S2R JU EU Rail R&I; next EU Rail institutional partnership

4rd TC on Rail
Belgrade 4-5 March 2020
Monique van Wortel, Seconded National Expert at S2R JU
AN OPEN and ACTIVE ORGANISATION

- **28 Members**
- **412 Participants**
- **29 Countries**
- **109 SMEs**
- **113 Research Centres and Universities**

Values as at 1 Sept 2016 in Million EUR

- **2015** - € 52 M
  - Shift2Rail Initiative Lighthouse Projects
- **2016** - € 168 M
  - 27 Projects
- **2017** - € 112 M
  - 17 Projects
- **2018** - € 153 M
  - 19 Projects & 3 Tenders
- **2019** - € 150 M
  - 17 Projects & 4 Tenders

*Incl. at least 120M€ of additional activities
AN OPEN and ACTIVE ORGANISATION

...opening up new Capabilities coming from emerging technologies or concepts!
Programme approach
The S2R Programme implementation

- Master Plan
- MAAP
  - Part A
  - Part B
- Annual Work Plans
- R&I Projects
Railway - System of Systems

IP1 Cost-efficient and Reliable Trains, including high-capacity trains and high speed trains

IP2 Advanced Traffic Management and Control System

IP3 Cost-efficient, Sustainable and Reliable High Capacity Infrastructure

IP4 IT Solutions for Attractive Railways Services

IP5 Technology for Sustainable and Attractive European Rail Freight

CCA Cross Cutting Activities
IP3: Cost Efficient and Reliable High Capacity Infrastructure

- Infrastructure: tracks, S&C, bridges and tunnels, new station design
- Asset Management
- Energy Management
IP3: key achievements and ongoing activities

**Intelligent Asset Management:** Shift from reactive to proactive maintenance based on innovative monitoring/measuring & processing technologies

- Innovative technologies in asset measuring & monitoring (satellite, drones, robotics), data processing & decision support (IoT, Artificial Intelligence)
- Demonstration & evaluation of asset management, maintenance strategies: Thermal Stress Monitoring, and Lean Tamping

**Intelligent Energy Management:** mapping of all energy flows in railway system for management strategies. Future traction power supply system in integration with public grid

- Proof-of-Concept in light-train environment (tramway)
- Design of an intelligent substation, 66% savings on transmission losses, 25% reduction on dimensioning
IP3: key achievements and ongoing activities

✔ Optimized & Future Infrastructure Design:
  ✔ Track and S&C System: Analysis of deformation mechanisms & introduction of advanced capabilities to existing systems. Design of radically new designs & systems
  - Novel concept for locking & detection capabilities
  - Conceptual designs for radical switch actuation, locking and detection

✔ Bridges & Tunnels: Improved inspection & repair methods → service life extension, disruption time reduction, N&V reduction
  - Digital Imaging for asset monitoring + BIM-based asset management for remaining life estimation & bridge prediction behavior
  - Investigation of bridge-rolling stock interface & contribution to standards

✔ Stations: New designs enhancing mobility, accessibility & crowd management
  - Analysis of the passenger needs and expectations at railway stations
  - Conceptual design of Platform-Train Interface (PTI) solution
S2R GoSafe Rail project

• The GoSAFE RAIL project aims to implement machine learning approaches to aid decision making in rail infrastructure management.

• WP4: New techniques for object detection have been demonstrated in Norway, Ireland and Croatia.

• Case study for Croatia and Ireland public available

• Use of advanced technologies, such as AI and machine learning methods, to predict potential infrastructure issues

• [http://www.gosaferail.eu/workplan/wp4](http://www.gosaferail.eu/workplan/wp4)
GoSafe Rail detection technologies

- Automatic Radar system
- Lidar (3-D laser scanning)
- Train mounted thermal camera
- Drones equipped with high resolution cameras flying in front of the train
- Multi-sensor train mounted system
IP5: Technologies for Sustainable & Attractive European Rail Freight
**IP5: key achievements and ongoing activities**

**TD5.1 Fleet Digitalisation/Automation:** digital automatic coupling (flexible wagon composition), CBM (data handling, analytics and dashboards), ATO/DAS (testing of ATO developed in IP2)

SMART: Multi-sensor obstacle detection system prototype development: based on on-board CCTV technologies assisting the ATO system used for detection up to 1 km
Dynamic field tests in May 2019 for integrated Object Detection System
System installed in SERBIA CARGO locomotives series 444
Test trials on 2 sections of Serbian Railways: Nis Junction and Serbian part RFR to Thessaloniki

**Outcome of testing: good results**

**Follow up:** SMART2 project (dec 2019-dec 2022): assessing new requirements for obstacle detection and track intrusion detection up to 2 km

Automatic brake test and a new silence wheelset
AWP and Call 2020: Open Calls IP3
S2R-OC-IP3-01-2020: Next Generation Track Transition Zones

• TD3.4 Next Generation Track System: aims to improve the track system substantially, targeting a time horizon of some 40 years beyond current state-of-the-art

• Provide optimum track support conditions within transition zones, e.g. S&C, change of track construction, underbridges

• Topic of the OC: Deliver detailed design and technical specification for physical transition zone demonstrators (output->CFM for real scale demo TRL 6/7)

• Deliver prototypes and small-scale demonstrators of next generation transition zone components and sub-systems - TRL 5

• Complementary to CFM project IN2TRACK2: Next Generation Track

• EU funding: 1,350,000 €

• Impact: in delays due to less defects, N&V, lifecycle costs
S2R-OC-IP3-02-2020: Technology Development for Railway Systems Asset Management

- TD3.6 Dynamic Railway Information Management System (DRIMS) Demonstrator
- The DRIMS aims to define an innovative system for the management, processing and analysis of railway data.
- New technologies for prescriptive analysis: prediction of future issues, provide preventive solutions
- Topic of the OC: Prescriptive data analytics tools (statistics, machine learning, AI) to implement a Decision Support System, with man in the loop, for Intelligent Asset Management Systems – prototype TRL 4-5
- Multi-objective decisions’ optimization tools (models, AI) for Intelligent Asset Management Strategies – prototype TRL 4-5
- Complementary to CFM project IN2SMART2
- EU funding: 1,710,000 €
- Impact: ↑ operational reliability, optimise maintenance, ↓ costs
S2R-OC-IP3-03-2020: Advanced tools and equipment: collaborative robots & wearable mobile machines

• TD3.8 Intelligent Asset Management Strategies Demonstrator (IAMS)
• The TD aims to deliver new working methods, tools and equipment
• Topic of the OC: Development of standalone demonstrator of an improved existing plant (machines and equipment) by integrating robot technology to support future inspection and execution of maintenance actions – TRL 5-6
• Development and validation of a prototype of exoskeleton suitable for outside conditions which can perform a set of different maintenance tasks – TRL 5-6
• Complementary to CFM project IN2SMART2
• EU funding: 2,700,000 €
• Impact: ⬆ workers safety, accuracy of results, ⬇ costs of working method
Information on TD and AWP 2020 topics

- https://projects.shift2rail.org/s2r_ip_TD_r.aspx?ip=3&td=0bacb768-862f-4382-bc4d-b9629d0fa9d8
Union Institutional Partnership for Transforming Europe’s Rail System
### ERRAC Challenges and Answers towards 2030 Mobility and Transport

#### CHALLENGES FOR THE MOBILITY OF 2030

<table>
<thead>
<tr>
<th>Attractiveness &amp; Convenience</th>
<th>Maximized Affordable Capacity</th>
<th>Sustainability/Security</th>
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<tbody>
<tr>
<td>• End-use/citizen driven services, passenger &amp; logistics</td>
<td>• Matching capacity with demand</td>
<td>• Decarbonised mobility</td>
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<tr>
<td>• Integrated door-to-door mobility</td>
<td>• Affordable and minimising infrastructure changes</td>
<td>• Energy efficiency</td>
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<tr>
<td>• Minimising Journey Time. No waiting times</td>
<td>• Resilient transport system and quick recovery</td>
<td>• Reducing congestion in populated areas</td>
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<tr>
<td>• Punctual, reliable &amp; secure</td>
<td>• Customised &amp; Flexible: adaptable to changing needs</td>
<td>• Limiting noise, vibration and ground space</td>
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<tr>
<td>• Comfortable &amp; Quiet</td>
<td></td>
<td>• More secure and resilient</td>
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<tr>
<td>• Affordable and tailored for all needs</td>
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**The rail sector addresses these challenges as the backbone of integrated mobility**

#### THE RAIL SECTOR'S ANSWERS TO THESE CHALLENGES (Supported by Horizon Europe)

<table>
<thead>
<tr>
<th>Digitalisation</th>
<th>Automation</th>
<th>New Mobility Solutions</th>
<th>Sustainable Solutions</th>
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<tbody>
<tr>
<td>• Connected &amp; integrated railways</td>
<td>• Real time operational management</td>
<td>• Seamless integration between modes of transport</td>
<td>• Greener energy technologies</td>
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<tr>
<td>• Intelligent &amp; cost efficient asset management</td>
<td>• Trains running closer together, Platooning &amp; virtual coupling</td>
<td>• Smaller and more frequent trains</td>
<td>• Interconnection between Energy and mobility systems</td>
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<tr>
<td>• Cyber-security solutions</td>
<td>• Autonomous trains</td>
<td>• New types of rail transport solutions (pods &amp; others)</td>
<td>• Apply digitalisation to energy</td>
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<tr>
<td>• End-User/citizen-centric services</td>
<td>• Automated freight operation</td>
<td>• Stations and terminals as mobility hubs</td>
<td>• Slient railways</td>
</tr>
<tr>
<td>• Digital control command</td>
<td>• AI &amp; Robotics</td>
<td></td>
<td>• Pro-active security</td>
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<td></td>
<td>• Extracting value from data</td>
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<td>• Non-invasive inspection solutions</td>
</tr>
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#### COST SAVINGS AND DEPLOYMENT OF INNOVATION

- Improved deployment, bottom-up transport system standards solution, better adapted regulation/certification (virtual), rapid deliveries...
**EU as an area of:**
- European wellbeing - freedom of movement of peoples and goods
- Sustainability - economic development

**EU policy priorities**
- European Green Deal: decarbonisation through sustainable and smart (-multimodal) mobility
- An economy that works for people: Support growth and increase competitiveness
- A Europe fit for the digital age: Innovation and modernisation

**EU rail policy objectives**
- Sustainability, interoperability, safety, connectivity (e.g., SERA)
- Passenger focused: Customer experience, accessible mobility
- Rail freight improved: performance and competitiveness
- Faster modernisation of the rail industry including deployment for the whole sector

**New Rail iPPP vision objectives expected impacts**

**general objectives**
- Integrated European Rail Networks
  - Urban
  - SERA

**specific objectives**
- Zero emission rail systems: Circumstances economy applied to the rail sector
- Freight logistic chain: Integration and common technological solutions applied to integrate operations across EU to serve user needs
- Zero barriers rail systems for passengers
- New land guided systems’ concepts

**Shift2Rail**
R&I BEYOND 2020

HORIZON EUROPE

Fundamental research and « blue sky »

BREAKTHOUGH IDEAS
TRL: 0 -> 2

BREAKTHOUGH IDEAS
TRL: 0 -> 2

APPLIED RESEARCH
TRL: 3 -> 7

DEMO
S2R solutions with S2R JU supervision

LARGE SCALE OPERATIONAL DEMOS
TRL: -> 9

Transforming overarching project:
*Future Railway System as a whole, with connection with other transport modes*

Deployment Activities
CEF / BLENDING / OTHER

Projects
Transforming
Projects reaching TRL9

Partnership collaboration

exchange
S2R JU and Western Balkans

- MoU between S2R JU and South East Europe Strategic Alliance for Rail Innovation (SEESARI) signed in 2018 to promote mutual cooperation
- Exchange of information, experience and best practice on railway system transformation, focus on digitalisation and interoperability
- Creation of opportunities for testing demonstrators resulting from S2R R&I in SEESARI area
- Joint Declaration: “Engage in R&I regarding the deployment of digital, autonomous, connected and sustainable rail systems and operations”
- Possible areas of S2R of interest for Western Balkans: IP3 (predictive and condition based maintenance of IF), IP5 rail freight (digital, autonomous solutions), IP2 ERTMS
- Possible MoU S2R JU and Western Balkan Transport Community