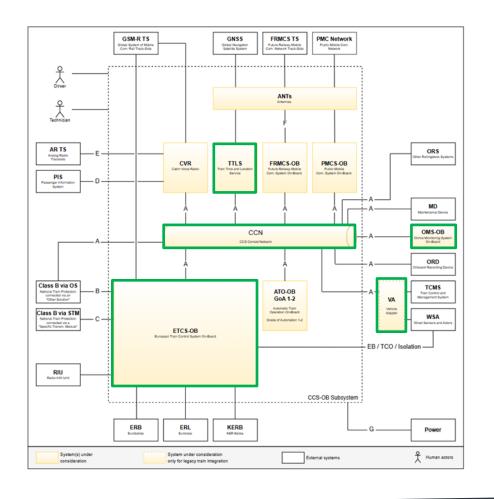








# 1<sup>st</sup> Release of CCS-OB Euro Spec Q4/2025



- First version of the requirements for ETCS-OB, CCN, TTLS, OMS-OB, and VA can be expected in Q4/2025.
- Based on TSI-CCS:2023, considering expected amendments for FRMCS.
- Still needs to be aligned with the TSI-CCS 2023 application guide, once available.
- Requirements to close gaps in the TSI-CCS 2023 (e.g. SS-119, SS-147).













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# **Sector Dialogue**











# OCORA Release Imprint

- Publisher: OCORA Cooperation
- Channel: OCORA publishes exclusively over <a href="https://github.com/OCORA-Public/Publication">https://github.com/OCORA-Public/Publication</a>
- Any feedback for OCORA is welcome!
   If you would like to attend a workshop or give a feedback, please contact <u>luca.de\_libero@sbb.ch</u>.
   For specific feedback the OCORA-BWS01-040 Feedback Form shall be used.
- For active collaboration (within the OCORA framework) the OCORA Code of Conduct must be accepted and signed. In case of interest for active collaboration and you are eligible to become a partner according to the OCORA Code of conduct, please drop a "interest of becoming a OCORA member by mail" to <a href="luca.de">luca.de</a> <a href="libero@sbb.ch">libero@sbb.ch</a>.
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