S2R R&I 2016 - 2018
A public-private partnership, a platform for the rail sector as a whole to work together to drive innovation in the years to come … 2024… to achieve

- a 50 % reduction of the life-cycle cost of the railway transport system (i.e. costs of building, operating, maintaining and renewing infrastructure and rolling stock);
- a 100 % increase in the capacity of the railway transport system;
- a 50 % increase in the reliability and punctuality of rail services (measured as a 50 % decrease in unreliability and late arrivals).

Council Regulation (EU) No 642/2014 of 16 June 2014 (S2R Regulation)
programme financials

Values as at 1 Sept 2016 in Million EUR

Programme 967M

S2R (H2020)  Co-Fin 450M  Railway Sector Net  Contribution 490M

IPs 777 M

IP1  225M  IP2  195M  IP3  153M  IP4  86M  IP5  83M  CCA  35M

IKAA  163M

Other  27M

Other  27M
S2R IP1 projects status and the MAAP

**IP 1**
- Cost-efficient and Reliable Trains, including high capacity trains and high speed trains
- Value: 221.5M€ until 2024

**IP 2**
- Advanced Traffic Management & Control Systems

**IP 3**
- Cost-efficient, Sustainable and Reliable High Capacity Infrastructure

**IP 4**
- IT Solutions for Attractive Railway Services

**IP 5**
- Technologies for Sustainable & Attractive European Freight

**Lighthouse project**
- Value: 14.9M€

**CFM projects**
- Value: 42.5M€ (18.9M€ S2R grants)

**OC complementary projects**
- Value: 6.7M€ (100% funded)

Calls 2015-2016
S2R IP1: Quick Overview

SYSTEM LEVEL
Technical Integration
System level Performance:
- Capacity
- Operational reliability
- Life cycle cost
- Energy efficiency
- Comfort
- ...

SUB-SYSTEM LEVEL
- New Technological opportunities
- Eliminate existing barriers for implementation of technologies from other fields

IP1 ROLLING STOCK

Train Control & Monitoring System
Carbodyshell
Modular Interiors
Doors & Access
Running Gear
Traction System
Brakes
S2R IP1: Development Philosophy

- Technologies developed to reach real application just after S²R ends
- Each subsequent project increasing Technology Readiness Level compared to the previous one
S2R IP1: Starting Up

Starting 2016

- Train Control & Monitoring System
- Carbodysshell
- Modular Interiors
- Doors & Access
- Running Gear
- Traction System
- Brakes

Starting 2017

- Train Control & Monitoring System
- Carbodysshell
- Modular Interiors
- Doors & Access
- Running Gear
- Traction System
- Brakes

Not all development lines can start on the 1st year
All activities starting within the first 2 years of S2R
## IP1 Projects Starting in 2016

<table>
<thead>
<tr>
<th>AREA</th>
<th>SCOPE</th>
<th>TRL</th>
<th>CONSORTIUM</th>
</tr>
</thead>
</table>
| TRACTION & BRAKING    | • New traction components and sub-systems (especially Silicon Carbide based but also independently rotating wheel architecture for HST) customised for different market segments.  
• Energy saving technologies  
• Maintenance solutions (Condition Based Monitoring of traction components, remote diagnostic, ...)  
• Methodologies and tools for noise emission prediction  
• Increase traction system reliability and smart maintenance.  
• Virtual validation and certification of traction systems  
• Adhesion management tools and solutions for braking to map different adhesion conditions occurring in rail traffic  
• Specifications for Adhesion Recovery Systems & improved requirements for Wheel Slide Protection (WSP) | TRL 2/4 | PINTA  
(S2R Members) |

![Shift2Rail Logo](image)
<table>
<thead>
<tr>
<th>AREA</th>
<th>SCOPE</th>
<th>TRL</th>
<th>CONSORTIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAIN CONTROL &amp; MONITORING SYSTEM (TCMS) &amp; BRAKING</td>
<td>• Feasibility studies for safety related communications: Technologies and architectures from other sectors &lt;br&gt; • Technology and feasibility studies for functional distribution architectures. Tech. transfer from automotive &lt;br&gt; • Technology and feasibility for virtual certification &lt;br&gt; • Certification aspects for high safety braking electronics</td>
<td>TRL 2</td>
<td>SAFE4RAIL (Open Call) &lt;br&gt; Signature Pending</td>
</tr>
<tr>
<td></td>
<td>• Wireless TCMS for Train-to-train and Train-to-ground communications development &lt;br&gt; • Drive-by-data: SIL4 TCMS for safety critical functions &lt;br&gt; • Functional Distribution architecture &lt;br&gt; • Virtual placing on the market: methodology and architectures &lt;br&gt; • Safe control for brakes: high safety integrity level architectures for brake control</td>
<td>TRL 3/4</td>
<td>CONNECTA (S2R Members)</td>
</tr>
</tbody>
</table>
## Next Activities foreseen to start 2017

<table>
<thead>
<tr>
<th>AREA</th>
<th>SCOPE</th>
<th>TRL</th>
</tr>
</thead>
</table>
| CARBODY SHELL             | • Build on previous projects towards a regulatory framework for composite materials in trains (REFRESCO) and preliminary activities (Roll2Rail)  
                           | • Progress on material selection and manufacturing alternatives                                                                                                                                   | Low / mid TRL |
| RUNNING GEAR              | • Technical specifications of running gear of the future. Development on:  
                           | o Innovative sensors for condition monitoring  
                           | o Noise reduction  
                           | o New materials for bogies  
                           | o Control systems                                                                                                                      |      |
| BRAKES                    | • Technologies for efficient force generation:  
                           | o Friction pair solutions  
                           | o Frictionless low noise brake solutions  
                           | o Electromechanical brakes                                                                                                               |      |
| DOOR & ACCESS             | • Access system for PRM  
                           | • New technologies for door surveillance  
                           | • Innovative materials for doors                                                                                                          |      |
| INTERIORS MODULARITY      | • Analysis of new interior modularity concepts  
                           | • Studies and developments                                                                                                                |      |

**OPEN CALLS**
- Specialist technologies / tech. transfer
- Feasibility analyses
- New / blue sky approaches

**CLOSE COOPERATION**
- Architectures
- Technology application
- Demo-oriented activities

**MEMBER CALLS**
Thank you for your attention
S2R IP2 projects status and the MAAP

- **IP 1**: Cost-efficient and Reliable Trains, including high capacity trains and high speed trains
- **IP 2**: Advanced Traffic Management & Control Systems
- **IP 3**: Cost-efficient, Sustainable and Reliable High Capacity Infrastructure
- **IP 4**: IT Solutions for Attractive Railway Services
- **IP 5**: Technologies for Sustainable & Attractive European Freight

**Long-term needs and socio-economic research**

**Smart materials and processes**

**System integration, safety and interoperability**

**Energy and sustainability**

**Human capital**

**CFM projects**
- 45M€ value (20M€ S2R grants)

**OC complementary projects**
- 3M€ value (100% funded)

**191,4M€ until 2024**

**Calls 2015-2016**
### IP2 Topics submitted (AWP 2015)

**IP2 Topics**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide activities for an adaptable IP communication system based on new technologies with enhanced throughput, safety and security functionalities, supporting the current and future needs of signalling systems and voice services.</td>
<td><strong>Member Consoritum</strong> X2Rail-1</td>
</tr>
<tr>
<td>• Provide development and test bench focusing on ATO GoA2 starting from inputs from Ten-T 3rd call (ATO over ETCS - Technical Interoperability Requirement for GoA2), from the results of the European NGTC project and existing standard IEC 62290-2. Perform the feasibility study and preliminary design for GoA3 and GoA4 solutions.</td>
<td></td>
</tr>
<tr>
<td>• Provide the definition of the Moving Block Work Package for a high capacity, low cost, high reliability signalling system, based on Moving Block principles, which is applicable across all railway market segments.</td>
<td></td>
</tr>
<tr>
<td>• Definition of a common test process framework to support guidance for improving lab/simulation tests. Definition/implementation of a dedicated system test architecture for lab testing. Standardization of interfaces and test processes.</td>
<td></td>
</tr>
<tr>
<td>• Define and provide specification for practical demonstration for development of an autonomous, intelligent, maintenance-free smart equipment (“box”) able to connect with any signalling wayside object and communicating device in the area (by radio or satellite) in order to foster overall cost reduction both of installation and maintenance.</td>
<td></td>
</tr>
<tr>
<td>• Definition of a cyber security system dedicated to railway and the definition of a security-by-design standard.</td>
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<tr>
<td>AREA</td>
<td>SCOPE</td>
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<td>-----------------------------</td>
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</tr>
</tbody>
</table>
| **Cyber-security**          | - Security assessment of railway systems;  
                              - Identification and analysis of the different **cyber-attack threats** applicable to different railway segments (Urban/Mass Transit, Suburban/Commuters and Main Line) and interfaces with other modes;  
                              - Selection of the standard framework to be applied for the development of cyber secure railway applications in order to reach "security by design". | CYRail (Open Call) Signature pending |
| **IT virtualisation**       | - Develop the concept of **virtualisation** for holistic railway testing environments;  
                              - Develop an **IT virtualisation** of hardware (HW) and software (SW) **platform**;  
                              - Propose different **scenarios** (railway system combinations and configurations) that could be deployed at the same time but running separately (scenario by scenario);  
                              - Develop a **demonstrator** with the selected parts of the testing environment. | VITE (Open Call) Signature pending |
| **Adaptable Communication system** | - Definition of new **business model scenarios** for the use of the more advanced radio technologies in the railways domain;  
                              - **Analysis and definition** of conditions in which the use of **public radio communication network** instead of dedicated networks could be possible. | MISTAL (Open Call) Signature pending |
Thank you for your attention
S2R IP3 projects status and the MAAP

Long-term needs and socio-economic research
Smart materials and processes
System integration, safety and interoperability
Energy and sustainability
Human capital

Cost-efficient and Reliable Trains, including high capacity trains and high speed trains
Advanced Traffic Management & Control Systems
Cost-efficient, Sustainable and Reliable High Capacity Infrastructure
IT Solutions for Attractive Railway Services
Technologies for Sustainable & Attractive European Freight

150,3M€ until 2024

Calls 2015-2016
CFM projects
22,7M€ value (10,1M€ S2R grants)

OC complementary projects
5M€ value (100% funded)

Lighthouse project
13M€ value
Objectives of IP3

- Builds on In2Rail – lighthouse project
- Improved reliability
- Enhanced capacity
- Improved customer experience
- Lower investment costs
- Reduced operating costs
- Respect and adaptation of TSIs
- Removal of open-points
- Improved standardisation
Management of inter-dependencies

IAMS = Intelligent Asset Management Solutions
RIMMS = Railway Integrated Measuring and Monitoring System
DRIMS = Dynamic Railway Information Management System
Annual Work Plan 2015

- In2Smart; In2Track; S-Code projects
Thank you for your attention
S2R IP4 projects status and the MAAP

- **IP 1**: Cost-effective and Reliable Trains, including high capacity trains and high speed trains
- **IP 2**: Advanced Traffic Management & Control Systems
- **IP 3**: Cost-effective, Sustainable and Reliable High Capacity Infrastructure
- **IP 4**: IT Solutions for Attractive Railway Services
- **IP 5**: Technologies for Sustainable & Attractive European Freight

**OC complementary projects**
- 12M€ value (100% funded)

**CFM projects**
- 84,8M€ until 2024

**Calls 2015-2016**
- 12,8M€ value (5,7M€ S2R grants)
- 3M€ value
IP4 projects: current status

• **IT2RAIL : lighthouse project**
  - Started in May 2015
  - Halfway, presented on 21st Sept at UNIFE stand
  - Cover all IP4 TDs, but with a reduced complexity

• **S2R-CFM-IP4-01-2015 : Co-Active**
  - Travel Shopping (TD2) and Booking & ticketing (TD3)
  - Activities started 1st Sept, official KOM 5th October

• **S2R-CFM-IP4-02-2015 : ATTRACKTIVE**
  - Travel Companion (TD4) and Trip Tracking (TD5)
  - Activities started 1st Sept, official KOM 5th October

• **S2R-OC-IP4-01-2016 : GoF4R (Gov. of the Interop. Framework 4 Rail)**
• **S2R-OC-IP4-01-2016 : ST4RT (Semantic Transformation 4 Rail Transport)**
* Open calls should start in November 2016
IP4 projects: CFM projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Content</th>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-Active (TD2+TD3)</td>
<td>‘one-stop-shop’ capability initiated in IT2Rail completed with post-sale business transactions, and payment-settlement solution for co-modal journey</td>
<td>Thales, Amadeus, Indra, Hacon, Network-Rail</td>
</tr>
<tr>
<td>ATTRACKTIVE (TD4+TD5)</td>
<td>Travel companion and Trip-tracking activities, including degraded modes, and automatic re-accomodation, clearing and settlement treatments</td>
<td>Hacon, Diginext, Indra, Thales, Network-Rail, Ansaldo</td>
</tr>
</tbody>
</table>
**IP4 Overall plan**

- Including an ITD for an overall integration
- 4 releases in 2017, 2018, 2020, and 2022 with increased complexity
- Two non technological Open Calls:
  - Demo with operators (incl. urban sector) for ITD in 2018

**TIMELINE**

<table>
<thead>
<tr>
<th>Year</th>
<th>TD1 &amp; TD6</th>
<th>TD2/3</th>
<th>TD4/5</th>
<th>TD6</th>
<th>ITD7</th>
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<tbody>
<tr>
<td>2015</td>
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<td>2020</td>
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<td>ITD support - OC-2018</td>
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<td>2021</td>
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**IP4 Overall plan**

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<td>Final release</td>
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</tbody>
</table>
Thank you for your attention
S2R IP5 projects status and the MAAP

Long-term needs and socio-economic research
Smart materials and processes
System integration, safety and interoperability
Energy and sustainability
Human capital

IP 1: Cost-efficient and Reliable Trains, including high capacity trains and high speed trains
IP 2: Advanced Traffic Management & Control Systems
IP 3: Cost-efficient, Sustainable and Reliable High Capacity Infrastructure
IP 4: IT Solutions for Attractive Railway Services
IP 5: Technologies for Sustainable & Attractive European Freight

CFM projects
- 14.8M€ value (6.6M€ S2R grants)

OC complementary projects
- 3.5M€ value (100% funded)

Lighthouse project
- 6M€ value

82.1M€ until 2024
Driving Innovation within Shift2Rail: Innovation Programme IP5
“Technologies for sustainable and attractive European Rail Freight”

**Structure IP5**

- Implementation Strategies and Business Analytics
- Freight, Electrification, Brake and Telematics
- Access and Operations
- Wagon Design
- Novel Terminal, Hubs, Marshalling yards, Sidings
- New Freight Propulsion Concepts
- Long-term vision for autonomous rail freight system

**Vision IP5**

- Identification of requirements in market segments, KPI’s and Migration
- Condition-based maintenance, Automatic Coupling, Telematics and electrification
- Time table planning, Real-time yard & network management
- Low-noise, lightweight, track friendly running gear, core and new market wagon 2020
- Intelligent video gate terminal with new design, Hybridisation of legacy shunting Fleet
- New power technologies including battery solutions and new mainline operations enabling longer trains
- Autonomous Train Operation (ATO) and Demonstration on market level
- Longer coupled trains with distributed power
- Smart eco-efficient propulsion technologies
- Logistics capable Future wagon
- Condition monitoring for predictive maintenance
- Automated train composition and operation
- Asset Control tower & customer communication

**Targets of Shift 2 Rail**

- Reduction of Green House Gases
- Market Growth & Modal Shift
- Improved services and customer quality until 2030
- Cost reduction
### IP5 Open call Projects

<table>
<thead>
<tr>
<th>AREA</th>
<th>SCOPE</th>
<th>CONSORTIUM</th>
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</thead>
</table>
| Freight Automation | - Analysis of the requirements for obstacle detection for targeted autonomous trains with E-locomotive on European mainlines in existing infrastructure;  
                     - Analysis of technologies available for transfer and adaptations and interfaces;  
                     - Specification of requirements for an integrated obstacle detection system;  
                     - Development of the obstacle detection system prototype;  
                     - Development of a safety framework, testing and validation in lab.  
                     - Analysis of requirements of a real-time simulation towards the modelling of local marshalling yards and the modelling techniques;  
                     - Detailed modelling of all assets, resources and processes based on requirements analysis;  
                     - Advancement of existing simulations platform to provide optimisation of decisions in real-time;  
                     - The preparation of the simulation system for integration in an IT production system and the pilot testing of real-time management of a given large marshaling yard. | SMART (Open Call) Signature pending           |
## IP5 Open call Projects

### Improved vehicle/train dynamics

<table>
<thead>
<tr>
<th>AREA</th>
<th>SCOPE</th>
<th>CONSORTIUM</th>
</tr>
</thead>
</table>
|      | - Develop and demonstrate new design concepts using lightweight and self-cleaning materials, noise absorbing structures as well as mechatronic systems;  
- Analyse, specify, integrate and implement various functions, such as braking, cooling, noise reduction, torque transmission, radial steering and advanced monitoring systems in next generation bogies  
- Developing reasonable solutions for a radio remote controlled traction and braking system;  
- The work should implement methods to determine, simulate and evaluate longitudinal forces within longer trains;  
- Trains up to 1,500 m will be operated as double trains. For this reason it is necessary to adapt certain infrastructure components, such as stations, where efficient coupling and sharing processes for freight trains can be realized | DYNAFREIGHT  
(Open Call)  
Signature pending |

### Intelligent freight wagon with predictive maintenance

<table>
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<tr>
<th>AREA</th>
<th>SCOPE</th>
<th>CONSORTIUM</th>
</tr>
</thead>
</table>
|      | - Cargo condition monitoring technologies  
- Wagon design  
- Predictive maintenance | INNOWAG  
(Open Call)  
Signature pending |
Thank you for your attention
S2R CCA projects status and the MAAP

34,6M€ until 2024

Work Area 1: Socio economics
- Socio-economics and System Platform Demonstrators

Work Area 2: KPI
- Key Performance Indicators

Work Area 3: Safety, Standardisation & Smart Maintenance
- 3.1 Safety
- 3.2 Standardisation
- 3.3 Smart Maintenance
- 3.4 Smart Materials
- 3.5 Virtual Certification

Work Area 4: Smart Mobility
- 4.1 Smart Planning
- 4.2 Integrated Mobility Management

Work Area 5: Energy and Sustainability
- 5.1 Energy
- 5.2 Noise & Vibration

Work Area 6: Human Capital
- Human Capital

CFM projects
- 4,5M€ value (2M€ S2R grants)

OC complementary projects
- 3,5M€ value (100% funded)

Lighthouse projects
- 6,1M€ value

Calls 2015-2016
### CCA Topics submitted (AWP 2015)

#### CCA Topics

<table>
<thead>
<tr>
<th>IMPACT 1</th>
<th>Member Consortia</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Analysis of the Socio-economic impact to identify future trends and liaise with Shift2Rail bringing a perspective leading to 2050</td>
<td>IMPACT 1</td>
</tr>
<tr>
<td>• System platform demonstrators define the 4 System Platform Demonstrators that will be used to demonstrate the effects of the Shift2Rail</td>
<td>IMPACT 1</td>
</tr>
<tr>
<td>• KPI Tree Definition show how the expected results of the key Shift2Rail targets are achieved</td>
<td>IMPACT 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FINE 1</th>
<th>Member Consortia</th>
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</thead>
<tbody>
<tr>
<td>• Develop and use the methodology for assessing the overall energy reduction</td>
<td>FINE 1</td>
</tr>
<tr>
<td>• Technical assessment and integration on system level of N&amp;V</td>
<td>FINE 1</td>
</tr>
<tr>
<td>• Traffic noise scenarios and baseline for evaluation and monitoring noise effects of Shift2Rail innovations</td>
<td>FINE 1</td>
</tr>
<tr>
<td>• Interior Noise modelling Sources and assemblies</td>
<td>FINE 1</td>
</tr>
<tr>
<td>• New methodologies and technologies to support the development of new tools for auralisation and visualisation for demonstration and selection of the best means and appropriate usage of noise control improvements.</td>
<td>FINE 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLASA</th>
<th>Member Consortia</th>
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</thead>
<tbody>
<tr>
<td>• Development and enhancement of a basic smart planning model to disruptions and elaboration of case studies</td>
<td>PLASA</td>
</tr>
<tr>
<td>• Management of the safety of the railway system based on risk assessment</td>
<td>PLASA</td>
</tr>
<tr>
<td>AREA</td>
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</tbody>
</table>
| **Long-term needs of different actors in the railway sector** | • Collect and analyse the long-term changes in future needs of actors and users of the railway sector and customer requirements  
• Analyse mega-trends, scenarios and disruptions to the “landscape of mobility”, changing the circumstances for railway, in 2022, 2030 and 2050  
• Analyse the implications for the railway sector in case of car usage reduction, i.e. by 10% or more  
• Match the outcome of customer requirements, scenarios and society effects of the aforementioned studies with the objectives of S2R Master Plan | NEAR2050 (Open Call) Signature pending                                                                                                                    |
| **Energy usage, generation and saving approaches** | • Analyse the energy requirements for urban rail traffic all over Europe  
• Develop an energy simulation model and provide a simulation tool allowing the evaluation of energy consumption (high speed, regional, urban and freight)  
• Develop the optimum drive strategies and energy management for different propulsion systems and traffic segments.  
• Analyse the losses of energy within the traction chain including their cooling needs for different traction systems  
• Develop a global vision of energy in railways including smart management of railway networks. | OPEUS (Open Call) Signature pending                                                                                                                      |
<table>
<thead>
<tr>
<th>AREA</th>
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<th>CONSORTIUM</th>
</tr>
</thead>
</table>
| Noise reduction methodologies | • Evaluation and monitoring of impact on traffic noise scenarios of S2R research and innovation activities  
• Develop interior noise simulation model  
• New Technologies: auralisation and visualisation  
• Perform and demonstrate feasibility of active and other new noise control technology on noise proof windows | DESTINATE (Open Call) Signature pending |
| Safer infrastructure – improved object detection and prevention of safety critical events and integrated mobility | • Safety: Develop a global approach to an integrated management system for the safety of the railway system, based on a global risk assessment model  
• Integrated mobility (smart planning): improvement of basic micro-level railway network simulation models and test its implementation | GOSAFERAIL (Open Call) Signature pending |
Thank you for your attention