OCORA

Open CCS On-board Reference Architecture

Problem Statements

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Revision history

Version	Change Description	Initial	Date of change
0.01	▪ First Proposal for Gamma Release	RM	29-10-2020
0.02	▪ Improved Proposal for Gamma Release	RM	04-11-2020
1.00	▪ DRAFT for Gamma Release	RM	25-11-2020
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4.00	Decoupled document from a specific OCORA release	RM	28-06-2022
4.10	Minor textual adjustments	RM	17-11-2022
4.20	Update based on brush up and editorial work	RM	09-05-2023
5.00	Update business objectives based on OCORA refocus	LDL	25-11-2024

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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

1 Introduction

1.1 Purpose of the document

The purpose of this document is to describe the existing problems to overcome with the OCORA collaboration.

This document is addressed to experts in the CCS domain and any other person interested in the OCORA concepts for CCS on-board. The reader is invited to provide feedback to the OCORA collaboration and can, therefore, engage in shaping OCORA. Feedback on this document and any other OCORA documentation can be given using the feedback form [4].

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

If you are an organization interested in developing CCS on-board building blocks according to the OCORA design principles, the information provided in this document can be used as input for your development.

1.2 Applicability of the document

The document is considered informative. Its focus is on CCS on-board.

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 reading the Introduction to OCORA [5]. The reader should also be aware of the Glossary [2] and the Question and Answers [3].

2 Problem Statements

The scope of the following problem statements is the CCS On-board in general. In order to develop/compile the problem statements, RUs have collected issues on current ETCS On-board solutions and considered foreseeable challenges such as the game changer developments. Thus, they have been able to determine the gap between the existing and future solutions.

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);

7. are **lacking built-in cybersecurity**;

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 (braking curve, odometry accuracy, etc.) also need improvements 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.

3   OCORA Actions

The following list aligns high level Business Objectives to identified action fields. It is expected that the list will evolve in the future, mainly in the dimension of identified action fields. Nevertheless, over time, additional Business Objectives could emerge as well.

Business Objectives:	OCORA Actions:
Ensure easier Access to Interoperability	• Perform formal modelling on selected subsets together with the industry in EU-Rail System-Pillar to improve and complete TSI specifications. • Perform Proof of Concepts, Demonstrators or Prototyping in order to increase Technical Readiness Level of conceptual ideas, both within the EU-Rail Innovation-Pillar and RU projects. • Establish common test centre / reference system facilities including trackside and on-board end-to-end testing, off production.
Reduction of one-off efforts increase standardization	• Establish a modular design safety case structure in line with current and future standards • Standardize an evolution management process in CCS systems • Optimize the homologation process from CCS to full vehicle • Address existing fleet while introducing a standardized gateway • Separate SIL from non-SIL functionality
From **Project to Product**, increase batch size	• Define and promote OCORA principles as common tendering base • Encapsulate all vehicle specific configuration and adaptation in the functional vehicle adapter, FVA • Introduce an Ethernet based network technology to standardize peripheral device interfaces, specified on OSI Layers 1-6 to complete SS-147 • Introduce new strategic initiatives to further promote a market shift
Introduce Modularity and precisely **defined Interfaces** to **ensure Upgradeability**	• Introduce an open architecture and identify a balanced amount of building blocks regarding the specification efforts vs. the modularity benefits. • Structure EVC monolith into functional blocks, and separate ETCS core from other functions • Allow both, designs with a deployment on multiple hardware and multiple functionalities on the same hardware platform • Promote standardized interfaces between building blocks on all OSI layers to allow for exchangeability and migrateability • Elaborate test methods and set requirements to ensure exchangeability
Improve Product Maturity (maintenance, monitoring, diagnose, performance)	• Introduce remote maintenance, monitoring and diagnostics to reduce operational cost and improve reaction / correction time • Follow a stepwise approach, use gained upgradeability to serve individual migration strategies and set the basis for a faster ERTMS rollout in Europe • Ensure the technical feasibility and economic viability of the vehicle migration roadmap towards the first plateau defined in EU-Rail • Collect and analyse performance issues of the whole ETCS system, define steps to improve these • Monitor developments, raise risks and RU needs for state-of-the-art cyber-security

Figure 1   OCORA Actions