Shift2Rail Joint Undertaking

Preparation of the Shift2Rail Master Plan

European Commission - DG MOVE

Shift2Rail stakeholder meeting - 20 June 2014
• Shift2Rail: State of play & process
• Background and policy context
• Objectives and general approach
• Priority research and innovation activities
  • Cross-cutting themes
  • Innovation Programmes
Shift2Rail

- State of play & process
State of play & process

- Council Regulation **adopted on 16 June 2014**.
- **Entry into force** on 7 July.
- Set-up activities are underway with a view to making the JU operational by early 2015:
  - First formal meeting of the **Governing Board**, to take place as soon as the JU is formally established (mid-July).
  - Publication of the vacancy notice for the **Executive Director** due end July and recruitment of first staff in autumn 2014.
  - Establishment of **advisory bodies** (States representatives group + scientific committee)
Preliminary draft of the S2R Master Plan:

- starting point = EU transport policy objectives and 4th railway package
- timeframe towards 2030
- builds on the input from the Shift2Rail "promoters", who have been preparing a detailed technical programme for the past 3 years
- broad consultation process, including the European Railway Agency and ERRAC + stakeholder meeting & feedback (until 4 July)
- living document, to be further developed by the JU Members and approved by the JU Governing Board before endorsement by Council (2015)
- to be translated into detailed multi-annual and annual work plans
Open call for Associated Members:

- to be launched by the Commission in **August / September 2014** on the basis of the **strategic Master Plan**
- aim to ensure a **wide and balanced participation of actors from the full rail value chain** + from outside the traditional rail sector
- open to single legal entities or **consortia**
- **individual own financial contribution** of at least 2.5% of the budget of the Innovation Programme in which it participates (~ €2 to €6 million depending on the IP or ~€20 million for participation in all IPs, with a lower threshold for railway undertakings/infra managers)
- **total financial contribution** of 150M€+50M€ in additional activities
- **first activities** to be launched early **2015**
Background and policy context
Key challenges

- **Overall challenge**: strengthen the role of rail in the European transport system
- **Quality of service challenge**: Poor customer satisfaction
- **Cost challenge**: Reliance on public subsidies & low profitability due to product customisation, capital-intensity of investments, long product lifecycles, and long and costly authorisation procedures
- **European challenge**: Fragmentation of rail markets and diversity of national standards
- **Competitiveness challenge**: increasing global competition in the rail industry
- **Know-how challenge**: Technical know-how in decline with 30% of sector workforce retiring within next 10 years
EU Policy context

White paper on transport

Single European Railway Area

Regulatory Approaches (incl. technical standards)
Fourth Railway Package

Infrastructure policy and investment
Connecting Europe Facility

Research and Innovation Policies to complement and support the regulatory and policy approaches
Horizon 2020
White Paper – a vision for rail transport 2050

**Freight**
- Shift 50% of road freight over 300 km to other modes
- Double rail freight volumes
- Achieve CO2 free city logistics in major urban centres
- Connect all seaports to the rail freight system
- Rail Freight Corridors
- Deploy ERTMS

**Passenger**
- Triple length of high-speed rail network
- Majority of medium-distance passenger transport by rail
- Connect all core network airports to the rail network
- Phase out ‘conventionally-fuelled’ cars in cities
- Multimodal info, management & payment system
Fourth Railway Package

- Improve *competitiveness* of rail
- Spend *public money* more efficiently

- Remove administrative and technical barriers to improve interoperability and safety
- Open domestic rail passenger transport to competition
- Better governance of rail infrastructure
- **Innovation** pillar of the Single European Railway Area
Horizon 2020 Funding

Horizon 2020
77 028 M€

Excellent Science
24 441 M€

Industrial leadership
17 016 M€

Societal challenges
29 679 M€

Smart, green and integrated transport
6 339 M€

Rail
450 M€

Air

Road

Water-borne

Urban

Cross-cutting

~7%
H2020 encourages partnerships, namely in the form of Joint Undertakings to:

• Foster focused, coordinated and long-term investment in EU rail R&I;
• Increase the leverage effect of EU rail R&I funding;
• Establish sustained networks and knowledge exchange between diverse stakeholders;
• Ensure a system-wide approach to innovation;
• Support close-to-market projects that meet business and end-user needs;
• Increase the operational performance and cost-effectiveness of rail R&I.
Shift2Rail

Objectives and general approach
• Achieve the **Single European Railway Area** through the removal of remaining technical obstacles holding back the rail sector in terms of interoperability;

• Radically enhance the **attractiveness and competitiveness of the European railway system** to ensure a modal shift towards rail;

• Help the European rail industry to retain and consolidate its **leadership on the global market** for rail products and services.
Specific objectives of Shift2Rail

Shift2Rail

Single European Railway Area
- Improved services and customer quality
  - Improved reliability
  - Enhanced capacity
  - Customer experience

Attractiveness and competitiveness
- Reduced system costs
  - Lower investment costs
  - Reduced operating costs
  - Externalities
- Enhanced interoperability and safety
  - Respect and adaptation of TSIs
  - Removal of remaining open points

Leadership on the global market
- Simplified business processes
  - Improved standardisation
  - Simplified certification and authorisation
Shift2Rail approach and themes

- 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
Typology of activities

**RTD activities**

**Other supporting activities**

**Demonstration activities**

- **Technology Demonstrators (TDs):** Projects which specify, develop and demonstrate a specific technology, resulting in a laboratory tested and/or simulated prototype.

- **Integrated Technology Demonstrators (ITDs):** Projects integrating / combining TD prototypes at system level (both in lab and on-site) and testing system performance.

- **System Platform Demonstrators (SPDs):** Assessment of the whole system level performance based on the results of TDs and ITDs. SPDs will bring SZR’s innovative solutions to a technology maturity level for a new generation or railway systems.

**Railway system of the future**

- High-Speed / Mainline Passenger Transport, Regional Passenger Transport,
- Urban/Suburban Passenger Transport, Freight Transport
Shift2Rail
-
Priority research and innovation activities
Shift2Rail
-
Cross-cutting themes
1. Long-term needs and socio-economic research

- Identify and better understand **societal needs and key trends** (urbanisation, demographic changes, hyper-connectivity, etc.) affecting rail services in different segments

- Common methodology and tools to better understand the mobility behaviour of users and predict **customer needs** and reactions to innovative mobility measures

- Customer-oriented **business models** of the future

- **Common methodology for evaluating the economic, safety and environmental impacts, costs and benefits** of the different R&I actions and their contribution to the Shift2Rail objectives
2. Smart materials and processes

- Simplify authorisation processes and eliminate on-track testing
- Integrate best practice from other sectors for inspection, verification, testing and certification
- Adapt innovative industrial processes and materials from other sectors (mechatronic science, advanced robotics, nanomaterials, 3-D printing, big data analytics)
3. System integration, safety and interoperability

- Ensure that TSIs are fulfilled and, where possible, close remaining open points in today’s target system specifications, propose adaptation of TSIs to take into account new technologies

- Define a target operations concept, defining the optimal level of harmonisation of operation and traffic management

- Develop an integrated operations concept, with seamless information exchange, that allows for harmonisation across Europe and enables all rail stakeholders to measure their performance and optimise their operations and planning

- Develop a whole-system approach on safety and risk
4. Energy and sustainability

- **System approach** integrating energy, noise and vibration into all IPs and projects to achieve optimal technical solutions across all system platform demonstrations

- Develop **methods for quantification of energy and CO₂ savings** at EU level based on different levels of investment

- Adapt **solutions from the energy sector** on standard power supply systems, smart grid design & integration of renewable energy sources (solar, wind, fuel cell technologies, hybrid propulsion, etc.)

- Further enhance **methods for predicting overall noise performance on a system level** (with separation and ranking of contributing sources) and clarify future targets for Noise TSI
5. Human capital

- System approach integrating the human factor in all IPs and projects
- Analyse the implications of technology-driven changes on staff
- Railway skills forecasts and gap analysis
- Improved risk management
- Develop a new generation of decision support tools, including timetabling and maintenance schedule planning
- Develop virtual learning environments, simulations and lifelong learning programmes
Shift2Rail
-
Innovation Programmes
Session 1: Advanced infrastructure and traffic management systems

• **Intelligent traffic management and control systems**, beyond signalling, building on current ERTMS, to optimise capacity, reliability and safety, while minimising life-cycle cost and providing better customer information (IP2)

• New railway **infrastructure** system that will radically improve performance, enhance capacity and reduce costs related to development, maintenance and renewals (IP3)
### Traffic management & control (IP2)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
</table>
| Improved services and customer quality | • Reduced risk of failure or disruption and faster operational recovery in case of failure, thanks to advanced traffic management systems and simplified architectures.  
  • Shorter headways and more flexible use of the vehicles on the line allowing a higher level of service to passengers and freight operators at peak times.  
  • Increased punctuality and use of real-time data for improved passenger information.                                                                 |
| Reduced system costs                    | • Reduction of construction and deployment costs thanks to flexible architectures, generic designs and layouts, standardised products and interfaces, that are adaptable to different market segments.  
  • Fewer and optimised maintenance interventions thanks to predictive maintenance, with auto-diagnostic functions and self-healing processes, and the reduction of electronic and mechanical components installed along the line.  
  • Reduction in the consumption of energy with the introduction of Intelligent Traffic Management, Driver Advisory Systems (DAS) and appropriate automatic train operation (ATO) functionalities.  
  • Decrease in carbon emissions and air pollution thanks to enhanced traffic management (including predictive and adaptive operational control of train movements). |
## Enhanced interoperability

- Control system design follows a holistic approach, taking into account interfaces with other sub-systems and using generic designs and layouts, standardised products and interfaces, thereby improving interoperability, including with the urban and mass transit railway sectors.

- Remaining technical “open points” in existing target system specifications (TSIs) are closed, in particular on electro-magnetic compatibility.

- Calculation of train data is harmonised and "integration" of ETCS in the train is improved.

## Simplified business processes

- Introduction of formal methods and assisted or automated testing process/tools - from specification up to commissioning phase - to key elements and systems the failure of which might cause major impact on line operation (e.g. signalling, telecom).

- Modular architectures to divide the validation effort, provide higher granularity interfaces for testing and allow system extensions. Software update processes are improved, taking into account for example the "over the air" (OTA) updating model.

- Improved and shorter authorisation processes, relying on lab methods rather than on on-track tests.
Priority R&I areas:

- Smart, fail-safe **communications and positioning** systems
- **Traffic Management Evolution**
- Automation
- Moving block and train integrity
- Smart procurement and testing
- Virtual coupling
- Cyber security
### Railway infrastructure (IP3)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improved services and customer quality</strong></td>
<td>• Novel designs and technologies with simplified architectures for key components and systems make them less prone to operational failure.</td>
</tr>
<tr>
<td></td>
<td>• Infrastructure is compatible for operation over 350km/h for passenger transport, and for high-speed freight. It is safe and resilient to degradation from weather and wear.</td>
</tr>
<tr>
<td></td>
<td>• New concepts for switches and crossings and self-steering vehicles, better asset information and less disruptive maintenance allows for higher utilisation of railway infrastructure.</td>
</tr>
<tr>
<td></td>
<td>• Stations evolve to enable higher throughput of passengers generated by the system's overall increased capacity. They enable seamless, high-quality travel for all passengers.</td>
</tr>
<tr>
<td><strong>Reduced system costs</strong></td>
<td>• Infrastructure (and rolling stock) life-cycles are extended thanks to more reliable and resilient subsystems, components and system architectures, with improved and standardised network-vehicle interface. This results in less infrastructure waste.</td>
</tr>
<tr>
<td></td>
<td>• Fewer defects and less disruptive and costly maintenance thanks to predictive maintenance, integrating risk-based or condition-based analytics, and automated, self-inspecting, adjusting and correcting concepts.</td>
</tr>
<tr>
<td></td>
<td>• Reductions in thermal and energy losses.</td>
</tr>
<tr>
<td></td>
<td>• Mitigation of noise and vibration through the development of innovative designs and quieter components for infrastructure assets.</td>
</tr>
</tbody>
</table>
# Railway infrastructure (IP3)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
</table>
| Enhanced interoperability   | • New infrastructure design takes into account interfaces with other sub-systems and uses generic designs and layouts and a holistic approach, thereby enabling rapid and cost-efficient construction and deployment as well as a reduction of network diversity.  
• Adaption of TSIs to reflect scientific and technological developments.  
• Remaining technical “open points” in existing target system specifications (TSIs) should be closed, in particular when it comes to the design requirement for tracks, including switches and crossings that are compatible with eddy current braking systems or the avoidance of the "ballast pick up" phenomenon, etc. |
| Simplified business processes | • A common "predict and prevent" strategy using risk-based maintenance standards is validated and deployed. More standardised and reliable component technologies are introduced to allow lower maintenance costs and greater interoperability. Special attention is given to track quality parameters and the OCL/pantograph compatibility and interaction.  
• Simplification of authorisation processes. |
Priority R&I areas:

- New directions in *switches and crossings*
- Innovative *track* design and materials
- Cost effective *Tunnel & Bridge* solutions
- Intelligent system *maintenance*
- Improved *station* concepts
- *Energy* efficiency
Session 2: Technologies to make railways more attractive and competitive

- Innovative **IT solutions** and services to provide **passengers** with smart and personalised services for multimodal journey information and ticket purchase, together with entertainment and communication services, making railway services more attractive (IP4)

- Sustainable and attractive **freight solutions**, helping rail to enter into new market segments and become an integrated part of advanced logistic solutions (IP5)
## Innovative IT solutions (IP4)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
</table>
| **Improved services and customer quality** | • Personalised passenger information, combining real-time data on service status with user preferences, resulting in easier door-to-door journey planning, improved perception of reliability and a lesser impact of disruptions.  
• Better and more flexible planning of services building on enhanced passenger information.  
• Enhanced, integrated and universally accessible ticketing systems. |
| **Reduced system costs**     | • Better information on real passenger routes, leading to a better allocation of rail investments in terms of infrastructure and operations.  
• Sourcing and investment costs in advanced ICT solutions will be decreased by the opening of a competitive market, thanks to improved interoperability.  
• Information on the carbon footprint of journeys is provided to customers and enable them to make more sustainable transport choices.  
• Better and more standardised on-line monitoring provide accurate data on the actual condition of the train to optimise vehicle maintenance. |
## Innovative IT solutions (IP4)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
</table>
| **Enhanced interoperability**     | • The TAP TSIs and other standards are fully respected. The activities under S2R may identify opportunities for the development and enhancement of TSI and other standards.  
• Open specifications and access to the open interoperability framework will offer to any European travel industry player the tools to develop smart services for a seamless door to door travel experience, including with other modes of transport, thereby improving interoperability with other modes. |
| **Simplified business processes** | • Harmonised terms and definitions, processes for different services (booking, ticketing, validation, etc.) are defined.  
• Media independent ticketing data content are enhanced to achieve complete interoperability between different modes. |
Innovative IT solutions (IP4)

Priority R&I areas:

• Improved technical framework
• Customer experience applications
• Multimodal travel services
## Innovative freight solutions (IP5)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
</table>
| **Improved services and customer quality** | • Freight wagon design is improved to increase wagon capacity, average speed, train formation and handling times.  
• New generations of locomotives and braking systems enable the operation of longer (up to 1500m) and heavier trains.  
• New terminal management systems include optimal modules for handling and storage in terminals and better coordination of traffic management.  
• Integrated information, planning and systems, covering the entire logistics and transport chains, are implemented to support shippers, forwarders and transport operators with real-time data to improve service delivery. |
| **Reduced system costs** | • Operating costs are reduced with the use of more versatile, track-friendly locomotives and freight wagons, wagons with higher payloads or capacity, higher levels of automation and higher energy-efficiency.  
• Better and more standardised on-line monitoring provide accurate data on the actual condition of the train to optimise vehicle maintenance.  
• Electrification, the development of hybrid propulsion systems and new braking systems result in increased energy efficiency, reduced noise and air pollution.  
• Higher level of standardisation contributes to lower investment and maintenance costs. |
## Innovative freight solutions (IP5)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired outcomes</th>
</tr>
</thead>
</table>
| Enhanced interoperability   | • The TAF TSIs and other standards are fully respected.  
                             | • Information on the movement of trains is synchronised with terminal operation.  
                             | • Interoperability with other modes is improved through better exchange of information with other transport modes, in particular road transport, and with terminals as the interfaces become compatible between the modes. |
| Simplified business processes| • Data on train conditions are integrated in standard diagnostic systems.  
                             | • New sub-systems of freight wagon designs are standardised.  
                             | • Systems and procedures for automation of train formation processes and operation of longer/heavier trains are standardised.  
                             | • Transport documents in intermodal transport chains are harmonised.  
                             | • Simplification of authorisation processes. |

Innovative freight solutions (IP5)

Priority R&I areas:

• Implementation strategies and business analytics
• Freight electification, brake and telematics
• Access and operation
• Wagon design
• Novel terminal, hub, marshalling yard, siding solutions
• New freight propulsion concepts
• Long-term vision for an autonomous rail freight system
• Develop and demonstrate the future generation of trains that:
  • Are lighter, more energy and cost-efficient;
  • provide comfortable, safe and affordable travel experience across Member States (IP1)
• Apply an innovative systems approach instead of traditional, incremental approach
### Cost-efficient and reliable trains (IP1)

<table>
<thead>
<tr>
<th>S2R Objectives</th>
<th>IP1 - Desired outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improved services and customer quality</strong></td>
<td></td>
</tr>
<tr>
<td>Customer experience</td>
<td>• Reliable and safe rail vehicles with a high degree of operational flexibility</td>
</tr>
<tr>
<td></td>
<td>• Comfortable and attractive train interiors</td>
</tr>
<tr>
<td></td>
<td>• Innovative passenger access systems</td>
</tr>
<tr>
<td>Reliability, performance and safety of trains</td>
<td>• Better train subsystems that are known to be more prone to operational failure</td>
</tr>
<tr>
<td></td>
<td>• Better resilience of trains towards extreme environmental conditions</td>
</tr>
<tr>
<td>Capacity</td>
<td>• New vehicle designs will allow more space for passengers</td>
</tr>
</tbody>
</table>
# Cost-efficient and reliable trains (IP1)

<table>
<thead>
<tr>
<th>S2R Objectives</th>
<th>IP1 - Desired outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduced System Costs</strong></td>
<td></td>
</tr>
<tr>
<td>Investment costs</td>
<td>• Improved and simplified authorisation processes</td>
</tr>
<tr>
<td></td>
<td>• More standardised approach to the use of vehicles and its subsystems</td>
</tr>
<tr>
<td></td>
<td>• Retrofitting solutions can help to extend vehicle lifetime</td>
</tr>
<tr>
<td>Operational costs</td>
<td>• Innovative technologies which increase energy efficiency</td>
</tr>
<tr>
<td></td>
<td>• Track friendly vehicles</td>
</tr>
<tr>
<td>Externalities: Noise,</td>
<td>• New design features for traction, brakes, running gear, carbodyshell and doors</td>
</tr>
<tr>
<td>emissions and vibrations</td>
<td></td>
</tr>
</tbody>
</table>
### Cost-efficient and reliable trains (IP1)

<table>
<thead>
<tr>
<th>S2R Objectives</th>
<th>IP1 - Desired outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interoperability</strong></td>
<td></td>
</tr>
<tr>
<td>Respect and adaptation of TSIs</td>
<td>• Adapt and improve the TSIs to take advantage of scientific and technical progress</td>
</tr>
<tr>
<td>Removal of &quot;open points&quot;</td>
<td>• Closing of remaining technical “open points” of TSIs (e.g. doors, safety, EMC compatibility)</td>
</tr>
<tr>
<td><strong>Simplified Business processes</strong></td>
<td></td>
</tr>
<tr>
<td>Improved standardisation</td>
<td>• More standardised and reliable system architectures, component technologies</td>
</tr>
<tr>
<td>Simplified certification and authorisation</td>
<td>• Virtual certification rather than on-track tests</td>
</tr>
</tbody>
</table>
Cost-efficient and reliable trains (IP1)

Priority R&I areas:

- Train **Interiors**
- **Doors** and intelligent access systems
- **Traction**
- Train Control and Monitoring System (**TCMS**)
- **Carbody shell**
- **Running Gear**
- **Brakes**
Next steps

• **4 July:** deadline for written comments on the draft Master Plan to be sent to the following address: move-shift2rail@ec.europa.eu

• **7 July:** Entry into force of the Shift2Rail Regulation

• **August / September:** Launch of the Call of Associated Members
THANK YOU FOR YOUR ATTENTION!

- **Keir Fitch**, Head of Unit, DG MOVE C/2
  - Keir.FITCH@ec.europa.eu
  - +32 229-59316
- **Rachel Smit**, DG MOVE C/2
  - Rachel-Amanda.SMIT@ec.europa.eu
  - +32 229-56302
- **Antoine Kedzierski**, DG MOVE C/2
  - Antoine.KEDZIERSKI@ec.europa.eu
  - +32 229-54232