

ANNEX II - 2018 Calls for non-JU members – Topic descriptions

Open call for proposals

S2R-OC-IP1-01-2018 Technical solutions for the next generation of TCMS

Specific Challenge:

The Train Control and Monitoring System (TCMS) is the brain and the communications backbone of the train, which has some essential roles on vehicle performance. The next generation of TCMS should include wireless capabilities, should provide seamless coupling, enhanced interoperability, throughput and reliability, should be built on a new architecture based on distributed functions with standardised interfaces, while supporting safety-critical and security functionalities, and should offer easier certification procedures and self-configuration.

Scope:

In order to address the challenges described above, the proposals should address all the following domains, in line with the S2R MAAP (TD1.2)

As a result of the activities carried out in the lighthouse project ROLL2RAIL (GA 636032) described in the public deliverables D2.5 and D2.7³¹, in CONNECTA³² (S2R-CFM-IP1-02-2016), SAFE4RAIL³³ (S2R-OC-IP1-02-2016) and X2RAIL-1 (S2R-CFM-IP2-01-2015) projects described in their public deliverables published so far, the following further research activities, reaching TRL 3-4, should be carried out for the wireless TCMS, based on LTE communication technologies:

- a) Specification, implementation and validation of railway mobile LTE equipment (based on release 14³⁴), supporting multicast transmission. This should include the impact analysis on the IEC61375-2-5 Ethernet Train Backbone Nodes (ETBN) and proposals for their modification.
- b) Analysis of mobility and dynamic aspects of LTE equipment for wireless TCMS and the interaction of multiple cells in busy scenarios (e.g. main stations, depots etc).
- c) Proposal for technical solutions to merge all on-board radio links (incl. signalling) taking advantage of the LTE equipment.
- d) Participation in the interoperability wireless ETB tests of S2R-CFM-IP1-02-2018 in the laboratory demonstrator, by providing the required LTE expertise and hardware and technical support.
- e) Exploratory work on the applicability of 5G and the seamless transition between LTE and 5G in the railway TCMS domain.
- f) Evolution studies on how CONNECTA's Drive-by-Data concept (i.e. SIL4 TCMS) could be deployed through a wireless Ethernet Train Backbone.

The complementary action S2R-CFM-IP1-02-2018 will continue CONNECTA's activities so the proposals also should participate in the set-up of two laboratory demonstrators and in particular address the following activities (TRL4/5):

- i. Provide train subsystem to be integrated in the virtual homologation's simulation framework and participate in combined tests including remote with hardware-in-the-loop for both demonstrators around
- ii. Provide the implementation of network devices (i.e. modified EBTN and car switches) for integration into the Drive-by-Data concept based demonstrator architectures and participate in validation activities for both demonstrators around

³¹ <http://roll2rail.eu/Page.aspx?CAT=DELIVERABLES&IdPage=45291e18-8d8f-4fd6-99f8-5d4b7a519b9c>

³² http://projects.shift2rail.org/s2r_ip1_n.aspx?p=CONNECTA

³³ <https://safe4rail.eu/news/deliverables>

³⁴ Based on release 14 developed by 3GPP <http://www.3gpp.org/release-14>

- iii. Provide the implementation of a real train subsystem function to be integrated in CONNECTA (i.e. wireless TCMS, drive-by-data, functional open coupling)³⁵ functional distribution framework (i.e. Integrated Modular Platform) for both demonstrators around

In addition, proposals should carry out applicability studies (TRL 2) of the proposed technologies developed through CONNECTA for supporting the Virtual Coupling concept.

- Finally it is expected that the proposals include the organisation (including the required funding for two meetings) of a joint advisory group, which should include experts from 3GPP and 5G PPP amongst others. In addition, available results of the Shift2Rail projects ROLL2RAIL (GA 636032), CONNECTA (S2R-CFM-IP1-02-2016), SAFE4RAIL (S2R-OC-IP1-02-2016) and X2RAIL-1 (S2R-CFM-IP2-01-2015) should be considered.

The action that is expected to be funded under this topic will be complementary to the actions that are expected to be funded under the following topics:

- S2R-CFM-IP1-02-2018 Implementing new technologies for the TCMS
- S2R-CFM-IP2-01-2018: Advanced Signalling, Automation and Communication System
- S2R-CFM-CCA-01-2018: Virtual certification & Smart Planning

As specified in section 2.3.1 of the S2R AWP for 2018, in order to facilitate the contribution to the achievement of S2R objectives, the options regarding 'complementary grants' of the S2R Model Grant Agreement and the provisions therein, including with regard to additional access rights to background and results for the purposes of the complementary grant(s), will be enabled in the corresponding S2R Grant Agreements.

An indicative scheduling of the deliverables is suggested below³⁶:

- Deliverable under item d) is expected by month 20
- Deliverables under item i), ii) and iii) are expected by month 24

Expected Impact:

Actions will support S2R-CFM-IP1-02-2018 to validate in a relevant environment (TRL4/5) and for two representative railway applications (i.e. mainline and urban), the following technologies:

- The Functional Distribution concept, together with the Integrated Modular Platform, leading to a reduction of LCC and improvement of operational reliability;
- The Virtual homologation simulation framework to enable further reductions in LCC.
- The interoperability of the proposed wireless Ethernet Train Backbone, to reduce LCC, increase operational reliability and capacity, by adding flexibility to the system.

In addition, activities on LTE equipment should close identified open points (TRL3/4) and bring enough maturity for allowing full scale demonstrators of the wireless TCMS from 2020.

Type of Action: Research and Innovation Action

³⁵ CONNECTA technical proposals relevant to virtual coupling will be published through the public deliverables D2.4 (08.2018), D3.5 (08.2018) and D4.2 (03.2018).

³⁶ The scheduling of the deliverables is provided to facilitate the complementarity with the CFM actions and it is not binding. Additionally, each deliverable may have some flexibility in the scheduling.