Over the next couple of months, the first batch of projects to benefit from EU funding under the Shift2Rail research and innovation programme will be selected, and start to get underway.

This pan-European joint technology initiative has been a long time gestating since the initial Declaration of Intent was signed by a group of Unife member companies on July 1, 2011 (RG 1.12 p38). The idea was to establish a ‘more appropriate structure for industry-wide research’ during the EU’s 2014-20 budget period, both to help meet the European Commission’s 2050 goals for the rail sector and to enhance the competitiveness of the European railway supply industry.

After much discussion, the Regulation establishing the Shift2Rail Joint Undertaking was published by the Commission in December 2013 and adopted by the EU’s Council of Ministers on June 16, 2014 (RG 7.14 p12). The JU was legally established as an EU body the following month, becoming the first European Public Private Partnership specifically tasked with leading strategic research in the rail sector.

The nine founding members — including the EU itself — were subsequently joined by Associate Members selected through an open call launched in October 2014 (Table I). These were selected following an assessment of the contribution they could make to the objectives laid down in the Shift2Rail Regulation.

Shift2Rail has a total budget of €920m. Of this, €450m is coming from the EU’s Horizon 2020 research programme and the remainder will be co-financed by the members and other industry partners.

When launched in 2014, the JU was expected to be ‘functionally independent’ by early 2015, but it has taken longer than envisaged to get up and running. A key milestone was reached on February 16 this year, with the appointment of Carlo Borghini as Executive Director (p35). He is due to take up his post this month, succeeding Keir Fitch, the Head of Unit for Research at DG Move, who has been serving as Interim Executive Director.

**Master Plan**

The JU is responsible for co-ordinating, managing and integrating the various EU-approved research and development projects that will be pursued over the next five or six years. These will be undertaken by the Founding Members, Associate Members and third parties.

The overall research strategy is laid out in the Shift2Rail Master Plan, which was endorsed by the Council on February 10, 2015. This confirms the three ambitious targets set out in the initial proposals:

- to cut the life-cycle cost of rail transport by up to 50%;
- to double railway capacity; and
- to increase reliability and punctuality

With 56 research proposals submitted for funding under the first call for proposals the European Shift2Rail joint technology initiative is finally starting to gain momentum.

Academic research bodies and industry partners will be working together on various Shift2Rail projects.

**GIORGIO TRAVAINI**

Programme Co-ordinator
Shift2Rail Joint Undertaking

*RESEARCH Europe*

Shift2Rail moves into full gear
**Table I. Shift2Rail Members**

* European Union
* Axfa-Fmc consortium
* Alstom
* Amaudis IT group
* Ansaldo STS
* AZD Praha
* Bombardier Transportation
* CFV consortium (Competitive Freight Wagon)
* Construcciones y Auxiliar de Ferrocarriles
* Deutsche Bahn
* Diginext
* Euroc consortium (European Rail Operating Community)
* Faiveley Transport
* HaCon Ingenieurgesellschaft
* Indra Sistemas
* Kapsch CarrierCom
* Knorr-Bremse
* MerMec
* Network Rail
* Siemens
* Smart DeMain consortium
* Smart Rail Control consortium
* SNCF
* SW/Tracken consortium
* Patentes Talgo
* Thales
* Trafiverket
* VVAC+

Table I. Shift2Rail Members

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**DIRECTOR**

**Time to get started**

‘Shift2Rail is no longer in the set-up phase’, insists Carlo Borghini, the newly-appointed Executive Director of the Joint Undertaking. ‘We are operational, and moving towards the launch of the implementation activities.’

Appointed by the JU governing board on February 16, Borghini takes up his post this month. He brings experience in running large scale research programmes, as well as European agencies and feels that his experience in different industries will help to ensure the ‘sound implementation’ of the five Innovation Programmes.

Borghini graduated in Business Economics from Milano’s Bocconi University in 1990, and worked for various private companies in the finance sector, including SO.PA.F Group and American Express Bank. He then joined the European Commission as Head of the Internal Audit Unit in the Directorate General for Budget.

In 2008 Borghini was appointed Deputy Executive Director for the SSTAX (Single European Skies Advanced Research) Joint Undertaking covering the aviation sector. With specific responsibilities for corporate governance, administration and finance, he managed a research budget amounting to more than €2bn, and a portfolio of more than 300 different projects undertaken by the 16 SJU members. In July 2014, he moved to the European Defence Agency as Corporate Services Director, responsible for the management of financial and human resources, as well as administrative issues.

‘Shift2Rail is Europe’s most ambitious programme of research in the rail sector’, says Borghini, adding that it is ‘vital to ensuring the long term competitiveness of the industry and to delivering sustainable transport in Europe’. He believes that ‘the enhanced synergies of a Public-Private Partnership are motors for innovation and the prospects are very exciting.

‘Shift2Rail is jointly owned by the EU and industry. This programme is vital at a European level and the IPs identified in the Master Plan will build on the reforms envisaged in the Fourth Railway Package. As well as encouraging competition and innovation in domestic passenger markets, this legislation will implement structural and technical reforms, leading to higher levels of safety, interoperability and reliability in the European rail network. Making rail more attractive for passengers and freight shippers is essential to reach our ambitious transport decarbonisation objectives.’

Borghini points to Enns as ‘a prime example of how the European rail sector can drive innovation and support the creation of a harmonised railway area, improving efficiency, while opening up significant business opportunities for the European rail industry, both in and outside the EU.’

‘Since my appointment, I have started meeting with the key stakeholders in the European rail industry and listened to their concerns. Our primary objective is to implement what we aim to deliver and to start work in each IP. As you can see from our targets there is a lot of work to do, so let’s get started!’

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**Lighthouse projects**

While the JU was being established, the European Commission agreed to move ahead with a series of so-called ‘lighthouse’ projects, which would bridge the gap between the research work supported by the previous Framework Programme 7 and the 2nd Innovation Programmes. Following a call for proposals, €52m was awarded to four 30 or 36-month projects, which were launched in May 2015 (RG 6.15 p63).

In2Rail is setting the foundations for a resilient, consistent, cost-efficient and high-capacity European rail network. It will feed into IP2 and IP3, helping to deliver smart infrastructure, intelligent mobility and improved energy management.

IT2Rail forms the first step towards IP4. The introduction of ‘radical new technologies and solutions’, is expected to transform users’ global travel interactions into a ‘fully integrated and customised experience’. The long-term aim is to make the entire European transport system a natural extension of people’s work and leisure environments, across all modes, local and long-distance, public and private.

**Roll2Rail** is kicking off many of the initiatives to be continued in IP1. It is looking to develop key technologies and help overcome hurdles to innovation in rolling stock development.

**Smart Rail** focuses on rail freight improvements as a prelude to IP5. It covers five aspects that are important to freight shippers: reliability, lead time, costs, flexibility and visibility. The project is looking to test a range of proposals on three so-called Continuous Improvement Tracks, along specified rail corridors.

In addition to the lighthouse projects, across all modes, local and long-distance, public and private.

**Findings**

A prime example of the enhanced synergies of a Public-Private Partnership is the Motor Rail Freight (MRF) project, which is looking for ways to make rail freight more competitive with road freight. The project is looking to improve the reliability and consistency of rail freight services, which are currently up to five days behind road freight. The project is also looking to improve the cost-efficiency of rail freight services, which are currently up to 20% higher than road freight.

The projects are expected to deliver significant benefits for freight shippers, including reduced lead times, improved reliability and cost-efficiency. The projects are also expected to create significant business opportunities for the European rail industry, both in and outside the EU.

**Cross-Cutting Activities**

Cross-Cutting Activities designed to further the integration of railways as a system.
since the beginning of 2016, the JU members have been able to start some additional activities to support the Shift2Rail work programme.

Initial calls

Following the adoption of the Shift2Rail Multi-Annual Action Plan and the Annual Work Plans for 2015 and 2016, the JU published its first calls for proposals in December 2015. These cover research and innovation activities to be conducted over the next 36 months with an estimated value of €170m, co-financed by the EU up to €90m. Some are reserved for the JU members and others are open calls for outside participants.

Announcing the results on March 30, the JU expressed ‘broad satisfaction’ with the response. No fewer than 56 proposals with a nominal value of €222m had been submitted (Table II). These represented a total of 454 participating organisations, of which 25% were SMEs. Analysis of the proposals began in April, and the process is due to be completed by the end of June; the applicants will be informed by mid-July. The selected projects are expected to begin by December at the latest, but some may be getting underway sooner.

Of the 56 proposals, 13 came from the 27 JU members, requesting a total of €63m, to which the members are planning to contribute a further €80m. The 15 open call topics attracted 43 proposals seeking funding close to €80m against an available budget of just €26-1m.

According to Interim Executive Director Keir Fitch, ‘the application rate for the open calls should ensure that we have healthy competition in most of the topics. We are confident that this will result in the JU funding excellent projects in all its Innovation Programmes. We are particularly enthusiastic to see the high participation rate of SMEs.’

As representative of the founding members, Network Rail’s Andy Doherty added that the JU was ‘confident’ that the selected projects would ‘complement the work already launched under the lighthouse projects’.

The initial call covers a mix of projects in each of the IP areas as well as cross-cutting activities.

Within IP1, there are projects looking at advanced traction systems such as silicon carbide semiconductors, as well as new architectures for train control and monitoring, train-to-ground communications and electronic braking.

The IP2 projects initially focus on automation, high-capacity radio communications, and safe train separation; these offer the prospect of improved functionalities and standardised interfaces, helping to facilitate the migration from legacy systems and to decrease overall costs. Another project will address the growing issue of cyber security.

Early IP3 activities are taking a whole-system approach to track, switches and crossings in order to optimise capacity. Work in the structures area will look at ways to extend the life of bridges and tunnels. The aim is to find more holistic, intelligent and consistent ways of maintaining assets, using lean operational practices and smart technologies.

Passenger-centric projects in IP4 will be looking to develop a suite of applications to support a ‘one-stop shop’ selling transport products and related services across different modes. These will offer real-time travel planning and information, including support in the event of disruption. Research will also look at the development of a multi-modal market place supported by an interoperable ‘semantic web’.

Among the initial projects in IP5 will be a range of freight-related research,
including greater automation and the testing of autonomous freight trains. Particular attention will be paid to noise and life-cycle costs, improved freight locomotives, driver advisory systems, and the operation of longer freight trains. A key aim is to address the challenge of last-mile connectivity in the overall distribution chain. Other concepts to be investigated include intelligent wagons with predictive maintenance, especially for perishable, dangerous or expensive goods, and low-cost tracking and tracing systems.

The Cross-Cutting Activities will start by defining the socio-economic factors that can contribute to a more attractive railway, and consider how these relate to the Innovation Programmes. Looking at preferences, behaviours and lifestyles will help the industry to identify the main influencing factors, from mega-trends to evolving customer requirements.

**Technology demonstrators**

The Multi-Annual Action Plan also envisages the development of tools and approaches to evaluate the potential impacts of the various technologies resulting from the different research initiatives.

Shift2Rail is funding various types of research, designated as Co-ordination & Support Actions, Research Innovation Actions and Innovation Actions. The aim is to conclude with demonstration projects up to a Technology Readiness Level of 6 or 7 as defined under Horizon 2020 (Table III).

Demonstration activities are a priority, as they will enable the entire rail sector to visualise and test the concepts. The demonstration phase will be based on a three-level architecture (Fig 3).

The Technology Demonstrators will enable a more appropriate quantification of the impact of each new technology, either alone or in combination through the Integrated Technology Demonstrators. The aim is to encourage a more collaborative system approach toward innovation, breaking down the possible silos between subsystems. This approach will also help to identify any possible compatibility issues at an early stage.

The System Platform Demonstrators will compare the various activities against the system-level targets in the Master Plan. There will also be a ‘transversal evaluation’ to look at energy, noise and vibration issues.

Shift2Rail is taking an integrated approach to railway safety and security, with integrated planning to consider the interdependencies in the railway system.

In order to support this systems approach, a number of call topics and future projects for both members and non-members were included in the first calls as ‘complementary contributions’. These will facilitate the sharing, integration and future exploitation of the results. The project results will also be shared with European Railway Agency, which holds an advisory role in the JU, with a view to ensuring future interoperability as well as safety.

Looking to the future, the JU is preparing to scale up its activities, and launch additional calls for proposals and tenders. It will also ensure adequate funding for the projects that will contribute to achieving the Master Plan targets as they evolve.

**Table III. Horizon 2020 Technology Readiness Levels**

<table>
<thead>
<tr>
<th>TRL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic principles observed</td>
</tr>
<tr>
<td>2</td>
<td>Technology concept formulated</td>
</tr>
<tr>
<td>3</td>
<td>Experimental proof of concept</td>
</tr>
<tr>
<td>4</td>
<td>Technology validated in laboratory</td>
</tr>
<tr>
<td>5</td>
<td>Technology validated in relevant environment</td>
</tr>
<tr>
<td>6</td>
<td>Technology demonstrated in relevant environment</td>
</tr>
<tr>
<td>7</td>
<td>System prototype demonstration in operational environment</td>
</tr>
<tr>
<td>8</td>
<td>System complete and qualified</td>
</tr>
<tr>
<td>9</td>
<td>Actual system proven in operational environment</td>
</tr>
</tbody>
</table>

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