4.2.3 S2R-OC-IP1-03-2020 Innovative technologies for Carbodies and Running Gear of the future

The project funded under this action covers three topics for two TDs: carbody (TD 1.3) and running gear (TD 1.4).

SPECIFIC CHALLENGE

Carbody

The proprosal is to complement the carbody developments and activities within the S2R JU programme, especially within the S2C-CFM-IP1-01-2019. These activities are described globally in the S2R MAAP and the S2R-CFM-IP1-01-2019 specification of the AWP 2019. The detailed information about the scope of the Open Call contribution is inspection methods for new materials adapted for the maintenance in railway environment.

On the new generation of carbodies the inclusion of different combination of materials (metal alloys and composites) to achieve the proper balance between cost, weight and performance require specific efforts not only in the design and manufacturing phases but also for maintenance of the Rolling stock. To that end specific development should be done in the phase of inspection process of the carbodies in service to adapt the solution to the railway environment.

Running Gear

The proposal is to complement the running gear developments and activities within the S2R JU programme, especially within the S2C-CFM-IP1-01-2019. These activities are described globally in the S2R MAAP and the S2R-CFM-IP1-01-2019 specification. The detailed information about the scope of the Open Call contribution is mentioned in the following work-stream: Innovative approaches to contribute to running gear development progress

New technological solutions for running gear need to have sufficient durability to operate between overhauls or even through the entire vehicle design life of up to 40 years. Especially for elastomeric material and journal bearings this is a significant challenging factor.

The challenge is to develop innovative approaches to contribute to running gear development progress related to light, silent, track-friendly, and reliable, LCC running gear components. This multi-technology approach will have to address several functions (comfort, curving, structural function, rolling components, health monitoring, etc.).

SCOPE

In order to address the challenges described above, proposals should address all the following work streams, in line with the S2R MAAP:

Work-stream 1 (on carbody): Inspection Methods for new materials adapted for the maintenance in railway environment

1. Development of new methods of inspection applicable for composite and hybrid carbodies/components using non-destructive testing from only one side (exterior side), valid for monolithic panels or sandwich. TRL 4/5
2. Development of the equipment at prototype level.
3. Application of the new methods and equipment after the testing campaign.

Work-stream 2 (on Running Gear): Innovative approaches to contribute to running gear development progress should include tools, methodologies and technological development in the following areas:

1. New elastomeric materials with enhanced lifetime (TRL 3/4)

   Elastomeric materials are widely used in the Railway sector and more deeply in rail vehicles. Components like springs, airbags, bump stops and bushings are made of elastomeric materials, usually of both natural and synthetic rubber. The main drawback of these components is the relatively short maintenance period and lifetime due to the natural ageing of rubber compared to metallic components (i.e. coil springs) usually designed to withstand whole vehicle lifetime.

   New Elastomeric Materials should provide in this regard enhanced durability to levels of metallic components and maintaining its mechanical properties for the complete lifetime.

   New material shall be capable of being industrialized and manufactured in serial production for the typical Elastomeric Components in the railway field.

   The result of this study is the validation of the new material at component level (lab tests). Additionally it shall be manufactured railway components to be tested in field application.

2. New Journal Bearings with enhanced LCC and lifetime (TRL 3/4)

   Existing technology of journal bearing show a relevant LCC that represent a significant cost of the running gear maintenance. For a journal bearing the LCC is derived mainly from the lifetime and maintenance/Inspection period and in minor importance of acquisition cost.

   Therefore the action should investigate the development of a new technology of journal bearings that provides a significant improvement regarding lifetime and reduced periods of maintenance.

   This new development can be based on improving existing greases and/or optimizing roller elements, cages and race, both geometry and material.

   The focus should be directed to the high speed application conditions/ requirements as described in SPD1 by the IMPACT project (GA 730816) (D4.1 - Reference Scenarios). Current estimated maintenance period for such bearing can be considered as 2.5 Mkm

An indicative scheduling of the deliverables is suggested below[47] :

- Deliverable under work-stream 1-1 is expected by M14
- Deliverable under work-stream 1-2 is expected by M23
- Deliverable under work-stream 1-3 is expected by M35
- Deliverables under work-stream 2 are expected by M24

The S2R Joint Undertaking considers that proposals with a duration of 30 months would allow this topic to be addressed appropriately. Nevertheless this does not preclude submission and selection of proposals with another duration.

COMPLEMENTARITY

As specified in section 2.3.1 of AWP 2020 in order to facilitate the contribution to the achievement of the S2R JU objectives, the options regarding 'complementary grants' of the S2R JU 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 JU Grant Agreements.

[47] 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

The action 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-IP1-01-2019: Development of new technological concepts towards the next generation of rolling stock, applied to major subsystems such as Car body, Running Gear, Brakes, Doors, Modular interiors and HVAC.

EXPECTED IMPACT

For Work-stream 1 (on carbody): new skills and methodologies available for railway sector, reduced dwell time due to inspection of the new generation of the rolling stock. It is also expected to make the inspection of the carbody in 12 hours.

For Work-stream 2 (on running gear): activities are expected to contribute to the running gear work streams according the MAAP:

- Developing an understanding of the opportunities and risks presented by new elastomeric materials with a focus to increase the lifetime and reduce the LLC. New materials have to resist the lifetime of 25 years without losing significant performance, without increasing the maintenance costs and providing 100% safety. The new solution has to improve the total cost saving by 15% compare the parts in use today without changes of the space envelope.
- New approaches of bearing systems have to contribute to a maintenance cost reduction by increasing the lifetime to 25 years (without losing significant performance, without increasing the maintenance costs and providing 100% safety) or by proposing innovative system with simple maintenance/overhauls in without disassembling. The new solution has to improve the total cost saving by 15% compare the parts in use today for the SPD1 without changes of the space envelope or bearing concept

Furthermore, the activities are also expected to contribute to the following key S2R JU objectives:

- Vehicle weight reduction by 50% through the use of new concepts based on lighter materials. This weight reduction will have several side effects such as:
    - Reduction of the energy consumption of the vehicle
    - Increased track friendliness
    - Additional freedom for vehicle design
- Reduction of the LCC by 50% of the vehicle and the whole railway system, derived from the reduction of track damage due to the reduction of mass and the improvement of guidance ability of running gear, and improved health monitoring supported by new running gear sensor systems, which will contribute to a cost reduction of up to 20%.
- Increase in operational reliability and composite material acceptance supported by better performing health monitoring and sensor systems, which will contribute to a cost reduction of up to 20%.

Type of Action: Research and Innovation Action (RIA)