IP5 TECHNOLOGIES FOR SUSTAINABLE AND ATTRACTIVE EUROPEAN RAIL FREIGHT

❖ Context & Motivation
  ▪ Intra-EU rail freight transport decline in past years
  ▪ Shift of 30% of road freight over 300 km to rail by 2030
  ▪ More than 50% by 2050.

❖ Global Objectives
  ▪ IP5 Core objective is to increase competitiveness of European Rail Freight:
    1. Maintain and defend its market position in the transport segments of today making use of digitalization
    2. Open up new market segments so that in total an effective gain of the overall market share becomes reality.
  ▪ Capacity Increase
  ▪ Operational reliability increase
  ▪ Railway System life cycle cost reduction
  ▪ Energy Efficiency
  ▪ Noise Reduction

❖ Past projects & IP Structure
  ▪ Use input from other EU projects developed in the field of freight, such as MARATHON, SPECTRUM, TIGER, E-FREIGHT, and D-RAIL etc.
  ▪ The IP is structured in seven (7) TDs with the ambition to deliver demonstrations at TRL 6-7.
IP5 TECHNOLOGIES FOR SUSTAINABLE AND ATTRACTIVE EUROPEAN RAIL FREIGHT

Overview of the Technical Demonstrators
• TD5.0 – Business analytics and implementation strategies
• TD5.1 – Freight electrification, brakes and telematics
• TD5.2 – Access and Operation
• TD5.3 – Wagon design
• TD5.4 – Novel Terminal, Hubs, Marshalling Yards, Sidings
• TD5.5 – New Freight Propulsion Concepts
• TD5.6 – Autonomous train operation

Expected value of the entire IP : EUR 82,7M
TD5.0 Implementation Strategies and Business Analytics

✓ Concept & Objectives

Dual Strategy Concept

- **Technical developments** in the field of wagons, its equipment or components, operational procedures, automation and algorithms, which are gathered in TD5.1 to TD5.6

- Perceive the rail freight transportation as an *integral part of the transport and logistic supply chain* (e.g. different business models depending on the value of the goods), which has to meet the requirements of the transport market today and in the future under progressive socioeconomics and environmental constraints. The mere support of technological advancement is not sufficient to ensure success.

✓ Specific Achievements

- Overview of *relevant segments of the transport and logistics market* which are currently served by rail (fully or partly) and of segments which could be served with appropriate technical improvements and adequate business models (focus on wagon design and components)

- Definition of *features and quality/cost parameters (KPIs)* required by customers and railways/logistics service providers to improve the competitiveness of rail freight and to realize the potential of rail freight to a greater extent.

- Development of *Migration Plans* for the introduction of new technologies, equipment and services to be developed in TDs. The focus will be on the European-wide roll-out of key technologies following Shift2Rail. In particular the demands of TAF/TSI standard data exchange.

✓ Specific time-frame

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<th>Task</th>
<th>2016</th>
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<td>Exchange of information with participants</td>
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<td>(migration plans for introduction of new</td>
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<td>technologies, equipment and services)</td>
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<td>Development work in TD5.1-TD5.6</td>
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Estimated Budget: 6,9 M€
TD5.1 Freight Electrification, Brake and Telematics

- **Concept & Objectives**
  - Real time monitoring and tracking of cargo
  - Increased punctuality
  - Better transportation conditions
  - Increased flexibility
  - Longer trains and increased loads
  - Cost reduction
  - Increased reliability

  - Telematics and electrification
    - Cargo and wagon monitoring system
    - Wagon On-board unit
    - Freight train status monitoring system
    - Energy harvester
  - Automatic Coupling
    - Automatic Coupling
  - Condition Based Maintenance
    - CBM Processes
    - Component sensing and wearing modeling
    - Algorithms and data handling

- **Specific Achievements**
  - Reduce cost and increase technical availability of assets (locomotives and wagons)
  - Provide real time information, alert notifications on goods, wagon, locomotive and train Conditions
  - Increase of the load capacity and degree of automation for freight trains

- **Specific time-frame**

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<tr>
<th>Tasks</th>
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Estimated Budget: 16,4 M€
TD5.2 Access & Operations

Concept & Objectives

- Develop highly reliable and flexible freight solutions enabling the optimization of overall transport time

- Increase the average speed for rail freight operations (reducing handling and set up times at marshalling yards and in terminals)

- Take into account the new automation technology

- Ensure rail freight better operation in conjunction with passenger traffic in order to maximize the utilization of the existing network.

- These solutions should build on best practices from the passenger sector and from other modes, in terms of information, planning and monitoring systems.

Specific Achievements

- Improved Method for time table planning

- A real-time yard management system and Single wagon load system

- A real time network management system

- Capacity planning in lines with freight trains better harmonized with passenger trains

- Increased speed of freight trains during day time traffic to increase line capacity

Specific time-frame

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<th>Tasks</th>
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Estimated Budget: 9,6 M€
**TD5.3 Wagon Design**

- **Concept & Objectives**

- **Specific Achievements**
  - **Freight Wagon 2020**: Low-noise, lightweight, high speed & track friendly Freight Running Gear Freight Wagon 2020 – for core market share increase & extended markets
  
  - **core markets** = traditional rail freight transport markets. (weight reduction by using high strength steels in bogie/carbody design, improved passive suspensions, wheel set technologies for higher speeds and track friendliness, capability for advanced diagnosis and monitoring functionalities for increased customer experience and reliability).

  - **extended markets** = increase existing and expand future new market share (reducing weight by using low cost composite materials in body/chassis design, aerodynamic, acoustic fairing for lower energy consumption and lower noise, system integration to supply intelligence on board, common chassis with different top units addressing different needs).

- **Specific time-frame**

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Estimated Budget: 10,1 M€
TD5.4 Novel Terminal, Hubs, Marshalling yards, Sidings

**Concept & Objectives**

- The intermodal segment relies mainly on the use of containers and semi-trailer trains. The growth of intermodal transport is one of the critical success factors for shifting cargo from road to rail. Despite the implementation of several yard management systems, there are a lot of necessary physical checks and manual data collection. With the Novel Terminal Design and Operation, the intention is to initiate the next logical step to a higher degree of automation of terminals.

- Additional focus on marshalling yards and sidings where shunting locomotives are a critical part of the value chain. To quickly react to competitive pressure from road, particularly for single wagon loads, and to defend rail freight’s position as most ecological freight mode, Hybridisation of the Legacy Shunting Fleet is most substantial (significantly lower the shunting loco lifecycle cost and achieve greater flexibility of operators for the benefit of customers).

**Specific Achievements**

- “Intelligent Video Gate Terminal” (TD 5.4.1): By 2020, the intention is to optimize a fully operational terminal with an intelligent video gate and data management to enable fast and reliable detection of incoming and outgoing assets.

- “Hybridisation of Legacy Shunting Fleet” (TD 5.4.2): By 2020, the intention is to refit an existing European Diesel shunting locomotive class to test two hybrid prototypes for an energy-efficient and environmentally friendly second life.

**Specific time-frame**

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Estimated Budget: 11.3 M€
TD5.5 New Freight Propulsion Concepts

- **Concept & Objectives**
  - **New powerful EU freight locomotives** with flexible and network independent operation capabilities,
  - Supporting increased train **lengths up to 1500m** & reducing massively energy consumption
  - Providing more attractive rail freight services to the final customer with competitive operating and maintenance costs.

- **Specific Achievements**
  - **Future Freight locomotive**: Advanced engine control, noise reduction, track friendly bogie designs, waste heat recovery systems
  - **Full electric last mile propulsion system**: mission management, thermal conditioning units for Li-Ion batteries, authorization of locomotives with Li-Ion batteries
  - **Long freight trains up to 1500m** with distributed power, braking capabilities, adequate radio communication, **European authorization**
  - **Driver Advisory System (DAS) connected to the various traffic management systems.** develop and implement a European standardized electronic interface for exchanging driving advices between Infrastructure Managers and Railway Undertaking.

- **Specific time-frame**

Estimated Budget: 21,8 M€
TD5.6 Long-term vision for an autonomous rail freight system

- **Concept & Objectives**
  - Whereas other modes have been quick to automate transport (ex Automated Guided Vehicle in modern harbors), rail runs the risk of lagging behind.
  - Although rail freight has the system advantage that is protected against lane change, there is still no solution for autonomous mainline transport on the market.
  - Develop a demonstrator of rail freight automation

- **Specific Achievements**
  - Test and validate a complete solution for ATO of a rail freight pilot on European mainlines from basic specification of system functionalities up to full testing of a test train on an international track section.

- **Specific time-frame**

  Estimated Budget: 5,7 M€
IP5 members

Deutsche Bahn (Chairman)
Trafikverket (Vice-Chairman)
Alstom Transport
Ansaldo STS
Bombardier Transportation
CAF
Competitive Freight Wagon Consortium (CfW)
Indra
Network Rail
Siemens AG
THALES
Virtual vehicle Austria Consortium (VVAC+)
EU
# IP5 2015-2016 Calls status

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<th>Subject</th>
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<td>S2R-CFM-IP5-01-2015</td>
<td>FR8RAIL</td>
<td>Requirements for sustainable &amp; attractive european rail freight</td>
<td>TRV</td>
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<td>S2R-CFM-IP5-02-2015</td>
<td>ARCC</td>
<td>Start up activity for freight automation</td>
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<td>S2R-CFM-IP5-03-2015</td>
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<td>Freight Propulsion Concepts</td>
<td>BT</td>
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<td>Freight Automation</td>
<td>BREMEN University</td>
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<td>S2R-OC-IP5-02-2015</td>
<td>DYNAFREIGHT</td>
<td>Improve vehicle/train dynamics</td>
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<td>S2R-OC-IP5-03-2015</td>
<td>INNOWAG</td>
<td>Intelligent freight wagon with predictive maintenance</td>
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IP5 2017 Open Call

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<td>S2R-OC-IP5-01-2017</td>
<td>Real-time yard and network management</td>
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Proposals should address all the following elements:

- definition and selection of suitable methods for data analytics and data management
- design and selection of a suitable simulation environment for real-time yard management in marshalling yards
- development of detailed functional and technical specifications of selected simulation environment including interfaces with real-time network management and IT production fulfillment system
- development of framework conditions and algorithms for disposition of resources in yards in real-time and adaptation of existing simulation systems according to the results of specification
- testing of simulation system in a production-like test and training environment focusing on one up to three existing Complex European marshalling yards
- performing feasibility test of real-time capabilities of the simulation system according to defined test cases, applicable to today’s operation in single-wagon load and block train transport
IP5 Vision for Future Freight

- High load efficiency
- Low energy consumption
- Low noise emissions
- Fully integrated logistical chain
- Increased intermodal competitiveness
- New services for new markets

- Increased flexibility through train coupling/sharing
- Increased train length for growth on European corridors
- Competitive strength

- Maximizing service quality, productivity, resource utilization and network capacity
- Pan-European rail freight as key enabler for automated driving systems

- Logistics capable Future wagon
- Longer coupled trains with distributed power
- Smart eco-efficient propulsion technologies

- Automated train composition and operation
- Condition monitoring for predictive maintenance
- Asset Control tower & customer communication

- Boosting productivity/punctuality
- Competitive cost structures
- Stimulating sustainable rail freight growth in Europe

- Driver assistance, hybridization and advanced propulsion technologies
- Significantly reducing energy consumption and emissions
- LCC cost and customers benefit
- Cost-efficiency in maintenance and operations
- Based on smart freight assets
- Maximizing reliability