Innovation Programme 3:

COST EFFICIENT - HIGH CAPACITY INFRASTRUCTURE

Entreprise commune européenne Shift2Rail
Information sur les appels à projets 2017

2 décembre 2016
Objectives

High level objectives for the activities within IP3

• New Switches & Crossing, that reduce the 30% of all infrastructure failures on European Railway to 10%

• New track system i.e Ballast/Substructure/Rail, to reduce carbon demand by 50%, reduce whole life cost by 30%, maintain passenger safety and improve safety of track/maintenance workers.

• Intelligent maintenance, fully integrated with the traffic management; embedded monitoring, self adjusting, self repairing, able to predict against traffic demand and usage.

• Enable further savings in infrastructure Managers budgets by 30%
Areas of interest

IP3 Challenges

- More Attractive
- More Capacity
- Lower cost
- Better Punctuality

IP3 Research Pillars

- More Attractive
- More Capacity
- Better Punctuality
- Lower cost
- Lower cost
Technical demonstrators

ITD – Enhanced Track System

- TD3.1 Enhanced S&C
- TD3.2 Next Generation S&C
- TD3.3 Optimised Track
- TD3.4 Next Generation Track
- TD3.5 Bridges & Tunnels

ITD – Next Generation Track System

ITD – Enhanced Energy

- TD3.6 DRIMS
- TD3.7 RIMMS
- TD3.8 IAMS

ITD – Intelligent Asset Management

- TD3.9 Smart Power Supply
- TD3.10 Smart Metering Energy
- TD3.11 Future Stations

ITD – Enhanced Energy

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<th>Switches and crossings</th>
<th>Track</th>
<th>Tunnels-Bridges</th>
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(*) Consortium Switracken coordonné par l’IRT Railenium
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(*) Consortium Switracken coordonné par l'IRT Railenium
TD3.1 et TD3.2

New Switches & Crossings (S&C) Pillar

Improvement of existing S&C and new concept of train direction changing (Mechatronic S&C) to reduce the noise, the number of delays attributable to failures in such equipment and the maintenance costs.
TD3.1 et TD3.2

Advanced and expected impacts on TD3.1 – TD3.2
• Reduced maintenance ➔ cost reduction
• Improved reliability ➔ reduced traffic disruption
• Standardization and pre-fabricated components ➔ investment reduction, construction timeline reduction
• SWITRACKEN target: Plug and Play, Maintenance Free systems
Radically Innovative Tracks Pillar

Optimisation of the entire track: New design of the entire track in order to optimise the response of it to traffic loads (e.g. design and implementation of a track bringing together both advantages of ballasted and slab tracks) and development/implementation of new technologies (e.g. « self-healing » rail steel to reduce rolling contact fatigue phenomenon). This cluster will also cover the structures (e.g. bridges).

TD3.3 et TD3.4

[Images of track components and railway infrastructure]
TD3.5 - Proactive Bridge and Tunnel

Assessment, Repair and Upgrade Demonstrator

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Results</th>
<th>Deliverables</th>
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</thead>
<tbody>
<tr>
<td>Enhanced bridge inspections, both regarding quality and effectiveness.</td>
<td>Automated and refined assessment methods. Improved repeatability and reproducibility.</td>
<td>Guidelines and case studies including demonstration of new methods.</td>
</tr>
<tr>
<td>Enhanced tunnel and bridge repair and upgrading methods with reduced time closure.</td>
<td>Repair methodologies with reduced need of access time including mechanisation techniques for the upgrading of tunnels and bridges without any need of track possession.</td>
<td>Guidelines and case studies with results from tests with new methodologies. Design concepts of new mechanised equipment for the improvements of tunnels.</td>
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</tbody>
</table>
## TD3.5 - Proactive Bridge and Tunnel

Assessment, Repair and Upgrade Demonstrator

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Results</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced tunnel and bridge technology for Design, Construction and Maintenance</td>
<td>Justified demands and requirements for tunnel and bridge design, construction and maintenance</td>
<td>Suggestions for codes and standards together with case studies including use of new technologies</td>
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<tr>
<td>Spread knowledge how new and enhanced technology for bridge and tunnels should be used.</td>
<td>Acceptance for new technology</td>
<td>Case studies with application of new technologies and guidelines how it can be used.</td>
</tr>
<tr>
<td>Reduce noise and vibration intensity related to structures</td>
<td>Methods for noise and vibration reduction on structures</td>
<td>Guidelines for design of noise and vibration reduction system for bridges and tunnels</td>
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</tbody>
</table>
TD3.6, TD3.7, TD3.8

Smart and Intelligent Infrastructure Maintenance

New solutions for Rail Asset Registers, Cutting edge measuring and monitoring tools, use based maintenance instead of condition based (maintenance engineering) and maintainability by design will further contribute to minimize cost, increase capacity and reduce noise.
TD3.6, TD3.7 and TD3.8
TD3.9: Smart Power Supply Demonstrator

TD3.9 “Smart Power supply” is aimed at defining and demonstrating solutions to optimize the Traction power supply systems of AC electrified railways.

Solutions for DC are mainly investigated in former EU-founded projects and actual under test operation. However, the connexion of the studied architecture with the different components available

TD3.9 “Smart AC Power supply” is aimed to define the necessary basis for application of Smart AC Rail power systems ready for application, based on prototype testing within technical demonstrators covering the following topics:

- Innovative control and protection systems for traction substations;
- Control concept and specification for integration of FACTS equipment in traction substations
- Control procedures for networks of intelligent substations considering the interaction with rail operation and feeding grid.
TD3.10: Smart Metering for Railway Distributed Energy Resource Management System Demonstrator
TD3.10: Smart Metering for Railway Distributed Energy Resource Management System Demonstrator

The key areas to focus the technical ambition will be:

• Adaptation of the wireless sensor networks to railway energy networks measurements.
• Autonomous supplied sensor nodes.
• Data aggregation and data fusion algorithms.
• Energy consumption estimation algorithms for non-intrusive measurements.
• Analysis of smartphone or other low cost communicating sensors for on-board and track side energy measurements.
• Development of embedded learning algorithms for energy estimation and mobile device navigation applications.
• Development of a global architecture for the data collection, data synchronization, post-processing, analysis and applications.
• Integrate the railway applications in the generic energy analytics ODM platforms as a distinct use case.
TD3.11: Future Stations Demonstrator

Plan to develop station design concepts optimising station management, creating cost effective solutions and technologies so they can be applied in a variety of scenarios.

The primary ambition is for customer experience at stations to be dramatically improved, increasing the number of customers that will use rail as their preferred transport mode.

Objectives are:
1. **Improved flow between platforms and concourse**:
   Improved congestion management in large stations; seamless end to end journey; accessibility and perturbation control in urban based stations using passenger capacity modelling tools; exploration of dynamic wayfinding systems.

2. **Improved Station Designs and Components**:
   Classification of European Construction Industry components suitable for use in small stations with a view to reducing whole life costs and standardising design where possible. This might be demonstrated as part of implementing a small station rather than constructing prototypes.

3. **Improved Accessibility to Trains**
   Analysis of the Platform to Train Interface (PTI) issues and testing of suitable solutions for existing stations, to allow safe and inclusive access while minimising dwell time of the train at the station.

4. **Emergency Strategies for major stations**
   A better understanding of existing security and emergency shortfalls in large stations should lead to the development of a European wide methodology for dealing with such issues that will supported by other European initiatives in this field.
2017 Annual Work Plan (AWP)
Topics for JU members & non members

For the IP3
# Undergoing projects (calls 2015-2016)

<table>
<thead>
<tr>
<th>Topic number</th>
<th>Project acronym</th>
<th>Title</th>
<th>Coordinator</th>
<th>Indicative Budget (EU contribution)</th>
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<tbody>
<tr>
<td>S2R-CFM-IP3-01-2016</td>
<td>IN2TRACK</td>
<td>Research into enhanced tracks, switches and structures</td>
<td>TRV</td>
<td>2,799,993.00 €</td>
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<tr>
<td>S2R-OC-IP3-01-2016</td>
<td>S-CODE</td>
<td>Switch and Crossing Optimal Design and Evaluation</td>
<td>THE UNIVERSITY OF BIRMINGHAM</td>
<td>4,999,771.25 €</td>
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<td>S2R-CFM-IP3-02-2016</td>
<td>IN2SMART</td>
<td>Intelligent Innovative Smart Maintenance of Assets by integRated Technologies</td>
<td>ANSALDO</td>
<td>7,290,632.50 €</td>
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Topics for JU members

For the IP3
## 2017 AWP – topics for JU members

<table>
<thead>
<tr>
<th>Topic Number</th>
<th>Topic name</th>
<th>Type of action and expected Technical Readiness Level (TRL)</th>
<th>Value of the actions (*)</th>
<th>Maximum S2R cofunding (*)</th>
<th>In-kind contribution(*)</th>
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<tbody>
<tr>
<td>S2R-CFM-IP3-01-2017</td>
<td>Smart system energy management solutions and future station solutions</td>
<td>RIA, up to TRL 5/6</td>
<td>13 501 350</td>
<td>6 000 000</td>
<td>7 501 350</td>
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Topics for non-JU members
“Open Calls”

For the IP3
2017 AWP
Topics for non-JU members (“Open Calls”)

<table>
<thead>
<tr>
<th>Topic Number - IP</th>
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<th>Type of action and expected Technical Readiness Level (TRL)</th>
<th>Maximum S2R funding</th>
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<tr>
<td>S2R-OC-IP3-01-2017</td>
<td>Smart metering and asset management of railway systems</td>
<td>RIA, up to TRL5</td>
<td>2 200 000</td>
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<tr>
<td>S2R-OC-IP3-02-2017</td>
<td>Future stations and accessibility (IP1 and IP3)</td>
<td>RIA, up to TRL3</td>
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<tr>
<td>S2R-OC-IP3-03-2017</td>
<td>Satellite and autonomous monitoring systems’ solution</td>
<td>RIA, up TRL5</td>
<td>600 000</td>
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</tbody>
</table>
2017 AWP – Smart metering and asset management of railway systems

Scope based on:
Smart Metering for Railway Distributed Energy Resource Management System” (TD3.10), where the specific challenge relies on the technology development and demonstrator implementation in order to realise a non-intrusive Smart Metering sensor networks at Railway System level.

“Dynamic Railway Information Management System (DRIMS)” (TD3.6) where the challenge is to generate knowledge from data and/or information – driven whenever necessary by the available domain knowledge - valid for life cycle management and intelligent asset maintenance planning including automatic detection of anomalies, discovering and describing the maintenance workflow processes and implement predictive models of decaying infrastructural assets.
2017 AWP – Smart metering and asset management of railway systems

Work-stream 1: Management of energy related data (1.3 million)

1. Development of sensors for railway systems energy data collection and transmission from the field, as well as technical support for the aims of TD 3.10 installation.

Work-stream 1: Management of energy related data (1.4 million)

2. Energy data management architecture research for the TD3.10 data collection, processing and storage, including the following software specifications and developments

Work-stream 1: Management of energy related data

3. Energy user applications development and associated modelling research applied to the TD3.10. The following Application domains should be investigated:
2017 AWP – Smart metering and asset management of railway systems

Work-stream 2: Management of asset related data (0.8 millions)

The activities regarding this work stream should address the necessary IT solutions and related methodologies for business security, economic sustainability and decision support in the field of big data and analytics railway applications in the field of asset management, covering:

- IT solutions for data and transactions security and safeguarding data ownership rights.
- Methodologies and related IT solutions for the extraction of (visual or rule-based) explicit knowledge from data-driven models, exploitable by decision makers to interpret phenomena underlying analytics algorithms.
- Study and proof-of-concept on the metrics and methods/tools to measure the accuracy of analytics algorithms.
- Study and proof-of-concept on the railway specific structural contract mechanisms for information and knowledge exchange in order to guarantee a proper management of the value of the information dealt with, and the exploitation of general accounting services.
2017 AWP – Future stations and accessibility (IP1 and IP3)

The Scope:
Crowd flow analysis in large train station areas (TD3.11) (0,4 millions)

The activities are expected to provide an in-depth technical review of best practices and latest research in order to:

• study the crowd flow in large stations and describe the main behaviours and characteristics in the movement of passengers.
• develop the modelling of multiple passenger flows in large stations and the ways to control crowds particularly in emergency situations.
• identify available enabling technologies to analyse crowd management and people’s movement in stations.

Improved Accessibility to Trains
Platform-based design solutions for Platform-Train Interface (TD3.11) (0,4 millions)

Improved Accessibility to Trains
Train Access Door System for an independent and easy access (IP1-TD1.6) (0,2 million)
Research on platform detection technologies for station platform height and position determination (IP1-TD1.6) (0,2 million)
2017 AWP – Satellite and autonomous monitoring systems’ solution

THE SCOPE:

The proposed research and innovation activities should address all the following elements, in line with the S2R MAAP (TD.3.7):

• Analysis of the monitoring performances determined in other industrial fields, of various measuring systems based on satellites and/or Unmanned Aerial Vehicles (UAVs) implementation;

• Identification of the relevant methods for data processing and post-processing, required to monitor the relevant parameters and generate the required information;

• Identification of gaps and/or barriers to be overcome for the usage of satellites and/or UAVs for asset monitoring, e.g. legal and security issues, technology improvement, etc.

**Type of Action:** Research and Innovation Actions
The objectives are:

The expected final output will include a prototype demonstration in relevant environment (corresponding to TRL5) of aerial unmanned monitoring (satellites, UAVs, etc.) of key railway-related assets for which there is a clear and sustainable return of investments.

The prototype will also have to demonstrate which sensor performances, geo-referencing capabilities, costs, post-processing and analytics methods are used, to collect such maintenance infrastructure-related information.

This work should be carried out considering that automation for acquisition but also for analysis of raw data obtained from UAVs and/or satellites is a critical issue: a large proportion of the acquired data will correspond to digital imaging, requiring dedicated post-processing methods that have to be completely automated to ensure effectiveness for the maintenance supervision.
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