

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

4rd TC on Rail

Belgrade 4-5 March 2020

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@Shift2Rail\_JU  
#Horizon2020





**28**  
MEMBERS



**412**  
PARTICIPANTS



**29**  
COUNTRIES

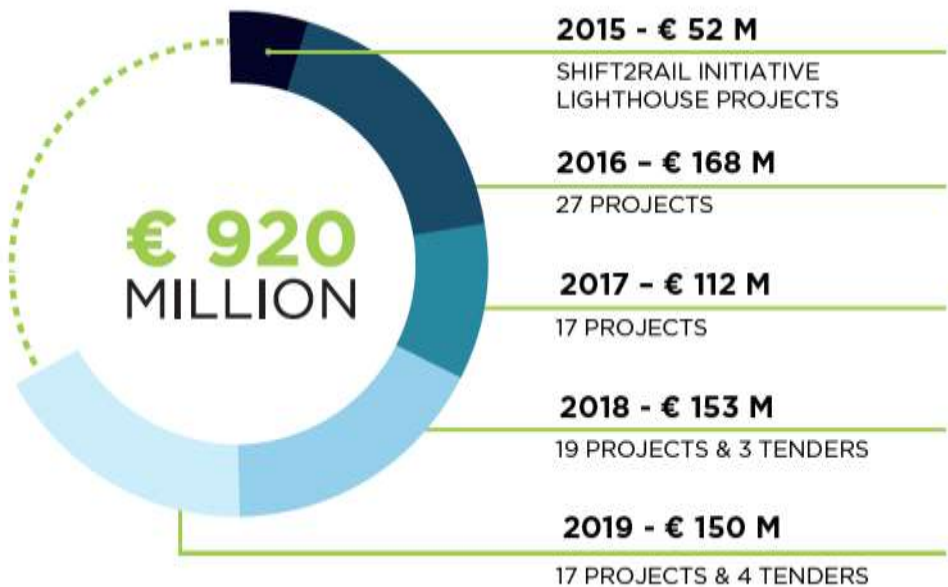


**109**  
SMEs

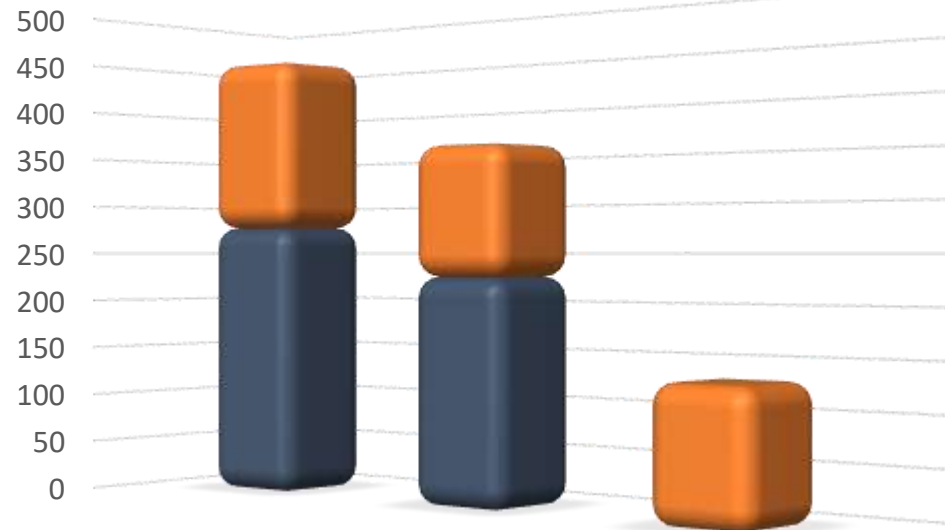


**113**  
RESEARCH CENTRES  
AND UNIVERSITIES

## AN OPEN and ACTIVE ORGANISATION



\*incl. at least 120M€  
of additional activities



8 Founding  
Members

19  
Associated  
Members

Open Calls

Values as at 1 Sept 2016 in Million EUR



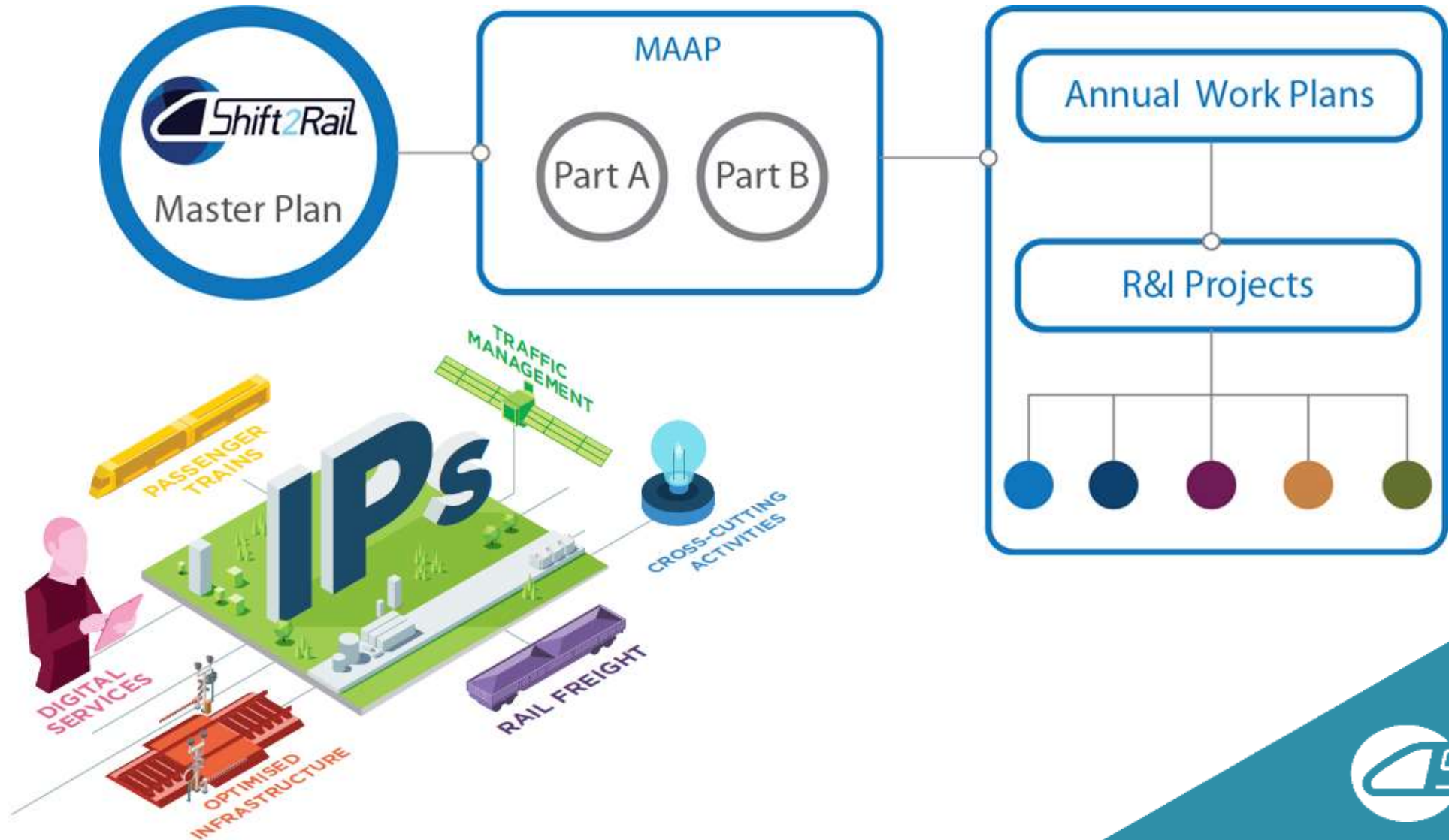
# AN OPEN and ACTIVE ORGANISATION



...opening up new  
Capabilities coming from  
emerging technologies or  
concepts!

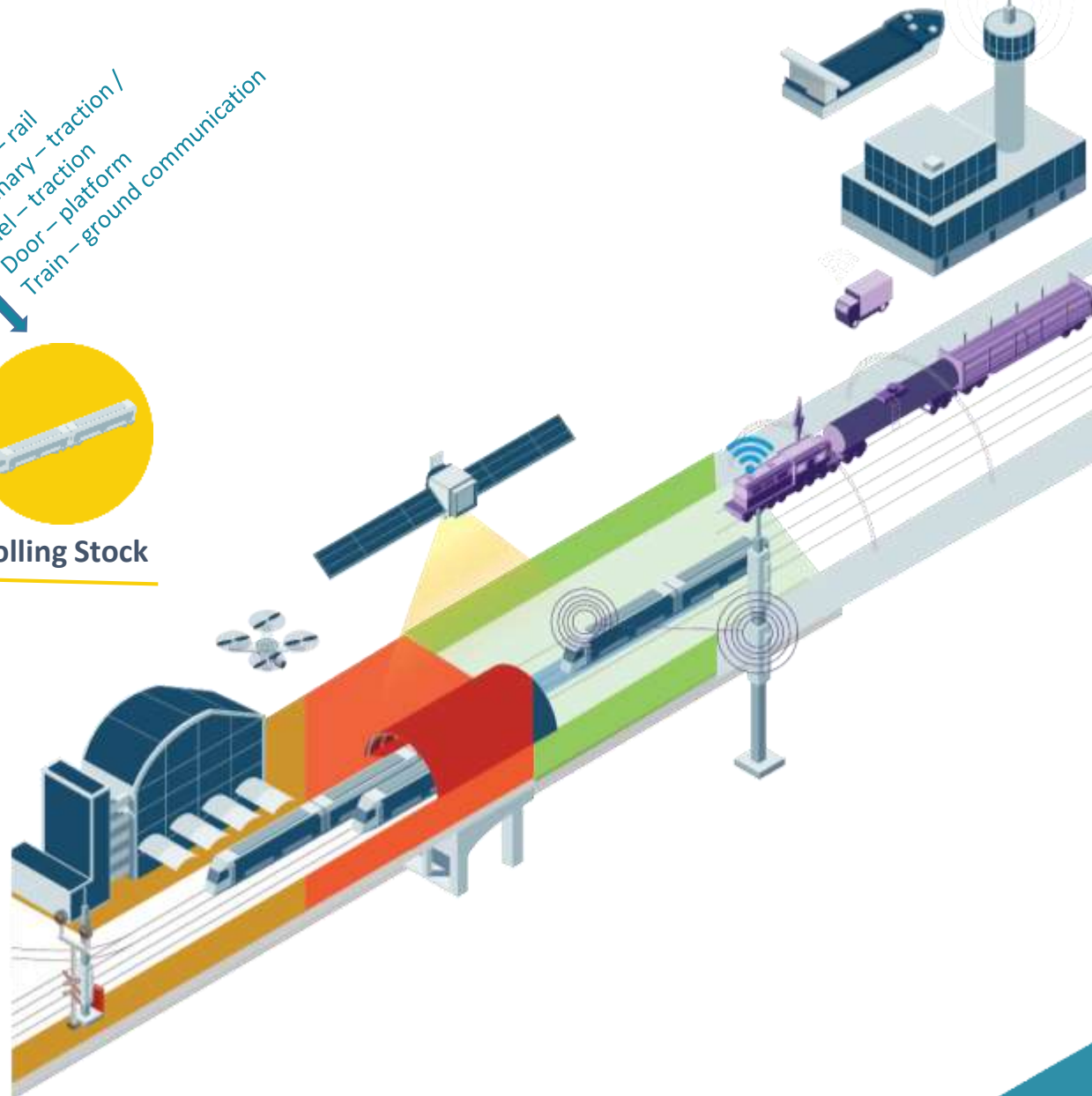
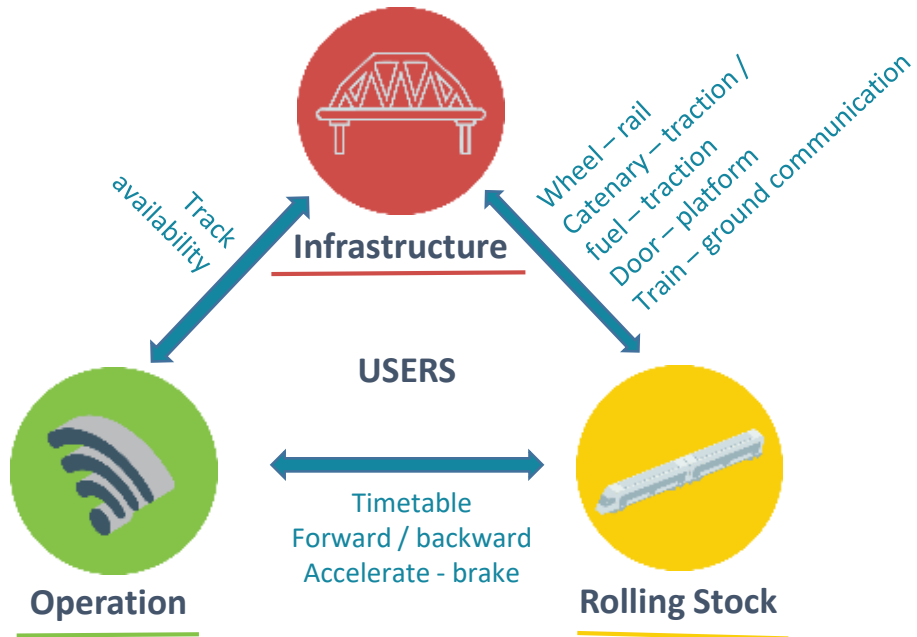
# Programme approach

# The S2R Programme implementation





# 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

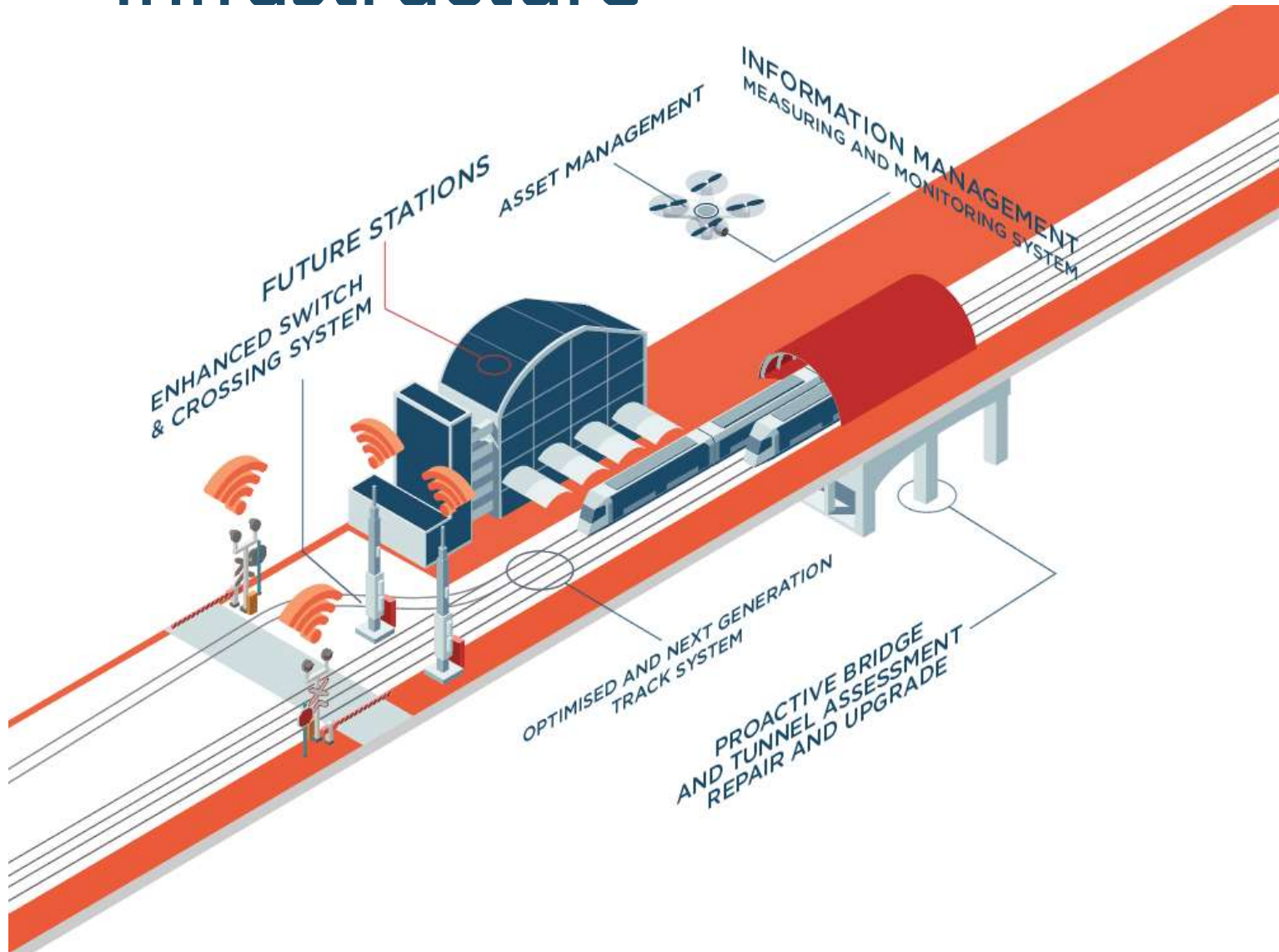
**IP3** Cost-efficient, Sustainable and Reliable High Capacity Infrastructure

**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 und tunnels,  
new station design

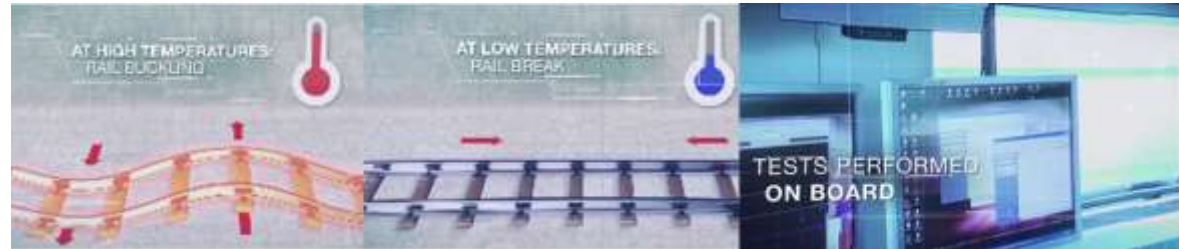
Asset  
Management

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>

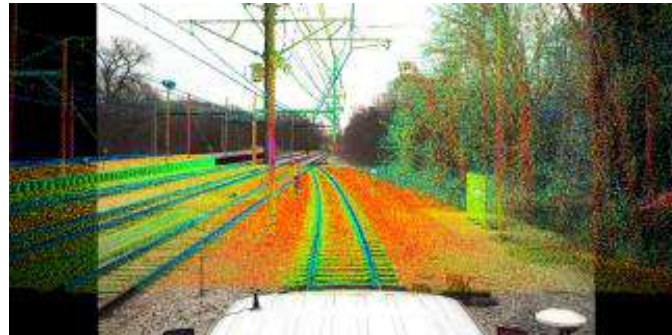


# GoSafe Rail detection technologies



Automatic Radar system

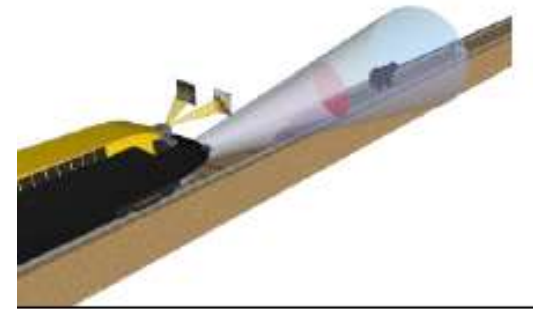
Lidar (3-D laser scanning)



Train mounted thermal camera

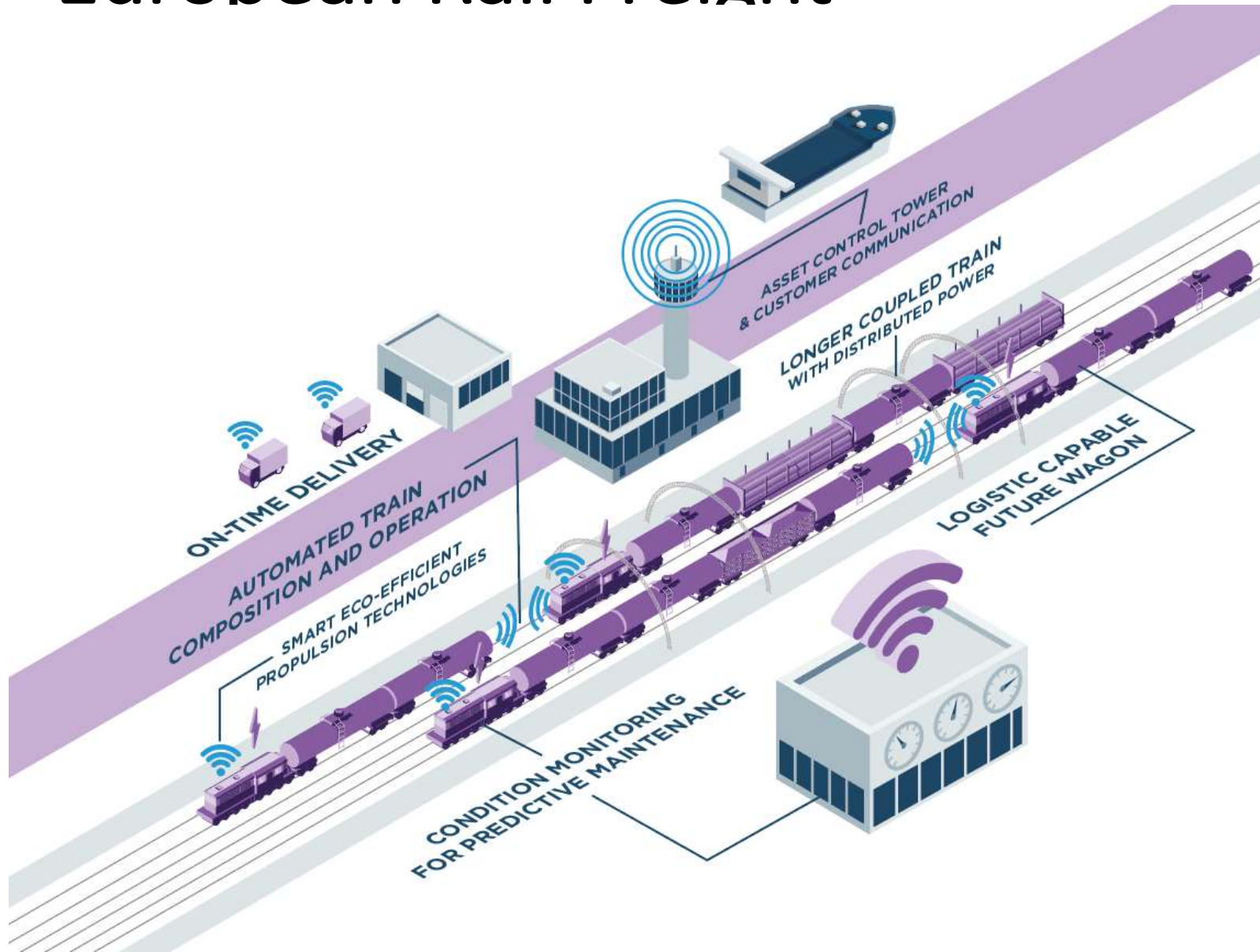


Drones equipped with high resolution cameras flying in front of the train



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

[https://projects.shift2rail.org/s2r\\_ip5\\_n.aspx?p=S2R\\_SMART2](https://projects.shift2rail.org/s2r_ip5_n.aspx?p=S2R_SMART2)



Automatic brake test and a new silence wheelset





# AWP and Call 2020: Open Calls IP3

# S2R-0C-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](https://projects.shift2rail.org/s2r_ip_TD_r.aspx?ip=3&td=0bacb768-862f-4382-bc4d-b9629d0fa9d8)
- <https://shift2rail.org/wp-content/uploads/2019/11/ANNEX-GB-Decision-8-2019-Annual-Work-Plan-and-budget-for-2020-REV-20191128.pdf>

# Union Institutional Partnership for Transforming Europe's Rail System

1

## CHALLENGES FOR THE MOBILITY OF 2030

### ATTRACTIVENESS & CONVENIENCE

- End-user/citizen driven services (passenger & logistics)
- Integrated **door-to-door** mobility
- Minimising Journey Time. No waiting times
- **Punctual, reliable & secure**
- **Comfortable & quiet**
- **Affordable and tailored** for all needs

### MAXIMISED AFFORDABLE CAPACITY

- **Matching capacity with demand**
- **Affordable** and minimising infrastructure changes
- **Resilient** transport system and quick recovery
- **Customised & Flexible:** adaptable to changing needs

### SUSTAINABILITY/SECURITY

- Decarbonised mobility
- **Energy efficiency**
- **Reducing congestion** in populated areas
- **Limiting noise, vibration and ground space**
- More secure and resilient

*"The rail sector addresses these challenges as the backbone of integrated mobility"*

2

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

### DIGITALISATION

- Connected & integrated railways
- Intelligent & cost efficient asset management
- Cyber-security solutions
- End-User/citizen-centric services
- Digital control command

### AUTOMATION

- Real time operational management
- Trains running closer together: Platooning & virtual coupling
- Autonomous trains
- Automated freight operation
- AI & Robotics
- Extracting value from data

### NEW MOBILITY SOLUTIONS

- Seamless integration between modes of transport
- Smaller and more frequent trains
- New types of rail transport solutions (pods & others)
- Stations and terminals as mobility hubs

### SUSTAINABLE SOLUTIONS

- Green energy technologies
- Interconnection between Energy and mobility systems
- Apply digitalisation to energy
- Silent railways
- Pro-active security
- Non-invasive inspection solutions

3

## COST SAVINGS AND DEPLOYMENT OF INNOVATION

Improved deployment, bottom-up transport-system standards solution, better adapted /regulation/certification (virtual), rapid deliveries...

**ERRAC**

**challenges and answers towards 2030 mobility and transport**



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

general objectives

**Integrated European  
Rail Networks**

Urban      SERA

**Deliver multimodality**  
Connected and automated door to  
door mobility for citizens and  
freight users

**Delivering European rail industry  
competitiveness**  
Bring to the market R&I results  
through coordinating live, large-  
scale demos

specific objectives

ETML (European  
Traffic Management  
Layer): develop the  
operation  
management level  
intended to optimise  
train movements at  
EU level

Mobility on Demand:  
develop a demand  
driven customer  
oriented system with  
multimodal solutions  
from door to door

Automated and  
autonomous  
sustainable and  
secure operations  
in EU corridor(s)  
building upon  
intelligent vehicles  
and digital  
infrastructure

Zero emission  
railway systems:  
circular economy  
applied to the rail  
sector

Freight logistic chain  
integration and  
common  
technological  
solutions applied to  
live pilots operations  
across EU to serve  
user needs

Zero barriers rail  
systems for  
passengers

New land guided  
systems' concepts

# New Rail iPPP

## vision objectives expected impacts

# R&I BEYOND 2020

HORIZON EUROPE

Fundamental research and  
« blue sky »

R&I

DEMO

S2R solutions with S2R JU  
supervision

BREAKTHROUGH IDEAS  
TRL: 0 -> 2

APPLIED  
RESEARCH  
TRL: 3 -> 7

LARGE SCALE OPERATIONAL  
DEMOS  
TRL: -> 9

Transforming overarching project:

*Future Railway System as a whole, with connection with other transport modes*

exchange

Partnership collaboration

Transforming-  
Projects  
reaching TRL9

DEPLOYMENT  
ACTIVITIES  
CEF / BLENDING /  
OTHER

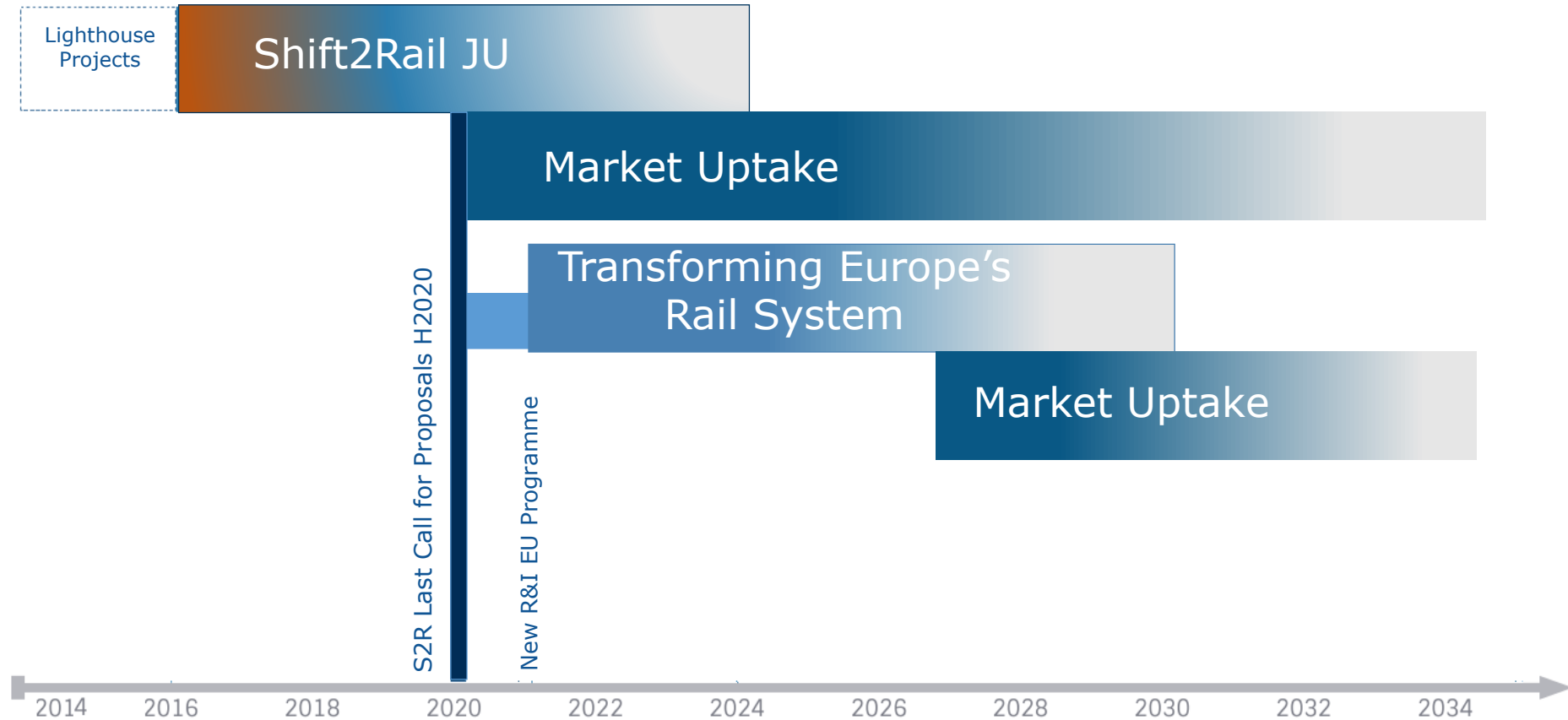
Deployment Proj

Deployment Proj

Deployment Proj

Deployment Proj

# RAIL R&I BEYOND 2020



# 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



## FOUNDING MEMBERS



## ASSOCIATED MEMBERS

