Session d’information sur l’entreprise commune Shift2Rail
IP5, des technologies pour un transport de marchandises européen durable et attractif

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MEDDE/CGDD/DRI

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IP5

Technologies for sustainable & attractive european freight

- New service oriented profile
- Increased productivity
- Partners/members in IP 5
  - Trafikverket,
  - CAF,
  - Ansaldo STS,
  - Bombardier,
  - DB,
  - INDRA,
  - CFW
    - *Contraffic GmbH, DLR, Waggonbau Niesky GmbH, Transcare GmbH, CEIT, Verband der Bahnindustrie in Deutschland*
  - VVAC+ (Virtual Vehicle Austria)
    - *Virtual Vehicle, FCP, Getzner, Kirchdorfer, Liebherr, Plasser&Theurer, Voestalpine Schienen, Voestalpine VAE, Wiener Linien, AVL, PJM, TATRAVAGONKA, AC2T, MCL*

IP5

Technologies for sustainable & attractive european freight

- **Main objectives from MP**
  - Improve services and customer quality
  - Reduced system costs
  - Enhanced Interoperability and capacity
  - Simplified business processes
- **Some important focus of the Multi Annual Action Plan**
  - Electrification and telematics enables via automated couplers/energy harvesting an automated approach in nodes and on the line
  - Capacity will be handled in real time yard management
  - Intelligent freight wagons
  - Efficient and automated terminals
  - Longer trains, freight locos of the future
  - Automation
  - Etude

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TD 5.0 – Business analytics and implementation strategies
(estimated budget 6.9M€)

- **Specific achievements to be delivered by TD5.0 (objectives table)**
  - 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 -(cf. Shift2Rail Scoping Paper, Task5.0.1 “Identification of Market Segments”)
  - Founding of a good working relationship with shippers and end customers for change of information, deriving specifications and validation of concepts and solutions to the benefit of the freight rail sector towards higher market share in the transport business. Addressing short improvements for increased competitiveness of the freight rail sector (ref. SmartRail project)
  - Definition of features and quality/cost parameters 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 (cf. Shift2Rail Scoping Paper, Task 5.0.1 “Development of KPIs” and SmartRail).
  - Migration Plan for the introduction of new equipment, wagons and services to be developed in TD5.1-TD5.6 including compatibility issues (cf. Shift2Rail Scoping Paper, Task 5.0.3 “Migration Plan)
- **Implementation of the work program**
  - Task 5.0.1 Identification of market segments
  - Task 5.0.2 Development of Specifications and Key Performance Indicators
  - Task 5.0.3 Migration plan
  - Task 5.0.4 Feasibility Study on business impact of semi-autonomous movement of single wagons insidings

TD5.1 Freight electrification, brakes and telematics
(estimated budget 18.5 M€)

- **Technological output to be delivered**
  - Telematics applications and electrification that will provide real time monitoring and tracking of cargo for logistic purposes and provide information to TMS about the convoy (EoT), real time conditioned monitoring (wagon and goods), automatic train set-up functionalities and information to the driver.
  - Automatic coupling and decoupling including power, air and data connectivity, which will serve electrification for condition monitoring of wagon and goods. that will enable an increased flexibility in the convoy composition
  - Development of an end-to-end solution for Condition-based maintenance, including processes, data handling, analytics, dashboards and a complete condition-based maintenance regime for a specific locomotive fleet covering the main modules traction motor, power conversion and train protection
- **Demonstration activities**
  - DEMONSTRATION ACTIVITY 1 – **TRL6** – telematics and electrification, automatic coupling with new wagon design (TD5.3)
  - DEMONSTRATION ACTIVITY 2 – **TRL6** – telematics and electrification with network management (TD5.2) and intelligent gate terminals (TD5.4)
  - DEMONSTRATION ACTIVITY 3 – **TRL7** – Condition based maintenance - In a live environment, the CBM system will, based on a CBM regime for a specific locomotive class, assign maintenance tasks to the relevant stakeholder

TD5.1 Freight electrification, brakes and telematics
(estimated budget 18.5 M€)

- **Implementation of the work programme**
  - T5.1.1 – High level specification definition, feasibility analysis and preliminary testing
  - T5.1.2 – Conceptual /architecture design
  - T5.1.3 – Detailed design/development, implementation and unitary testing
  - T5.1.4 – Integration of components
  - T5.1.5 – Demonstration activities

TD5.2 Access and Operation
(estimated budget 9.7 M€)

- **Technological output to be delivered**
  - A real-time yard management system
  - A real time network management system
  - Capacity planning in lines with freight trains better harmonized with passenger trains.
- **Specific achievements to be delivered**
  - 1. Improved methods for annual and ad-hoc timetable planning
  - 2. Methods to analyse timetable efficiency and robustness in advance and in follow up process
  - 3. Decision support and automation in timetable planning process (including the management of dangerous goods trains and their interaction with sensible targets along the route)
  - 4. Improved methods handling larger disturbances on the line and in yards and terminals in real time
  - 5. Slot planning/management (cross-border/cross-network)
  - 6. ETA calculation for operation
  - 7. Real-time monitoring of resources availability on yards, nodes and network.
  - 8. A real-time yard management system
  - 9. Standardized data formats / new interfaces in coordination with current TAF/TSI standards
  - 10. Increasing speed of freight trains during day time traffic to increase line capacity
  - 11. Systems for shared usage of marshalling yards between different service providers

TD5.2 Access and Operation
(estimated budget 9.7 M€)

- **Specific Demonstration activities and contribution to ITDs/SPDs**
  - Improved Methods for time table planning (TRL5)
    ➔Ready to use basic systems
    ➔Module based standards for deregulated markets with several actors. Connectivity requirements. Tools based on real time information
  - Real time yard management and Singlewagon load systems (TRL 7)
    ➔Ready to use basic systems ending with a pilot
    ➔Integration subsystems with an overall control system tested in a pilot
  - Real time network management (TRL5)
    ➔ Ready to use basic systems
    ➔ Integration subsystems with an overall control system
  - Increasing speed of freight trains during day time traffic to increase line capacity (TRL5)
    ➔Simulation of scenarios on freight Corridors
    ➔ Focus on simulation with time-tabling systems and evaluation.
- **Implementation of the work programme**
  - Task 5.2.1. Improved Methods for time table planning.
  - Task 5.2.2 New Single Wagon Load and real time yard management system
  - Task 5.2.3. Real-time Network Management.
  - Task 5.2.4 Faster and more dynamic freight trains to increase line capacity

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TD5.3 Wagon design
(estimated budget 10.9 M€)

- **Technological output to be delivered**
  - Low-noise, lightweight, high speed & track friendly Freight Running Gear
  - Freight Wagon 2020 – for core market share increase & extended markets
- **Specific demonstration activities**
  - Running Gear, TRL 5-7
    A track friendly, low weight, low noise high speed **Running Gear** capable to run under standard wagon bodies and the freight wagons 2020 will be demonstrated **in hardware in relevant environment** in a freight train including the technologies from TD5.1 (electrification, …)
  - Core Market Wagon 2020 et Extended Market Wagon 2020, TRL 5-6
    Modular, logistic capable and cost-efficient, low weight, payload and aerodynamic optimised **Freight Wagons 2020 for Core and Extended Markets** will be demonstrated together **in hardware in relevant environment** including technologies form TD5.1 (electrification, diagnosis and monitoring, telematics and communication and automatic coupling) in a freight train
- **Implementation of the work programme**
  - Task 5.3.0 Scanning of innovations
  - Task 5.3.1 Wagon design
  - Task 5.3.2 Running gear
  - Task 5.3.3 Definition of components and running gear and wagon manufacturing
  - Task 5.3.4 Complete freight wagon demonstrator implementation

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TD 5.4 Novel Terminal, Hubs, Marshalling Yards, Sidings
(est. budget 11.2M€)

- **Technological output to be delivered by this TD:**
  - "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.
  - "Hybridization 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 Demonstration activities and contribution to ITDs/SPDs**
  - Intelligent Video Gate Terminal (TD 5.4.1) TRL 7
    ➔Specification of terminal design transhipment processes in terminals equipped with intelligent video gate and information management
    ➔Based on a typical terminal along a European corridor, develop a solution for reduction of dwell time and improved handling of wagons and intermodal loading units using intelligent video gate technology
  - Hybridization of Legacy Shunting Fleet (TD 5.4.2)
    TRL 7➔ Specification of running gear, frame, cab, hybrid propulsion system and safety system for the retrofit of shunting locomotives
    ➔ Based on a reliable shunting locomotive platform, Replace the existing Diesel engine with a hybrid propulsion system consisting of an equally powerful combustion engine and traction battery
- **Implementation of the work programme**
  - Task 5.4.1.1 – Development of the IVG Terminal concept (TRL 3)
  - Task 5.4.1.2 – Development of IVG components and roll-out plan (TRL 5)
  - Task 5.4.1.3 – Demonstrator for IVG-Terminal Operation (TRL 7)
  - Task 5.4.2.1 – Pre-study study of hybrid base application(TRL 3)
  - Task 5.4.2.2 – Hybrid system design & engineering according to specification (TRL 4)
  - Task 5.4.2.3 – Implementation of technical solutions incl. preparation for homologation (TRL6)
  - Task 5.4.2.4 – Prototype testing, operational testing and energy management optimization (TRL 7)
  - Task 5.4.2.5 – Documentation of hybrid concept, lessons learnt and development roadmap (TRL 7)

TD 5.5 New Freight Propulsion Concepts
(estimated budget 22.6M€)

- **Technological output to be delivered by this TD:**
- New powerful EU freight locomotives with flexible and network independent operation capabilities, supporting increased train lengths up to 1500m and reducing massively energy consumption, thus providing more attractive rail freight services to the final customer with competitive operating and maintenance costs.
- **Specific Demonstration activities and contribution to ITDs/SPDs**
  - Freight Loco of the Future (up to TRL 7)
    ➔ Concepts and specifications
    ➔ Generic, specification of 6 vs. 4 axle, definition of power requirements including last mile, specification, design and development of bogie, energy efficiency, remote control via radio without driver for freight loco of the future.
    Study of applicability of new technologies on retrofitted locomotives.
    Subsystem specification and validation with functional mockups and laboratory prototypes.
  - Last Mile Propulsion Systems (TRL 7)
    ➔Architecture, specifications (HW, SW, Test, etc), documentation for construction and commissioning.
    ➔Li-Ion batteries, recuperation, homologation, mission management system, maintenance, system optimization & peak shaping, definition of last mile, homologation of batteries Both for new and retrofitting of Locos Demonstrator Loco in operation (TRL7)
  - Long Trains up to 1500m (TRL 7)
    ➔Development homologation documentation
    ➔Marathon Project is baseline, focus is now getting homologation of a train with no driver on the 2nd Loco
    Phase 1: Development of a European Longer Train Concept including the coordination of an European recognized certification method for operating Longer Trains and identification of the operational and infrastructural constraints
    Phase 2: Realization of Technology Demonstrators by developing and testing of a distributed power solution by radio remote control
    Phase 3: European Homologation and Rollout preparation including the development of a European roadmap for the implementation of Longer Trains
  - Driver Advisory System (TRL 6/7)
    ➔Definitions & specifications
    ➔Definition, implementation and testing of a European standard for communication for DAS between IMs and Rus for Freight

TD 5.5 New Freight Propulsion Concepts
(estimated budget 22.6M€)

- **Implementation of the work programme**
  - Task 5.5.0. Feasibility studies (indicative (TRL 3)
  - Task 5.5.1. Subsystem technology Specification (indicative TRL 3)
  - Task 5.5.2. Subsystem technology development (indicative TRL 5)
  - Task 5.5.3. Fully electric last mile propulsion system (indicative TRL 2-6)
  - Task 5.5.4. Manufacturing of the demonstrator (indicative TRL 6.)
  - Task 5.5.5 Homologation (indicative TRL 6):

TD 5.6 Autonomous train operation (estimated budget 6.7M€)

- **Technological output to be delivered by this TD:**
  - By 2020 TD5.6 will, in close linkage to TD2.2, 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.
  - The tests will accordingly be held starting with GoA (Grade of Automation) 2 with supervisor in cab, testing the system for semi-automated operation in near future scenarios, and extending the functionalities gradually to testing of unattended operation under GoA4 for long-term future scenarios. ETCS level 2 Baseline 3 in the most recent maintenance release and the ATO module developed in IP2 will be the basis. The development will focus on:
    - Implementation of the ATO module (auto-pilot) commanding loco control optimized for freight profiles, technically realized outside the safety-relevant ETCS architecture;
    - Obstacle detection by means of sensor-fusion from radar, lidar and stereo camera systems for short distance shunting onto buffers, and long distance forward-looking driving;
    - Fall-back levels built on system self-diagnosis for cases of failure or emergency.
  - The tests on pilot lines will provide:
    - Full scale demonstration of the technology of implementing ATO over ETCS;
    - Full scale demonstration of ATO behaviour within actual Mainline operational constraints (e.g. mixed traffic with fitted and non-fitted trains);
    - Evidence of the interoperability of implemented solutions.
- **Implementation of the work programme**
  - 5.6.1 Freight ATO – GoA 2 Specification
  - 5.6.2. Freight ATO – GoA 2 Prototype Development
  - 5.6.3. Freight ATO – GoA 2 Test Bench Demonstration
  - 5.6.4. Freight ATO – GoA 2 Pilot Line Demonstration
  - 5.6.5. Freight ATO – GoA 4 Feasibility Study.
  - 5.6.6. Freight ATO – GoA4 Specification
  - 5.6.7. Freight ATO – GoA 4 Prototype Development
  - 5.6.8. Freight ATO – GoA 4 Test Bench Demonstration
  - 5.6.9. Freight ATO – GoA 4 Pilot Line Demonstration

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