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# DELIVERABLE 1.3
# Rail Innovative Research Observatory

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|---|---|
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# 1. Executive summary

This deliverable reports the result of the task 1.3 of the TER4RAIL project which was aimed at monitoring, identifying and analysing new opportunities for innovative research for the rail sector. The task also focused on facilitating interactions that may lead to transversal exploratory research and knowledge transfer. Finally, the task included a mapping of existing links between non-rail European Technology Platforms (ETPs) and Public Private Partnerships (PPPs).

With the aim to build a Rail Innovative Research Observatory task participants organised interactions and shared experiences between the railway sector and other actors willing to boost innovation (regardless of whether they belong to the sector or not). The establishment of these interactions and their content will continue to support the identification of opportunities for innovative research and innovation coming from other sectors.

The basis for this work has been provided by Deliverable 1.1. "A comprehensive map of rail innovative research and key rail stakeholders" and Deliverable 1.2 "A report on the features of the next scenarios: Overview of the rail missions 2050". These two deliverables have identified and prioritized which topics to address and which actors to focus on in Task 1.3: Digitalisation and materials were identified as most important in the medium term. In the more short-term future 5G, automation, batteries, big data and energy were identified and the long-term future topics that are of highest concern are artificial intelligence, automation, power sources and autonomous mobility.

Chapter 3 of this report defines the methodology, identifies issues to be tackled and describes the way in which the communication actions and interaction between the rail sector and actors willing to boost innovation was developed, e.g. one-to-one contact, integration of dedicated sessions in rail sector meetings and others. A continuously updated Action Plan and close cooperation with S2R and ERRAC stakeholders has guided the development of the work.

Chapter 4 is dedicated to the most important interactions that have been the crucial element of the work in Task 1.3. Many kinds of interactions were organized such as the integration of non-rail experts into existing rail events, one of the most prominent ones being the ERRAC plenary where on one occasion cyber security experts were invited to discuss with rail stakeholders. UITP included a session on Urban Scenarios with architects and other non transport experts into their annual event and UNIFE included TER4RAIL presentations in their Technical Plenary. Other types of interactions were guest presentations at non rail events such as an intervention at the plenary of the European Construction Technology Platform (ECTP) where TER4RAIL was presented. Smaller and informal exchanges were also within the scope of task 1.3 and task partners engaged in several bilateral meetings to update on the TER4RAIL results and identify opportunities for future rail research collaboration.

In addition to the interactions the task included a cross-sectoral mapping of Shift2rail activities with projects of the non-rail European Technology Platforms and Public-Private Partnerships. These mappings provide a scan of existing links in R&I priorities and ongoing projects between

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these entities and the rail sector. The approach to these mappings was to analyse for each of the identified ETPs and PPPs the following:

- mention of railways or Shift2Rail in key documents
- analysis of S2R members that are also members of the platform/partnership
- analysis of the non-rail actor financed projects based on a set of key words. Linkage of research and innovation projects directly or indirectly related to railways, and with S2R TDs and projects
- other information considered relevant such as innovation capabilities, interesting organizational or structural information, etc.

It can be said that all mappings reveal some degree of linkage with the rail sector. Some mention rail more directly and have already identified rail as a use case or example which is the case for 5GPPP. Others have clear relevance for the railway sector such as EURobotics where the rail sector can be considered a use case for several applications in the future. The mappings also reveal among other aspects the number of already ongoing projects with relevance for rail as well as working groups that could offer opportunities for the rail sector to engage with.

Finally, this report features several appendixes providing a documentation of the interactions carried out and an illustration of how the activities were presented on the various occasions.

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# 2. Objective/Aim

The aim of deliverable D1.3 is to describe the Rail Innovative Research Observatory. The activities undertaken during the project aim at stimulating the transfer of knowledge within and outside the railway sector, structuring interactions that may lead to networking, cross-fertilisation, common collaboration and the kick-starting of new ideas, contributing to a more successful rail research and facilitating the transformation of the European rail system.

# 3. Thematic Approach and Methodology

## 3.1 Thematic Approach

According to the results of a survey carried out in Task 1.1 with regards to the most promising technologies or innovations that have the potential to transform the rail sector, **digitalisation and materials** are the main factors considered by the survey participants, both in the medium as well as in the long term. In the next 5 years, **5G, automation, batteries, big data and energy** have also been mentioned several times. Looking at the coming decades, **artificial intelligence, automation, cybersecurity power sources and autonomous mobility** are also appearing in the rankings. This is also in line with the data obtained from the analysis of rail policy and strategic documents. A selection of these topics will be addressed in the interactions.

The information contained in Deliverable 1.2 goes through different non-rail stakeholders that could potentially enrich research and innovation in the railway sector. On the one hand, it analyses future **urban scenarios**, with a 2050 timeframe, and the implications for the railway sector, drafting key topics, gaps and barriers. These are groups under the following headings: technology; environment; space planning; social dimension; safety; disruptive developments. On the other hand, it provides a first assessment of the current **European Technology Platforms and Public-Private Partnerships** existing at European level, collecting general information and establishing a first contact to identify commonalities with the railway sector. This combined exercise serves as a basis for the identification and first contact of a pool of expertise from different sectors and technology areas available to enrich railway community's discussions and sharing of experiences to boost innovation.

Regarding European Technology Platforms and Partnerships, the methodology followed under Task 1.2 resulted in the suggestion of the following entities and the sectors they represent to explore their potential to enrich or foster innovative rail research and identify synergies through T1.3 Innovative Rail Research Observatory:

- European Cyber Security Organisation - ECSO
- 5G Public-Private Partnership – 5G PPP
- European Construction, built environment and energy efficient building Technology Platform - ECTP
- Factories of the Future Public-Private Partnership - FoF

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- Electronic Components and Systems for European Leadership - ECSEL Joint Undertaking

The entities included under this heading seem to have touching points between the sectors they represent and the railway sector on research and innovation issues. They have a collaborative attitude with the TER4RAIL project as they have filled out the factsheet; having more information on their development would be interesting for the railway community.

Task 1.3 based its action plan and activities on the before mentioned outcomes.

## 3.2 Methodology

Task 1.3 has been carried out over 14 months and explored commonalities, established interactions, and shared experiences with the rail sector and other actors that have a potential to boost innovation in the railway sector. The interactions aimed at exploring with further detail the potential of other sectors / stakeholders to foster rail research and innovation relationships through the analysis of their developments and activities and using interactions as a tool to identify these commonalities. The information obtained may lead to networking, cross-fertilisation, common collaboration, and the kick-starting of new ideas in the long term, aiming at having effects also after conclusion of TER4RAIL Project. Therefore, task partners made sure to integrate their activity with existing structures, notably with ERRAC where the Working Group 2 (programme group) and Working Group 1 (strategic programme group) and Shift2Rail, performing a specific cross-sectorial mapping of technical relations between the specific fields targeted and Shift2Rail's Technical Demonstrators. This exercise explored commonalities based on the key words of rail and non-rail projects.

Task 1.3 priority was to map interactions and share experiences with other sectors, identifying commonalities and touching points on research and innovation, including three types of interactions:

1. TER4RAIL members integrated panels and sessions into existing rail events, including committee meetings or technical plenary meetings of the TER4RAIL partners, where speakers from the identified technology platforms will be invited to present
2. TER4RAIL members identified some relevant non-primarily rail events which relevant experts from the railway sector could join to seek interactions or to present TER4RAIL and the Rail Innovative Research Observatory, when possible.
3. TER4RAIL engaged in ad-hoc interactions with the identified actors when there was an opportunity for it

A flexible action plan, open to amendments during the entire process and constantly updated has guided the activities. Task partners used the experience gained over time to develop the future interactions and explore commonalities. For instance, the experience of the panel discussions

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organized at the ERRAC plenary was taken into account in the preparation of following events, such as the TER4RAIL final event. The aim has been to organize the interactions in a way that creates the highest value to establish promising relationships between the railway sector and non-rail actors.

Next to these interactions a mapping was produced over the course of the project:
In order to reinforce the identification of possible synergies and collaboration opportunities between the railway sector and other sectors, a specific cross-sectorial mapping of technical relations between the specific fields targeted by the selected ETPs / PPPs and Shift2Rail's aim and Technical Demonstrators has been elaborated. These mappings deliver a "snapshot" of the linkages and connections identified between the respective sectors and the railway sector, and serve as inspiration for different types of actors to explore further commonalities and possible engagements. The resulting mappings have been built in close communication with Shift2Rail, adjusting the identification of connections at technical level with their advice, and facilitating direct uptake of the information by IP leaders. With the dissemination of D.1.3 it will be available to the railway community and also to the targeted ETPs / PPPs.

The mappings have been elaborated based on the information of the factsheets delivered in task 1.2, the project scan of task 1.1 as well as additional, publicly available information at their websites and at the Participant Portal database, complemented with direct interactions. The methodology followed has been the analysis of the available information, trying to answer the following questions:

- Do the different documents (SRIA, vision, yearly reports, website, etc.) target or mention "railways" or "Shift2Rail"? And if so, in which context?
- Does the organisational structure of the ETP / PPP target the involvement of rail / transport stakeholders? If so, how?
- Does the specific ETP /PPP have common members with S2R?
- In the case that the ETP / PPP finance projects directly: are any of the projects financed during the H2020 period directly related to railways? If so, what do these projects have in common with the innovation programme of Shift2Rail (content, Technical Demonstrators, similar projects, partners, etc.)?
- Is there any other relevant information, such as events, transition towards Horizon Europe?

For this reason, the information contained in the mappings respond to the specific moment in which they have been elaborated, which is indicated in section 5.

The mappings have been elaborated looking at the five entities selected in task 1.2 (for further information see D.1.2) and three additional ones requested by Shift2Rail: 5GPPP, ALICE, ECSEL JU, ECSO, ECTP, ERTRAC, FoF and SPARC.

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# 4. Interactions

This section of the deliverable reports on the most important interactions carried out in the framework of Task 1.3 and their outcomes. Task partners decided on a case by case basis how to interact with the selected ETPs / partnerships to obtain the information and further identify commonalities. Interactions were selected based on where they would bring the highest added value in terms of thematic relevance and potential for future rail relevant research and collaboration with the rail sector, and took into account the previous work between the sectors already done.

**Table 1: List of Events for Task 1.3**

| Month | | Event/Meeting | Details | Who is involved | Outcome |
|---|---|---|---|---|---|
| M10 | 20th Sep 2019 | WP1 Meeting in Madrid | Internal meeting addressing Task 1.3 Action Plan | WP1 Members | Action Plan for Task 1.3 (first draft) |
| M12 | 29th Nov 2019 | ERRAC Plenary | Dedicated Session on Rail Innovative Research Observatory: Panel discussion on Cybersecurity with ECSO and railway experts | TER4RAIL experts - and ECSO | Report on main arguments in panel discussions |
| | 10-13 Nov 2019 | UITP Light Rail Committee | Semestral meeting of UITP body for light rail/tram operators and is composed of close to 50 members. It develops activities such as studies, workshops and contributions to the programme of other UITP events. | UITP members, light rail experts | Presentation of TER4RAIL outcomes to members of the LR committee from all over the world. In particular, the report on LRT was presented. |
| | 13 Nov 2019 | Plenary meeting of the Infrastructure & Mobility Committee of ECTP | Non-rail event: TER4RAIL has been invited to present at ECTP to explore common points between their activities and the rail sector | European Construction, built environment and energy efficient building Technology Platform (ECTP), UNIFE | Further interactions between rail sector and ECTP |
| | Nov 14-15th | NEWOPERA F&L Annual Conference in Naples marking 25th Anniversary | 15th Morning Session on EU Projects innovations & China Silk Road | NEWOPERA+130 F&L Delegates representing shippers & EU Transport & Logistics actors | NEWO Presentation + World Economic Forum, on future mobility & debates on major Supply Chain topics |

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|---|---|---|---|---|---|
| M13 | 9th Dec 2019 | UNIFE – Technical Platform | Afternoon Session on TER4RAIL | UNIFE members | Dissemination about TER4RAIL among UNIFE members. |
| M22 | 16th September 2020 | UIC: meeting of the R&I Coordination Group (RICG) | Regular Meetings of the RICG Group of UIC | UIC | Presentation available |
| M23 | 6th October 2020 | EURNEX General assembly in Shift2Rail | General assembly of EURNEX railway professors meeting with Shift2Rail, giving feedback on rail research roadmaps | EURNEX and Shift2Rail | Minutes of meeting with feedback from EURNEX for Shift2Rail roadmap |
| | 28th October 2020 | FFE - Spanish Railways Technological Platform (PTFE) | Advanced materials with application to the railway sector | Spanish National Advanced Materials Platform & PTFE - FFE | Compilation of materials innovation factsheets; programme; video recording |
| M24 | 12-13 Nov 2020 | NEWOPERA F&L Annual Conference in Geneva hosted by United Nations | Agenda is work in progress | NEWOPERA+150 delegates representing shippers, EU Transport & Logistics actors, service providers, users | Compilation of materials innovation factsheets,TER4RAIL conclusions recommendation |
| M24 | 19 Nov 2020 | TER4RAIL Final Conference & ERRAC Plenary | Final event | Wider audience railway Sector | News at TER4RAIL website |
| M25 | 1-3 December 2020 | UITP – IT TRANS | Leading event for digitalization in transport | Decision makers, industry experts, associations, research centres | Distribution of dissemination material to interested stakeholders coming mainly from IT sector in transport (all modes) |

**Adjustments undertaken due to the COVID-19 pandemic**

The impact of COVID-19 and the restrictions put in place throughout Europe since March 2020, as well as the mitigations measures undertaken is described below:

- The FFE event on "Advanced materials with application to the railway sector" organised as a collaboration between the Spanish railways Technological Platform (PTFE) and the

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Spanish Advanced Materials and Nanomaterials Technological Platform (MATERPLAT) scheduled for the 17th of March had to be cancelled and re-scheduled for the 28th of October 2020. As mitigation measure, in addition to the re-scheduling, a document compiling related innovations was prepared for the event (including an English version for the dissemination through TER4RAIL) and has been published by the organisers and disseminated by TER4RAIL. This compilation is available as news at TER4RAIL website.

- Planned interactions at TRA2020 have been removed, as the event has been cancelled. As mitigation measure, the dissemination material planed for TRA in WP4 has been still elaborated (project presentation) and WP1 has contributed to it.
- IT Trans (3-5 March) has been postponed until after the project end, to 1-3 December 2020. However, to mitigate the impacts on the project UITP has will attend the event and report beforehand on the foreseen interactions
- Rail Live Madrid, initially planned for the 31st March – 2nd April, has been postponed to the 30th November-1st December. The event had changed the way of performing it, reducing the number of days and becoming digital, and there was unfortunately no further space for the session planned at the March edition.
- Planned interactions at INNOTRANS 2020 have been removed, as the event has been cancelled. There was unfortunately no possibility to present the project as initially planned.

Further information on some of the activities reflected in Table 1, is provided here below.

**ERRAC Plenary, 29th November 2019**

Based on the information gathered inside task 1.1 and 1.2, the task 1.3 partners have started their cross-fertilization work on this topic by approaching entities working on cyber security, most importantly the European Cyber Security Organisation (ECSO).

As a starting point for the Rail Innovative Research Observatory, and in the context of the topic digitalisation, the issue of Cyber Security has been chosen by the task partners as a first topic to explore. Future technologies deployed in the railway sector will only be as good as they will be safe and secure. Cybersecurity is a transversal issue, and, in fact, all the innovations linked to digitalisation that have been identified as most important in the medium and long term, pose important questions related with cybersecurity. At the same time, the railway sector is not alone when facing this challenge and could benefit from reaching out to actors outside the railway system. Technologies, such as big data, artificial intelligence and automation, pose cyber security related questions that are addressed also by several non-rail specific initiatives in the field of cyber security.

During the ERRAC Plenary on November 29th a TER4RAIL panel discussion has been organized on the topic of cybersecurity. The panellists invited will be cyber security experts, an ECSO representative and stakeholders from the railway sector. The session aims to understand which will be the needs of the future rail, that will be fully digitalized, open and connected with other

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transport sectors (and non-transport), where Artificial Intelligent, robotics and other technological challenges will play a significant role in the coming years. The draft concept note for the panel is attached in Appendix 2.

Task partners promoted participation at the ERRAC plenary through their networks encouraging specifically participation of cyber security experts.

**UITP Light Rail Committee 10-13 Nov 2019**
UITP presented TER4RAIL in the context of UITP Light Rail committee, which discussed all aspects of LRT: current situation, challenges, gaps and evolutions with high level experts.

**Plenary meeting of the Infrastructure & Mobility Committee of ECTP**
On November 13th the TER4RAIL project was presented at the plenary meeting of ECTP. ECTP members were informed about TER4RAIL, the rail sectors' research priorities, and the Sector's vision, as outlined in the ERRAC 2050 document and the Rail 2030 – Research and innovation priorities. At this first exchange several areas of potentially mutual interest were identified, in particular in the area "Intelligent Assts Lifecycle Management". After a round of discussion, it was agreed to soon organize a follow up meeting and more concretely define areas of mutual interest.

**Nov 14-15th, NEWOPERA, F&L Annual Conference in Naples marking 25th Anniversary**
A TER4RAIL presentation was prepared for this event to be introduced by the NEWO President in a dedicated slot of the Agenda since immediately after there was the Italian Under Secretary of State for Trade and Development to present and discuss international trade opportunities, the Silk Road innovations and impacts on Italy and Europe. This was followed by a debate chaired by the World Global Forum.

**UNIFE Technical Platform**
UNIFE has dedicated one part of its annual technical platform to a presentation on the TER4RAIL project and its link with ERRAC, that took place on the 9th of December 2019. The UNIFE Technical Platform enables UNIFE members to have a better understanding of ongoing EU research, regulation and standardisation issues, their background and implications for the industry.

**Spanish Railways Foundation – Spanish Railways Technological Platform Workshop**
Innovation in Materials ranked at the top of the list of innovations to affect railways, both in the next 5 years and in the coming decades, identified by the survey of Task 1.1. As this topic was not directly addressed at the European ETPs / PPPs selected in Task 1.3., and cooperation between National Technology Platforms was established at Spanish level, FFE decided to choose this topic to promote an event. The Spanish Railways Technological Platform (PTFE), that gathers 437 members from the Spanish R&D railway community, of which 69% are companies, 4% railway managers and operators, 8% universities, 11% research and technology centres, 2% public administrations, and 5% foundations and associations, in collaboration with the Spanish Advanced Materials and Nanomaterials Technological Platform (MATERPLAT) and TER4RAIL project, scheduled an event on the 17th of March 2020 in Madrid, at FFE headquarters, exploring innovations and commonalities between both sectors, in which S2R's participation was envisaged.

This event had to be cancelled due to COVID-19 situation and had to be re-scheduled on the 28th of October 2020 as a digital event. At the same time, a **compilation of factsheets with key innovations on materials with application to the railway sector** was compiled among the members of both platforms and published in April as a mitigation measure. It gathers 52 innovative solutions, organized into four sections: coatings, structures, energy and manufacturing, with the objective of promoting the transfer of research, knowledge and materials technology towards railways. It has been distributed by PTFE and MATERPLAT and will be disseminated internationally by TER4RAIL.

**TER4RAIL Final Conference & ERRAC Plenary**

TEr4RAIL's Final Conference took place jointly with the ERRAC Plenary Meeting on the 19th of November 2020. Around 100 participants attended the event. It counted with a general presentation of TER4RAIL project describing key achievements in the morning, and a more detail explanation per work package in the afternoon.
https://ter4rail.eu/2020/11/09/errac-plenary-meeting-and-ter4rail-final-event-18-12-2020/

## 4.1 Other actions

This section describes other actions important to be mentioned, not included in Table 1.

- In order to contribute to building interactions and sharing of experiences with other sectors, TER4RAIL had inform the non-rail ETPs/PPPs collaborating with the factsheets of Task 1.2 regarding RAIL LIVE Madrid and had facilitated the establishment of contacts with the organisers the event. This interaction resulted in the inclusion in the programme of representatives of ECSO and 5G PPP; and exchanges with BDVA. The event was postponed to 1st&2nd of December 2020 due to COVID.

- TER4RAIL's twitter account @Ter4R has been used for the sharing of knowledge from other fields among railway stakeholders and for promoting the most interesting issues of the selected ETPs / PPPs, such as calls for proposals, events, deliverables related to railways, etc. These actions serve to reinforce the impact of COVID19 on interactions, establishing bridges digitally. In addition, a series of tweets highlighting the H2020 projects financed by the ETPs / PPPs with direct application to railways have been elaborated to promote share of knowledge and exchange of information between different sectors.

- Following the advice of Shift2Rail on dissemination issues, TER4RAIL agreed with the recommendation of not issuing a newsletter. In order to communicate news, the project has uploaded plenty of news at the TER4RAIL website and use the Twitter and Linkedin accounts.

- It was decided to focus the compilation mentioned ta the grant agreement on the field of innovation on materials with application to the railway sector. The document, gathers 52

innovative solutions, organized into four sections: coatings, structures, energy and manufacturing, with the objective of promoting the transfer of research, knowledge and materials technology towards railways. It is available at TER4RAIL's website: https://ter4rail.eu/2020/09/02/advanced-materials-for-the-railway-sector.

- Intermediate developments of WP1 have been shared with Shift2Rail, distributing first version of each mapping and obtaining feedback to improve them; and extensive dissemination actions have been undertaken towards ERRAC: feedback at each steering committee, distribution of information to the different work groups, engagement with ERRAC social media accounts, etc.

- In relation to ERTRAC, EURNEX has been invited to participate as Associated Partner bringing in railway knowledge at a proposal elaborated for the topic on setting up a common European research and innovation strategy for the future of road transport (LC-GV-09-2020) of the 2020 call for proposals of Smart, green and integrated transport.

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# 5. Mapping non-rail ETPs/PPPs versus Shift2Rail

A cross-sectorial mapping of technical relations between the specific European Technology Platforms / Public-Private Partnerships and Shift2Rail's general aim and Technical Demonstrators has been made and reported in this deliverable. This exercise explored commonalities based on key words of rail and non-rail projects and publicly available information.

This section gathers the findings in relation to each of the ETPs /PPPs analysed, following a common structure with these headings:

- Mention of railway in key documents: mapping whether, where and in which context railways are mentioned in key documents
- Members: analysis of S2R members that are also members of the initiative
- Technical Mapping: analysis of the non-rail actor financed projects per key words. Linkage of research and innovation projects directly related to railways, and not-directly related, with S2R TDs and S2R projects
- Other: other information considered relevant, e.g. related Innovation Capabilities, interesting organizational / structural information; etc.

The mapping exercise is performed for to the following ETPs / PPPs:

- 5G PPP, 5G Public Private Partnership (February 2020)
- ALICE, Alliance for Logistics Innovation through collaboration in Europe (August 2020)
- ECSEL, Joint Undertaking - the Public-Private Partnership for Electronic Components and Systems for European Leadership (December 2019)
- ECS PPP, European Cyber Security PPP (February 2020)
- ECTP, European Construction, built environment and energy efficient building Technology Platform (April 2020)
- ERTRAC, European Road Transport Research Advisory Council (May 2020)
- Factories of the Future (FoF) - Public-Private Partnership (June 2020)
- SPARC, Public-Private Partnership in Robotics (June 2020)

The date in brackets indicates the moment of elaboration, which is relevant bearing in mind the continuous evolution of the activities of the ETPs/PPPs.

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The following table summarises the results of the analysis of the ETPs / PPPs mentioned and what has been found for each one of the sections reviewed. More details of each one are provided on the following pages in each technology mapping.

| | 5GPPP | ALICE | ECSEL | ECS | ECTP | ERTRAC | FoF | SPARC |
|---|---|---|---|---|---|---|---|---|
| **Railways explicitly mentioned at key documents** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Rail related projects already in place** | 7 | - | 6 | - | - | - | 3 | 2 |
| **Possibility of participation of railways stakeholders through already stablished structures inside the PPP/JU** | Vertical Engagement Task Force (Transport) | Several Thematic Groups | - | WG3 Sectoral Demand (Transportation) | Infrastructure and Mobility Committee | Several working groups | - | Topic Group on Logistics and Transport |
| **Common members with S2R** | 7 | 3 | 10 | 7 | 8 | 2 | 4 | 7 |

Here after, a representation of the possible interactions between each ETP / PPP and the 12 railway capabilities is displayed.

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| Capabilities | 5GPPP | ALICE | ECSEL | ECS | ECTP | ERTRAC | FoF | SPARC |
|---|---|---|---|---|---|---|---|---|
| 1. Automated train operation | ✓ | | ✓ | ✓ | | | | |
| 2. Mobility as a Service | ✓ | | | ✓ | | ✓ | | |
| 3. Logistics on demand | | ✓ | | ✓ | | ✓ | | ✓ |
| 4. More value from data | ✓ | ✓ | | ✓ | | | | |
| 5. Optimum energy use | | | ✓ | ✓ | | | ✓ | |
| 6. Service timed to the second | ✓ | | ✓ | ✓ | | | | |
| 7. Low cost railway | | | | ✓ | ✓ | | ✓ | ✓ |
| 8. Guaranteed asset health and availability | | | ✓ | ✓ | ✓ | | | ✓ |
| 9. Intelligent trains | ✓ | | ✓ | ✓ | | | ✓ | |
| 10. Stations and "smart" city mobility | ✓ | | | ✓ | ✓ | ✓ | | |
| 11. Environmental and social sustainability | | | | | ✓ | | ✓ | |
| 12. Rapid and reliable R&D delivery | | | | | | | | |

Going through the different sections included at the mappings, some general conclusions can be drawn:

The fact that all ETPs / PPPs analysed **mention railways** or trains at least in one of their key strategic documents is an indication of the potential connection between their activities and the sectors they represent with the railway sector. There are differences between them with regards to the frequency and relevance of the role played by railways for their policies, agendas and reports. For example, some of them mention railways extensively, such as 5G PPP and ALICE - as railways are an intrinsic part of logistics-, as well as ECSEL and ERTRAC. In others, this connection is made in relation to a specific section, such as the case of ECTP and the area of infrastructures. There are others for which the mention of railways is briefer, but where transport is more widely considered, for example FoF or SPARC. Additionally, Shift2Rail JU is also explicitly mentioned in some documents of ALICE, ECSEL and ECS.

Looking at the projects financed in the framework of Horizon 2020 issuing own calls for proposals, it is possible to find **rail-related projects** at the four of them that directly finance projects: 5G PPP, ECSEL, FoF and SPARC.

- In the case of the 5G PPP, seven very interesting rail-related projects have been identified, comprising rail use cases and pilots in some of them: 5G PICTURE, 5GROWTH, 5G VICTORI, 5G-IoRL, 5G EVE, 5G Crosshaul and 5G Coral, This trend has continued, and the results of

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the last call for proposals that were released after the completion of the mapping have shown at least two more projects related to railways: 5GMED and 5GRAIL.

- Analysing the projects financed by ECSEL, six rail-related projects have been identified: WINSiC4AP, AMASS, ENABLE-S3, MEGAMART2, SCOTT and SECREDAS.
- Factories of the Future has financed three projects that have railway use cases: Sharework, RECOTRANS and MAESTRO.
- Regarding SPARC, two projects have been identified with potential application of their results to railways. These are ESMERA and AEROBI.

The existence of these projects opens plenty of opportunities in relation to specific technical issues, collaboration between running projects, cross-sectoral dissemination, identification of key partners and advances in the state-of-the art.

In relation to the possibility of **participation of railways stakeholders through already stablished structures** inside each PPP/JU the following cases have been identified:

- There are some already established groups and structures that may facilitate the involvement of railway stakeholders at some of the ETPs / PPPs: for example, in the case of 5G PPP, there is a "Trials Work Group" and a "Vertical Engagement Task Force" that envisages the participation of stakeholders from the sectors considered as "verticals" which includes railways and transport. In the case of ALICE, there are different thematic groups related to logistics to which rail stakeholders could contribute. ECS has a Work Group on Sectoral Demand (WG3), which includes transportation and railways. It organises workshops with stakeholders and has elaborated a specific publication on cybersecurity in transportation (including railways); another possibility at ECS would be WG6 - SRIA and Cyber Security Technologies, that is in charge of coordination with other PPPs. ECTP has a Committee for infrastructure and mobility, SPARC a Domain Topic Group on Logistics and Transport, where rail is explicitly mentioned.
- ERTRAC does not have a specific group to facilitate engagement with railways: However, collaboration is frequently established through joint road mapping with ERRAC, joint events, joint projects, participation at each other's plenaries, etc. This type of collaboration is also established with ALICE, as it takes place between transport-related European Technology platforms.
- In the case of FoF, a specific already existing structure that may facilitate engagement with the railway sector hasn't been identified. There are some mentions to transport, but it seems more focussed on automotive.

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- In the case of ECSEL, a structure or group in which rail-related stakeholders may participate representing the needs of the sector hasn't been identified.

**Common members with S2R**

All of the ETPs / PPPs analysed have member in common with the Shift2Rail Joint Undertaking. Sometimes the same entities are present in several ETPS /PPP, other times members are entities form the same business group.

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## 5.2 Mapping 5G PPP vs Shift2Rail

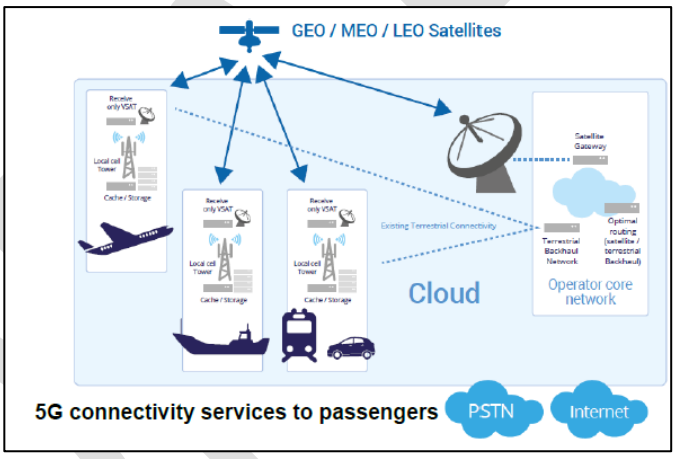
### 5G Public Private Partnership (5G PPP)

**a) Mention of railways at key documents**

Making a revision of the Papers and Views issued from the 5G-PPP in 2019, that are a total of 5 documents, railways have been mentioned at the two described below:

5G-PPP Software Network White Paper: "Cloud-Native and Verticals' services – 5G-PPP projects analysis"(September 2019)

- "Trains" are mentioned at the vertical use-case "Connectivity Services to Passengers" (p.36), that is one out of the fourteen described. It corresponds to specific satellite use cases for eMBB, focussing on communications on the move (see picture) and the capabilities offered by 5G for airplanes, vehicles, trains, and vessels.




Source: 5G-PPP Software Network White Paper: "Cloud-Native and Verticals' services – 5G-PPP projects analysis"

Other items that may be of interest:

- "Video Security for Smart Cities: Real-time low-latency object tracking" use-case (p.14), where security is provided by real-time object recognition and tracking. This may have commercial applications such as public transport optimization, traffic management and customer flow analysis, which could be interesting to railways.

5G PPP 5G Architecture White Paper Revision 3.0 – (June 2019)

- Use Case 4: "5G moving platform backhaul": Broadband connectivity to platforms on the move, such as airplanes, trains, or vessels (p.82), under the "Core & Transport Network Architecture". This is the same as mentioned before.

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In relation to other documents:

5G PPP Annual Journal 2016

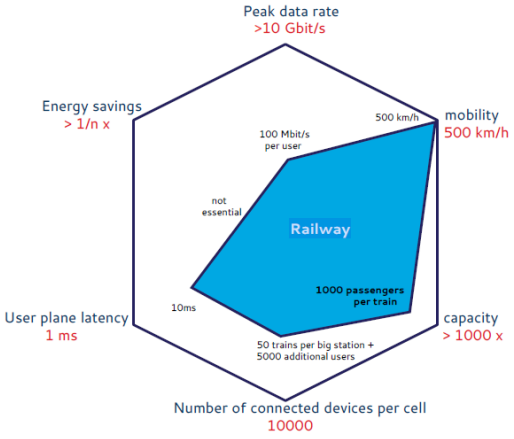
- Examples of possible applications of the 5G CROSSHAUL project (p.18). Mention of "Mobility Management Application (MMA) for mobility management optimization even in the most challenging scenarios (e.g. high-speed trains)."

5G PPP Annual Journal 2017

- Mention of the 5G CROSSHAUL project (p.21), as at the 2016 Journal, describing possible application to high-speed trains. Mention of a trial on energy management of 5G-Crosshaul Radio over Fibre (RoF) infrastructure to be set up in High Speed Train of Taiwan (p.21).

5G PPP Annual Journal 2018

- Mention of "railway stations" in relation to the spectrum for 5G (p.16) and 26 GHz band.
- Mention of railways in relation to the 5G PICTURE project: requirements for the railway vertical use case (see graphic on the right) (p.45); planned demonstrations "real 5G-railway testbed located in Barcelona, Spain" (p.46); listing of the railway trial "Adoption of the 5G disaggregated RAN (DA-RAN) architecture for demonstration of 5G rail services in a real railway testbed" with FGC and COMSA (p.96)




Source: 5G PPP Annual Journal 2018

- Mention of "trains (> 50 km/h)" in the table of KPIs of the NRG-5 Project (p.56), at the mobility section.
- Mention of "train" in relation to the 5G-CORAL project: at the description of the project as an example of a moving device in relation to mobile (non-stationary) Fog Computer Devices (p.80); as a High-speed train testbed, located in Hsinchu, Taiwan to verify seamless connection in the high-mobility scenario and provide functions on the fog/edge that could potentially mitigate the burden of passenger's mobility signalling on the backhaul (p.82).

5G PPP Annual Journal 2019

- Mention of railways in relation to the 5G PICTURE project: rail vertical use case (5G communications to trains; Sub-6 GHz LTE Massive MIMO technologies; multi-technology access network solutions; Internet of Things in Disaggregated 5G Networks) (p.37); detailed description of the railway demo to take place in Barcelona, Spain (p.39).
- Mention of railways in relation to the 5G EVE Project: use case on "intelligent railway for smart mobility (Smart Transport)" (p.77); smart transport test site in Italy (p.78).

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- 5G Vertical User Workshop hold on the 12-13 February 2019, mentioning the participation of railway experts.

5G PAN-EUROPEAN TRIALS ROADMAP VERSION 4.0 (document elaborated and supported by the Trials Working Group).

- It mentions "Funding from the National Productivity Investment Fund (NPIF) will be used to upgrade the Network Rail test track in Melton Mowbray and for the installation of trackside infrastructure along part of the Trans Pennine route with the rollout of full-fibre and 5G networks" (p.12).

5G empowering vertical industries Brochure

- Brief mention of "trains" in relation to critical infrastructure intelligence "trains today have their own network for signalization, which may be provided by 5G as a mission critical service" (p.7-9); "fibre optics deployed for connecting trains" (p.9)

5G IA's POSITION PAPER on a European Partnership on SMART NETWORKS & SERVICES under HORIZON EUROPE

- Mention of "public transport" as 10 key industries studied to which 5G and industrial digitalization will be relevant (p.7).

**b) Mention of Shift2Rail at key documents**

No mention or acknowledgement of Shift2Rail has been found at key documents.

c) **Members**

The 5G PPP, is composed by:

- 5G IA representing the private side
- the European Commission representing the public side

The Board of the 5G IA is composed by 11 members, elected from the membership, who, in turn, elect the Chair of the Association. Membership is open and the terms and conditions for joining can be found here. The Association brings together a global industry community of telecoms & digital actors, such as operators, manufacturers, research institutes, universities, verticals and SMEs. The Board is supported by the 5G IA Office.

The list of parties signing the 5G-PPP collaboration agreement exceeds 450 Individual Organisations and the list here is updated at intervals to reflect this growing community: https://5g-ppp.eu/parties-to-the-5g-ppp-collaboration-agreement/

Shift2Rail Members that are also members of 5GPPP are:

| Shift2Rail Member | Parties signing the 5G-PPP Collaboration Agreement | 5G IA members (link) |
|---|---|---|

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| (link) | | |
|---|---|---|
| **Bombardier Transportation GmbH** | ✓ | |
| **Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)** | | ✓ |
| **Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.** | ✓ | ✓ |
| **INDRA SISTEMAS, S.A** | | ✓ |
| **Infraestruturas de Portugal, S.A.** | ✓ | |
| **INSTITUT FÜR ZUKUNFTSSTUDIEN UND TECHNOLOGIEBEWERTUNG - IZT** | ✓ | |
| **Kompetenzzentrum – Das virtuelle Fahrzeug, Forschungsgesellschaft mbH virtual vehicle** | ✓ | |
| **Siemens Aktiengesellschaft** | ✓* | |
| **THALES** | | ✓* |
| **UNIVERSIDAD DEL PAIS VASCO** | ✓ | |

✓ Indicates that the Shift2Rail member is also member of the other entity.

✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. This is the case for:

- SIEMENS at 5G PPP: SIEMENS INDUSTRY SOFTWARE AND SERVICES BV; and SIEMENS MOBILITY, UNIPESSOAL LDA
- THALES at 5G PPP: THALES ALENIA SPACE ESPANA, SA; THALES COMMUNICATIONS & SECURITY SAS; THALES SA; THALES SERVICES SAS Thales SIX gts France part of the 5G IA.

### d) Structure in relation to Verticals

The 5GPPP has a complex structure due to its nature, which is transversal to many sectors and technologies. 5G sector defines the sectors in which their technology may be applied as Verticals. There are a series of defined verticals inside the 5GPPP. On the 5G Infrastructure PPP Phase 1 projects, railways were not included (Automotive had a specific vertical) but on the 5G Infrastructure PPP Phase 2 projects, there is a Transport vertical where railway is included. However, the focus is usually put on automotive, having a dedicated "5G Strategic Deployment Agenda for Connected and Automated Mobility in Europe" and dedicated working group.

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Relevant structures:

- Trials Work Group: develops the roadmap on technology trials with vertical sector use cases. Open for participation of vertical sector organisations. Membership not required.
- 5G-PPP Vertical Engagement Task Force: inside the industry association to (1) present 5G and its potential for verticals; (2) listen to industry professionals and gather specific requirements from different verticals

### e) Key technological challenges

The development of new communication networks is dependent on the emergence of globally accepted standards in order to ensure interoperability, economies of scale with affordable cost for system deployment and end users. This partnership aims to have European industry driving the development of 5G standards and to develop and exploit at least 20% of the 5G SEP (standards essential patents). The following parameters are indicative new network characteristics to be achieved at an operational level:

- Providing 1000 times higher wireless area capacity and more varied service capabilities compared to 2010.
- Saving up to 90% of energy per service provided. The main focus will be in mobile
- Communication networks where the dominating energy consumption comes from the radio access network.
- Reducing the average service creation time cycle from 90 hours to 90 minutes.
- Creating a secure, reliable and dependable Internet with a "zero perceived" downtime for services provision.
- Facilitating very dense deployments of wireless communication links to connect over 7 trillion wireless devices serving over 7 billion people.
- Enabling advanced user controlled privacy.

This new high-performance network will be operated via a scalable management framework enabling fast deployment of novel applications, including sensor based applications, with reduction of the network management opex by at least 20% compared to today.

In addition, new lightweight but robust security and authentication metrics suitable for a new era of pervasive multi domain virtualised networks and services will have to be provided.

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a) **Shift2Rail-5G PPP Mapping**

**Key Words: Communications, optical network, level crossings**

Relation with S2R TD:

TD2.1- Adaptable communications for all railways, TD2.2- Railway network capacity increase, TD2.9- Traffic management system

| | **5GPPP Projects directly related to rail** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | 5G Picture 5G-PICTURE | | | | | | 5G Growth 5GROWTH | | | |
| **Domain** | Communications, optical network | | | | | | Communications, level crossings | | | |
| **Related TDs** | TD2.1, TD2.2, TD2.9 | | | | | | TD2.1 | | | |
| **Relation with TDs** | 5G-PICTURE will demonstrate converged fronthaul and backhaul services in:<br>-a smart city environment,<br>**-a 5G railway experimental testbed showcasing seamless service provisioning and mobility management in high-speed moving environments**, and<br>-a stadium with ultra-high user density, supporting media services.<br>https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5b838fb48&appId=PPGMS | | | | | | There is a specific pilot on the communications and security systems of a level crossing | | | |
| **Shift2Rail Projects related** | XRail 1 | MISTRAL | EMULRADIO4RAIL | X2RAIL3 | ASTRAIL | XRail2 | XRail 1 | MISTRAL | EMULRADIO4RAIL | X2RAIL3 |
| **Common partners** | None | TU Dresden | None | None | TU Dresden | None | None | None | None | None |
| **Links** | www.5g-picture-project.eu<br>https://cordis.europa.eu/project/id/762057 | | | | | | www.5growth.eu<br>https://cordis.europa.eu/project/id/856709 | | | |

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**Key Words: Energy, Smart metering, stations**
Relation with S2R TD:
TD3.10- Smart Metering for Railway Distributed Energy Resource Management System Demonstrator
TD 3.11 - Future Stations Demonstrator

| | **5GPPP Projects directly related to rail** | |
|---|---|---|
| **Name** | 5G VICTORI | 5G-IoRL |
| **Domain** | **Energy, Smart metering** | **Future Stations Demonstrator** |
| **Related TDs** | TD 3.10 | TD 3.11 |
| **Relation with TDs** | 5G-VICTORI aims at conducting large scale trials for advanced use case verification in a commercially relevant 5G environment for a number of verticals including Transportation, Energy, Media and Factories of the The specific use cases that 5G VICTORI will concentrate on include:<br>"Enhanced Mobile broadband under high speed mobility", Vertical: Transportation – Rail,<br>"Digital Mobility", Cross-Vertical – Transportation and Media,<br>"Critical services for railway systems", Vertical: Rail,<br>"Smart Energy Metering", Cross-Vertical: Energy and Rail,<br>"Digitization of Power Plants", Vertical: Smart Factory, and<br>"CDN services in dense, static and mobile environments", Vertical: Media. | A portable IoRL demonstrator is being constructed with the aim of demonstrating the IoRL concept at EU CNC 2019 in Valencia, Spain. It will demonstrate video streaming to a 4k TV using a smart phone TV remote control app. This concept has the bit rate capacities to extend to 8k and 16k TVs. The demonstrator acts as a prelude to the construction of the IoRL concept in a Building Research Establishment home in Watford UK, Le musée de la carte à jouer in d'Issy-les-Moulineaux France, **Nuevos Ministerios train station in Madrid Spain** and a Chinese supermarket, where further broadband indoor services have been developed which will demonstrate: Virtual Tourism of Shakespeare's Globe theatre using Virtual Reality, Remote Tourism using 360 degree camera, multiplayer cycle trainer gaming using virtual reality, follow-me 4k TV over multiple TV sets in home, pictures in picture 4k TV, location based data access, augmented reality support of technicians in the field, indoor location |

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| | | | | |
|---|---|---|---|---|
| | | | guiding and monitoring etc. | |
| **S2R Common partners** | Bombardier Transportation, DB Netz, FRAUNHOFER, ;IZT INSTITUT FUER ZUKUNFTSSTUDIEN UND TECHNOLOGIEBEWERTUNG GEMEINNUTZIGE GMBH | | FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V | |
| **Shift2Rail Projects related** | IN2STEMPO | IN2DREAMS | IN2STEMPO | FAIRSTATIONS |
| **Common partners** | DEUTSCHE BAHN AG; IZT INSTITUT | UNIVERSITY OF BRISTOL; ;INSTITUTE OF ACCELERATING SYSTEMS AND APPLICATIONS | None | None |
| **Links** | www.5g-victori-project.eu<br>https://cordis.europa.eu/project/id/857201 | | https://iorl.5g-ppp.eu/<br>https://cordis.europa.eu/project/id/761992 | |

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**Key Words: Passenger Connectivity, Smart mobility, multimodality, Intelligent Transport Systems, IP4 coordination demonstrator**
Relation with S2R TD: TD4.1- Interoperability Framework
TD4.6- Business Analytics Platform
TD 4.7 - Overall IP4 Coordination and Demonstrations
WA4- Smart Mobility (4.1 Smart Planning, 4.2 I2M)

| | **5GPPP Projects directly related to rail** | |
|---|---|---|
| **Name** | 5G EVE   | 5G-IoRL   |
| **Domain** | Passenger Connectivity, Smart mobility, multimodality, Intelligent Transport Systems | Overall IP4 Coordination and Demonstrations |
| **Related TDs** | TD4.1, TD4.6, WA4 | TD4.7 |
| **Realation with TDs** | Scenario 2 (referred as Use Case 1.2) – Urban mobility 5G data flows analysis – This scenario concerns integration of 5G data and mobility data from different transport operators to enhance distributed computing and pattern recognition to support urban multimodality between railway network and other collective transportation services (both public and private) and to realize more accurate and reliable Intelligent Transportation System (ITS). | A portable IoRL demonstrator is being constructed with the aim of demonstrating the IoRL concept at EU CNC 2019 in Valencia, Spain. It will demonstrate video streaming to a 4k TV using a smart phone TV remote control app. This concept has the bit rate capacities to extend to 8k and 16k TVs. The demonstrator acts as a prelude to the construction of the IoRL concept in a Building Research Establishment home in Watford UK, Le musée de la carte à jouer in d'Issy-les-Moulineaux France, **Nuevos Ministerios train station in Madrid Spain** and a Chinese supermarket, where further broadband indoor services have been developed which will demonstrate: Virtual Tourism of Shakespeare's Globe theatre using Virtual Reality, Remote Tourism using 360 degree camera, multiplayer cycle trainer gaming using virtual reality, follow-me 4k TV over multiple TV sets in home, pictures in picture 4k TV, location |

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | based data access, augmented reality support of technicians in the field, indoor location guiding and monitoring etc. | | | | |
| **S2R Common partners** | None | | | | | | | FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V | | | | |
| **Shift2Rail Projects related** | GOF4R | CONNECTIVE | SPRINT | START | PLASA | PLASA2 | IMPACT2 | COHESIVE | SPRINT | SHIFT2MAAS | IN2STEMPO | FAIRSTATIONS |
| **Common partners** | TRENITALIA | None | TRENITALIA | TRENITALIA | None | None | None | None | None | None | None | None |
| **Links** | https://www.5g-eve.eu/ https://cordis.europa.eu/project/id/815074 | | | | | | | https://iorl.5g-ppp.eu/ https://cordis.europa.eu/project/id/761992 | | | | |

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**Key Words: Passenger Connectivity, IP4 coordination demonstrator (II)**

Relation with S2R TD: TD 4.7 - Overall IP4 Coordination and Demonstrations

| | **5GPPP Projects directly related to rail** | |
|---|---|---|
| **Name** | 5G Crosshaul | 5G Coral |
| **Domain** | Passenger Connectivity, Overall IP4 Coordination and Demonstrations | Passenger Connectivity, Overall IP4 Coordination and Demonstrations |
| **Related TDs** | TD4.7 | TD4.7 |
| **Realation with TDs** | Mobility-related 5G-Crosshaul experiments dealing with passenger connectivity will be performed using Taiwan's high-speed trains. | 5G-CORAL. A 5G Convergent Virtualised Radio Access Network Living at the Edge (Complementary 5G Projects, EU -Taiwan)<br>It is noteworthy that mobile (non-stationary) Fog CDs are also considered, for example when hosted on moving devices (e.g., car, train, mobile user).<br><br>High-speed train TEST<br>The testbed is located in Hsinchu, Taiwan and is coordinated by ITRI. It is amongst the very few commercial high-speed train testbeds in the world capable of collecting and experimenting real high-speed data on real scenarios. The envisioned goal of this testbed is to verify seamless connection in the high-mobility scenario. One anticipated goal is to provision breakout and mobility functions on the fog/edge that could potentially mitigate the burden of passenger's mobility signalling on the backhaul. |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **S2R Common partners** | Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V | | | None | | |
| **Shift2Rail Projects related** | COHESIVE | SPRINT | SHIFT2MAAS | COHESIVE | SPRINT | SHIFT2MAAS |
| **Common partners** | None | None | None | None | None | None |
| **Links** | http://5g-crosshaul.eu/ https://cordis.europa.eu/project/id/671598 | | | http://5g-coral.eu/ https://cordis.europa.eu/project/id/761586 | | |

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### f) Other information

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by 5G PPP is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | 5G PPP |
|---|---|---|
| 1 | Automated train operation | ✓ |
| 2 | Mobility as a Service | ✓ |
| 3 | Logistics on demand | |
| 4 | More value from data | ✓ |
| 5 | Optimum energy use | |
| 6 | Service timed to the second | ✓ |
| 7 | Low cost railway | |
| 8 | Guaranteed asset health and availability | |
| 9 | Intelligent trains | ✓ |
| 10 | Stations and "smart" city mobility | ✓ |
| 11 | Environmental and social sustainability | |
| 12 | Rapid and reliable R&D delivery | |

Other information

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

- When completing the Fachtsheet of TER4RAIL D1.2, the 5G PPP identified the following opportunities for collaboration with the railway sector in line with different collaboration models are envisaged following partnerships with other vertical industries:
    - Participation to 5G IA open Working Groups (e.g. Trial WG)
    - Cross participation to relevant events with high qualified speakers
    - Promote, as appropriate, each other dissemination and PR activities through respective social media accounts, newsletters and official websites
    - Participate to deliverables (e.g. whitepapers and similar)
    - Sign an MoU encompassing previous points

- At the Shift2Rail call text of S2R-OC-IP1-01-2018 Technical solutions for the next generation of TCMS, that was awarded to the SAFE4RAIL2 Project, included: *it is expected that the proposals include the organisation of a joint advisory group, which should include experts from 3GPP and 5G PPP amongst others.*

- NRG-5 PROJECT has not been included at the project analysis, although there is a mention of "trains (> 50 km/h)" in the table of KPIs of the NRG-5 Project (p.56), at the mobility section.

- A project proposal named 5GRAIL, 5G for Future RAILway Mobile Communication System, has been submitted to Horizon 2020's ICT-53-2020 5G PPP – 5G for Connected and Automated Mobility (CAM) Call. UNIFE's Annual Report 2019 (p.60).

Events:

- RAIL LIVE. 31st Martch – 2 April. Madrid. https://www.terrapinn.com/conference/rail-live/index.stm. In this framework, the TER4RAIL project has promoted, in collaboration with the Spanish Railways Technological Platform, a round table on 5G and railways. Carles Antón-Haro, from the 5G PPP, has accepted the invitation to participate. He is the coordinator of the Trials Work Group of the 5G PPP.
- 6G Wireless Summit. Levi, Finland – March 17-20, 2020. Hosted by the 6G Flagship Programme.
- 5G FORUM. Malaga, Spain- May 6-7, 2020.
- 8th Global 5G Event. Shanghai, China – July 2-3, 2020.

References and key documents:

- 5G PPP website. www.5g-ppp.eu

- 5G-PPP Software Network White Paper: "Cloud-Native and Verticals' services – 5G-PPP projects analysis". September 2019. https://5g-ppp.eu/wp-content/uploads/2019/09/5GPPP-Software-Network-WG-White-Paper-2019_FINAL.pdf
- 5G PPP 5G Architecture White Paper Revision 3.0 – (June 2019). https://5g-ppp.eu/wp-content/uploads/2019/07/5G-PPP-5G-Architecture-White-Paper_v3.0_PublicConsultation.pdf

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- 5G PPP Annual Journals 2016- 2019. https://5g-ppp.eu/annual-journal/
- 5G IA's POSITION PAPER on a European Partnership on SMART NETWORKS & SERVICES under HORIZON EUROPE. https://5g-ppp.eu/wp-content/uploads/2019/02/5G-IA-Position-Paper-Smart-Networks-and-Services_Horizon-Europe.pdf
- The 5G Pan-European Trials Roadmap Version 4.0. https://5g-ppp.eu/wp-content/uploads/2018/11/5GInfraPPP_TrialsWG_Roadmap_Version4.0.pdf
- Pilots and Trials (projects) http://5gobservatory.eu/5g-trial/major-european-5g-trials-and-pilots/

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## 5.3 Mapping of ALICE - Alliance for Logistics Innovation through collaboration in Europe

alice | Alliance for Logistics Innovation through Collaboration in Europe

### a) Mention of railways at key documents

ALICE's Terms of reference. Vs 2016. Link

- "The European Technology Platform on Logistics, cuts across all modes of transport, road, rail, water and air as well as vertical industry sectors" (p.5).

Summary of Mission Statement. Link

- The connection between modes of transport is an intrinsic part of Optimized Logistics and Supply Chain Management. railways are mentioned together with Air, Road and Waterborne (figure 1).

Roadmap Towards Zero Emissions Logistics 2050. 2019. Link.
Railways are mentioned several times through the whole document, as one of the transport modes considered for freight transport and logistics.

Truly integrated Transport System for Sustainable and Efficient Logistics. 2016. Link.
This document has been elaborated in collaboration with ERRAC, as well as ACARE, ERTRAC and WATERBORNE in the framework of the SETRIS project. Railways are mentioned several times through the document.

Research & Innovation Roadmap: Urban Freight. 2014. Link.

- Railways are mentioned only once, briefly in relation to the need to "explore the potential of infrastructure enabling the use of rail for urban logistics" (p.26).

Research & Innovation Roadmap: Global Supply Network Coordination and Collaboration. 2014. Link

- Railways are not explicitly mentioned. However, transport is mentioned several times through the document.

Research & Innovation Roadmap: Information Systems for Interconnected Logistics. Link

- Trains are mentioned in relation to "autonomous logistics for all modes" (p.24).
- It includes a mention to the FREIGHTWISE Project (p.42).

Research & Innovation Roadmap: Corridors, hubs and synchromodality. 2014. Link

- It mentions "the need of railways to become more competitive" (p.17).

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- Mentions the competition of rail and multimodal transport with road-only transport (p.19).
- It includes a mention to MARATHON project (p.41); SPIDERPLUS Projects (p.42); TIGER DEMO Project and freight trains (p.42).

Video on the Physical Internet. 2020. Link.
Railways appear as one of the transport modes of logistic nodes.

**b) Mention of Shift2Rail at key documents**

Research & Innovation Roadmap: Corridors, hubs and synchromodality. Link

- There is a specific section on the "Links with Shift2Rail" (p.17) in which the challenges to be addressed by rail freight transport are described (e.g. "continuously developing and improving products and services that evoke extreme responses, uncover missed costumer segments, look to, check and adopt services developed in other sectors that can be a source of inspiration"; "cooperation with actors from other modes"; "new service-oriented profile"; "increase productivity"). It mentions liaison of ALICE with S2R IP5 and liaison of S2R with Alice's WG2 (p.18).

Freight innovation Roadmap Rail. ALICE & Shift2Rail. Feb. 2020.

Document on seamless rail freight experience developed together between Shift2Rail and ALICE with an analysis on Market Access; Rail Operations and Business Models.

**c) Contact and collaboration with the railway sector / ERRAC**

According to the factsheet completed by ALICE on task 1.2 of TER4RAIL, ALICE identified the following issues when asked on the contact to date with the railway sector:

- Some of our ALICE members have a close link or are part of the rail sector such as: LINEAS, UIRR, HACON, New Opera and others are users of rail freight services (see Shippers & Retail as well as Logistics Service Category members). We also have a strong link to the sector with our Ports and Hubs members as well as infrastructure managers (Trafikverket and RWS).
- ALICE worked together with ERRAC and the rest of Transport ETPs in the development of the document on the *Truly integrated Transport System for Sustainable and Efficient Logistics* (Link to the document).
- ALICE has participated as speaker in 2 ERRAC Plenary meetings in 2015 and 2018.
- ALICE and ERRAC together with the rest of Transport ETPs are part of the Transport Research Arena (www.traconference.eu) Management, Program and Organizational Committees.
- ALICE and ERRAC together with the rest of Transport ETPs are part of the STRIA Governance group. Jointly, we have developed a Joint document on the STRIA Connected and Automated Transport Roadmap.

- ALICE, ERRAC and the rest of transport ETPs prepared together 3 topics36 that were proposed for Horizon 2020 Work Programme 2018-2020 in order to strengthen some collaborations and joint initiatives.
- ALICE, ERRAC and ERTRAC have a joint Working Group on Urban Mobility. • ALICE is part of Shift2Rail USER REQUIREMENTS/IMPLEMENTATION AND DEPLOYMENT WORKING GROUP.
- Shift2Rail and ERRAC representatives are invited to ALICE events and are in ALICE members distribution lists.
- Shift2Rail has participated actively in: Physical Internet workshop (link); Collaborative Innovation Day "New Global Routes: One Belt One Road Initiative & TEN-T" (link); International Physical Internet Conference (https://www.pi.events/).

d) **Members**

Shift2Rail Members that are also members of ALICE are:

| Shift2Rail Members | ALICE |
|---|---|
| Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. IVI | ✓* |
| HaCon Ingenieurgesellschaft mbH | ✓ |
| Trafikverket | ✓ |

✓ Indicates that the Shift2Rail member is also member of the other entity.
✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. In this case, the following entities are members of ALICE:

- Fraunhofer IFF
- Fraunhofer IML

ERRAC appears as member of Alice, under the type of organization "European Technology Platforms / PPPs" https://www.etp-logistics.eu/?page_id=131

**e) Structure**

ALICE counts with the following thematic groups (link):

- TG1 Sustainable Logistics Supply Chains
- TG2 Corridors, Hubs and Synchromodality
- TG3 Systems & Technologies for Interconnected Logistics
- TG4 Global Supply Network Coordination and Collaboration
- TG5 Urban logistics

**f) Other information**

Railway Innovation Capabilities

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

An indication on the Railway Innovation Capabilities that may be related to the activities performed by ALICE is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | ALICE |
|---|---|---|
| 1 | Automated train operation | |
| 2 | Mobility as a Service | |
| 3 | Logistics on demand | ✓ |
| 4 | More value from data | ✓ |
| 5 | Optimum energy use | |
| 6 | Service timed to the second | |
| 7 | Low cost railway | |
| 8 | Guaranteed asset health and availability | |
| 9 | Intelligent trains | |
| 10 | Stations and "smart" city mobility | |
| 11 | Environmental and social sustainability | |
| 12 | Rapid and reliable R&D delivery | |

Other information

- A webinar on ALICE Recommendations towards Horizon Europe 2021-2022 Work Programmes was organised. No more details are available (link).

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- It counts with a Knowledge Platform for members (link) with information on projects, funding opportunities, documents…

Events:

No future events are showcased in ALICE's website at the moment of elaboration of this document.

References and key documents:

- ALICE's Website: https://www.etp-logistics.eu/
- Documents and Publications. http://www.etp-logistics.eu/?page_id=292

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## 5.4 Mapping ECSEL JU vs Shift2Rail

**ECSEL, Joint Undertaking - the Public-Private Partnership**

**for Electronic Components and Systems for European Leadership**

ECSEL Joint Undertaking

### b) Mention of railways in key documents

Multi-Annual Strategic Plan ("MASP") 2019

- Transportation (automotive, railroad, aerospace) is mentioned at the key application areas section when looking at the competitive situation (p. 41).
- Focus areas: "Transport and smart mobility" is one out of five key applications mentioned (p.59).
- Railways are mentioned in relation to the following terms / key words: multimodality / intermodality (p.148); rail freight terminals (p.59-60); unmanned vehicles (p.60); autonomous train (p.60)s; smart sensors - Wireless non-safety critical vehicular networks (p.68); managing interaction between humans and vehicles (p.74); intelligent management of energy at railway stations in the framework of Digital Life (141); safety certification (p. 197).
- When describing the long-term vision, Railways are mentioned at the Transport and smart mobility section (p. 270)

Other items that may be of interest:

- Challenges for transport: Artificial Intelligence applications in transport; digital models (Digital Reality); physical infrastructure to be complemented by digital services (p.60)

ECSEL Strategic Research Agenda 2019 and 2020

The content of the Strategic Research Agenda is almost the same as the MASP 2019, so the same items described in the section before apply here.

There is one addition at the SRA 2020 in relation to fuel cell electrical vehicles, especially for long range mobility as well as for trucks and railways, where the development of the necessary ECS components and associated software is crucial (p.45).

### c) Mention of Shift2Rail at key documents

Multi-Annual Strategic Plan ("MASP") 2019

- Shift2Rail appears mentioned in relation to adaptable communications systems (p.60): More precisely:

  *Autonomous trains should take into account current project developments supported by **Shift2Rail JU** focusing on an adaptable communication system for train control applications in all market segments, using packet switching/IP (GPRS, EDGE, LTE, Satellite) technologies, enabling easy migration from legacy systems, providing enhanced throughput, safety and security functionalities to support the current and future needs of signalling systems, and*

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*resilient to interference and to radio technology evolution.*

ECSEL Strategic Research Agenda 2019 and 2020

The content of the Strategic Research Agenda is almost the same as the MASP 2019, so the same items described in the section before apply to this.

d) **Members**

ECSEL Members are:

- **Three associations (EPoSS, AENEAS and ARTEMIS** Industry Association) representing the actors from the areas of micro- and nano-electronics, smart integrated systems and embedded/cyber-physical systems;
- the **European Union** (through the Commission);
- **Member States and Associated Countries** to the Framework Programme Horizon 2020 on a voluntary basis (Austria, Belgium, Bulgaria, Czech Republic, Germany, Denmark, Estonia, Greece, Spain, Finland, France, Hungary, Ireland, Israel, Italy, Lithuania, Latvia, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia, Turkey, United Kingdom and Switzerland).

Shift2Rail Members that are also members of ECSEL are:

| **Shift2Rail Members** | **ECSEL** | | |
|---|---|---|---|
| | EPoSS | AENEAS | ARTEMIS |
| **ACCIONA INFRAESTRUCTURAS SA** | | | ✓* |
| **AVL List GmbH** | ✓ | | ✓ |
| **Centro de Estudios e Investigaciones Técnicas (CEIT)** | | | ✓ |
| **Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. IVI** | ✓* | ✓ | |
| **FUNDACION TECNALIA RESEARCH & INNOVATION** | | | ✓ |
| **Hitachi Rail STS – Hitachi Rail STS S.p.A** | ✓* | | |
| **INDRA SISTEMAS S.A.** | | | ✓ |
| **Kompetenzzentrum – Das virtuelle Fahrzeug, Forschungsgesellschaft mbH. Virtual Vehicle** | | | ✓ |
| **Siemens Aktiengesellschaft** | ✓ | | ✓ |
| **THALES** | | ✓ | ✓ |

✓ Indicates that the Shift2Rail member is also member of the other entity.

✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. This is the case of:

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- ACCIONA at ARTEMIS: Acciona Construcción S.A.
- Fraunhofer IVI at EPoSS: Fraunhofer EMFT; Fraunhofer ENAS; Fraunhofer IMM; Fraunhofer IPMS; Fraunhofer ISC; Fraunhofer IZM; Fraunhofer LBF
- Hitachi Rail at EPoSS: Hitachi
- Thales at ARTEMIS: Thales DIS France S.A.

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### e) Shift2Rail-ECSEL Mapping

**Key Words: Silicon carbide (SiC) technologies, power electronics, semiconductors.**

Relation with S2R TD: TD 1.1- Traction system

| | **ECSEL Projects directly related to rail** | | **ECSEL Projects not directly related to rail** | |
|---|---|---|---|---|
| Name | WINSIC4AP | | OSIRIS-ECSEL | REACTION |
| Domain | Silicon carbide (SiC) technologies, power electronics | | Silicon carbide (SiC) technologies | Silicon carbide (SiC) technologies |
| Relation with TD1.1 | It will develop Intelligent Power Switch (IPS-RA): High Voltage Power Converters (<10 kV) for embedded railway equipment's | | It has not a direct relation with the TD, but it is developing work on the SiC and can affect TD1.1 in the future (Economy related) | It has not a direct relation with the TD, but it is developing work on the SiC and can affect TD1.1 in the future(Energy and transportation) |
| Shift2Rail Projects related | PINTA | PINTA 2 | | |
| Common partners | None | None | | |
| Links | https://www.winsic4ap-project.org https://cordis.europa.eu/project/id/737483/es | | http://osiris-ecselju.eu/ https://cordis.europa.eu/project/id/662322/en | https://cordis.europa.eu/project/rcn/216108/factsheet/en |

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**Key Words: Cyber Physical Systems (CPS), proactive maintenance, digitalization, door controller, automatic train control verification**

Relation with S2R TD:

TD 1.2 - Train Control and Monitoring System Demonstrator
TD 1.6 - Doors and Access Systems Demonstrator
TD 2.2 - Railway network capacity increase
TD 3.5 - Proactive Bridge and Tunnel Assessment, Repair and Upgrade Demonstrator
TD 3.6 - Dynamic Railway Information Management System (DRIMS) Demonstrator
TD 3.7 - Railway Integrated Measuring and Monitoring System (RIMMS) Demonstrator
TD 3.8 - Intelligent Asset Management Strategies Demonstrator (IAMS)

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| | **ECSEL Projects directly related to rail** | | | | **ECSEL Projects not directly related to rail** |
|---|---|---|---|---|---|
| Name | [1]AMASS | | | | MANTIS |
| Domain | Cyber Physical systems (CPS), door controller, automatic train control, verification | | | | Cyber Physical Systems (CPS), proactive maintenance, digitalization |
| Related TDs | TD1.6, TD2.2 | | | | TD1.2, TD3.5, TD3.6, TD3.7, TD3.8 |
| Relation with TDs | One of the main domains of the project is the railway market. More precisely there is a part based on a Platform Screen Doors Controller (TD1.6) and another on Automatic Train Control Formal Verification (TD2.2) | | | | Although It has not a direct relation with any TD it is developing work on predictive maintenance for other sectors, which could affect and be interesting for the rail sector (infrastructure and rolling stock) |
| Common partners with S2R | FUNDACION TECNALIA; Thales Italia spa; Kompetenzzentrum - Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH; ALSTOM TRANSPORT SA | | | | |
| Shift2Rail Projects related | TD1.6 | | TD2.2 | | |
| | PIVOT | MAT4RAIL | X2RAIL1 | ASTRAIL | |
| Common partners (of both projects) | FUNDACION TECNALIA RESEARCH & INNOVATION; VIRTUAL VEHICLE | RISE | THALES IT; ALSTOM TRANSPORT | | |
| Links | https://www.amass-ecsel.eu https://cordis.europa.eu/project/id/692474 | | | | http://www.mantis-project.eu https://cordis.europa.eu/project/id/662189/en |

[1] This project is also related to TD2.6 (and to some extent TD2.11), as they´re very much focused on V&V and certification

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**Key Words: Automated Cyber Physical Systems (ACPS), Automated Command and Control Systems, ETCS, ETCS Testing, TCMS**

Relation with S2R TD:

TD 1.2 - Train Control and Monitoring System Demonstrator

TD 2.1 - Adaptable communications for all railways

TD 2.3 - Moving Blocks

TD 2.6 - Zero on-site testing

| | **ECSEL Projects directly related to rail** | |
|---|---|---|
| Name | ENABLE-S3 | MEGAMART2 |
| Domain | Automated Cyber Physical Systems (ACPS), Automated Command and Control Systems, ETCS, Verification, Testing | TCMS, ETCS Testing |
| Related TDs | TD 2.1, TD 2.3, TD 2.6 | TD 1.2, TD 2.6 |
| Relation with TDs | It has a dedicated specific domain for Rail Automated Command and Control Systems and the team is now dedicated to the verification and validation ETCS level 3 (affecting TD2.1 and TD2.3)<br><br>https://drive.google.com/file/d/1wXzw6c4XAoy6fzskQsR6S0h7xJItU3CA/view | It has a dedicated use case provider centred on the Bombardier MITRAC Trains Control and Management System (TCMS), which affects TD2.1.<br><br>Also, the same use case approaches the need for improvements of the **Model-Based Testing, which** concerns the investigation of innovative methods for test case generation, test case selection, and test results evaluation, affecting TD2.6 |
| Common partners with the JU | FUNDACION TECNALIA RESEARCH & INNOVATION; DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV; Kompetenzzentrum - Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH; SIEMENS; THALES | BOMBARDIER TRANSPORTATION SWEDEN AB; THALES |

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| Shift2Rail Projects related | TD2.1 | | TD2.3 | TD2.6 | | | TD1.2 | | | | TD2.6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | X2RAIL3 | EMULRADIO4RAIL | MOVINGRAIL | X2RAIL1 | X2RAIL3 | VITE | CONNECTA | CONNECTA2 | SAFE4RAIL | SAFE4RAIL-2 | X2RAIL1 | X2RAIL3 | VITE | GATE4RAIL |
| Common partners (of both projects) | DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV; SIEMENS; THALES | | None | SIEMENS; THALES TRANSPORTATION; DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV | THALES; DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV; SIEMENS | None | BOMBARDIER TRANSPORTATION | BOMBARDIER TRANSPORTATION | IKERLAN S. COOP | IKERLAN S. COOP | THALES; BOMBARDIER TRANSPORTATION | THALES; BOMBARDIER TRANSPORTATION | None | None |
| Links | https://www.enable-s3.eu<br>https://cordis.europa.eu/project/id/692455 | | | | | | https://megamart2-ecsel.eu<br>https://cordis.europa.eu/project/id/737494 | | | | | | | |

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**Key Words: Autonomous communication platform, Virtual coupling, freight telematics, On-board and on track communication, Train Control and Monitoring System**

Relation with S2R TD:
TD 1.2 - Train Control and Monitoring System Demonstrator
TD 2.8 - Virtually – Coupled Train Sets
TD 2.10 - Smart radio-connected all-in-all wayside objects
TD 5.1 - Fleet Digitalization and Automation

| | **ECSEL Projects directly related to rail** |
|---|---|
| Name | SCOTT |
| Domain | Autonomous communication platform, Virtual coupling, freight telematics, On-board and on track communication |
| Related TDs | TD 2.8, TD 2.10, TD1.2, TD 5.1 |
| Relation with TDs | It will develop a demonstrable first approach for a trustable Virtual Coupling solution for train sets based on safety-related vehicle to vehicle wireless communication technology and wireless sensor network technologies that will be able to perform a safe manoeuvre coupling and uncoupling between train sets (TD 2.8).<br>It will develop a demonstrable wireless safety communication platform for use in dangerous areas (e.g., level crossing without barriers, works zones on the track, etc.), where the previous lack of network infrastructure makes necessary to have an affordable workable system compatible with the current legacy infrastructure in order to compensate for the safety deficiencies of these zones (critical areas) (TD2.10)<br>A complete (on-board and on-track) demonstrable secure wireless communication platform for rail logistics and maintenance applications including the integration with a cloud-based platform that will enable the future development of multiple cost-efficient applications. (TD 5.1) |
| Common partners with S2R | FUNDACION TECNALIA RESEARCH & INNOVATION; DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV;Kompetenzzentrum - Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH; SIEMENS; THALES AUSTRIA GMBH; THALES ALENIA SPACE ESPANA, SA |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Shift2Rail Projects related | TD2.8 | | TD2.10 | | TD1.2 | | | | TD 5.1 | |
| | X2RAIL3 | MOVINGRAIL | XRAIL 2 | Etalon | CONNECTA | CONNECTA 2 | SAFE4RAIL | SAFE4RAIL-2 | FR8RAIL | INNOWAG |
| Common partners (of both projects) | SIEMENS; INDRA SISTEMAS S.A; | None | SIEMENS; INDRA SISTEMAS S.A; | None | SIEMENS | None | None | None | Kompetenzzentrum - Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH; INDRA SISTEMAS SA | |
| Links | https://scottproject.eu<br>https://cordis.europa.eu/project/id/737422/en | | | | | | | | | |

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**Key Words: Energy, energy harvesting, Energy recovery, energy management**

Relation with S2R TD:

TD 1.4 - Running Gear Demonstrator

TD 3.8 - Intelligent Asset Management Strategies Demonstrator (IAMS)

TD 3.9 - Smart Power Supply Demonstrator

| | **ECSEL Projects directly related to rail** | **ECSEL Projects not directly related to rail** | |
|---|---|---|---|
| Name | SCOTT | ENSO | CONNECT |
| Domain | Energy, energy harvesting | Energy recovery, energy harvesting, energy management | Energy management; smart grid |
| Related TDs | TD 3.9 | TD1.4, TD 3.8 | TD 3.9 |
| Relation with TDs | A demonstrable energy harvesting platform for rail systems that will make use of different energy sources (e.g., vibration, solar) is being developed. | Energy recovery through vibration is part of the challenges ofTD1.4. ENSO does not concentrate on that, but there is a domain on smart mobility that it may affect the work on this TD in the future (TD1.4)<br>The work developed by ENSO could be included also in the energy strategies of the rail sector (TD 3.8) | It has no direct relation with railways, but it may affect the TD on smart management of energy in rail (TD3.9) |
| Common partners with the JU | FUNDACION TECNALIA RESEARCH & INNOVATION; DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV;Kompetenzzentrum - Das Virtuelle | | |

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| | | | |
|---|---|---|---|
| | Fahrzeug, Forschungsgesellschaft mbH; SIEMENS; THALES AUSTRIA GMBH; THALES ALENIA SPACE ESPANA, SA | | |
| Shift2Rail Projects related | IN2STEMPO | | |
| Common partners (of both projects) | SIEMENS | | |
| Links | https://scottproject.eu<br>https://cordis.europa.eu/project/id/737422/en | http://www.enso-ecsel.eu<br>https://cordis.europa.eu/project/id/692482 | http://www.connect-ecsel.eu<br>https://cordis.europa.eu/project/id/737434 |

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**Key Words: Cybersecurity**

Relation with S2R TD:

TD 2.11 - Cyber Security

| | **ECSEL Projects directly related to rail** | | | **ECSEL Projects not directly related to rail** |
|---|---|---|---|---|
| Name | SECREDAS | | | Productive 4.0 |
| Domain | Cybersecurity | | | Cybersecurity |
| Related TDs | TD2.11 | | | TD2.11 |
| Relation with TDs | There is a big case for safety and security in the rail domain, concentrated on cybersecurity (TD2.11). There is no good information available. | | | There is a case of threat modelling in the railway domain, related with cybersecurity. Although it is not a central issue, it has been taken into account and may influence the work on TD2.11. There is no good information available, so we cannot analyse the common collaboration issues that might affect S2R. |
| Common partners with S2R | INFRAESTRUTURAS DE PORTUGAL SA; Kompetenzzentrum - Das Virtuelle Fahrzeug, Forschungsgesellschaft mbH;INDRA SISTEMAS; THALES AUSTRIA GMBH | | | |
| Shift2Rail Projects related | XRAIL 1 | CYR AIL | XRAIL 3 | |
| Common partners (of both projects) | THALES TRANSPORTATION SYSTEMS GMBH; INDRA SISTEMAS S.A | None | INDRA; THALES; | |
| Links | https://secredas.eu<br>https://cordis.europa.eu/project/id/783119 | | | https://productive40.eu<br>https://cordis.europa.eu/project/id/737459 |

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**f) Other information**

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by ECSEL is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | ECSEL |
|---|---|---|
| 1 | Automated train operation | ✓ |
| 2 | Mobility as a Service | |
| 3 | Logistics on demand | |
| 4 | More value from data | |
| 5 | Optimum energy use | ✓ |
| 6 | Service timed to the second | ✓ |
| 7 | Low cost railway | |
| 8 | Guaranteed asset health and availability | ✓ |
| 9 | Intelligent trains | ✓ |
| 10 | Stations and "smart" city mobility | |
| 11 | Environmental and social sustainability | |
| 12 | Rapid and reliable R&D delivery | |

Other information

- ARTEMIS, association member of ECSEL, participates at the discussions on Strategic Research, Innovation and Deployment Agenda (SRIDA) for a European Artificial Intelligence, Data and Robotics PPP fostered Big Data Value Association and euRobotics. http://www.bdva.eu/node/1359.

- ARTEMIS identifies the following Embedded Intelligence in relation to "Transport and Smart Mobility" (Arttemis Magazine N.26): https://artemis-ia.eu/publication/download/artemis-magazine-26.pdf
  - Embedded and cyber-physiscal systems
  - Secure IoT and systems of systems

Events:

- EFECS 2019. European Forum for Electronic Components and Systems. Focus on 'Our Digital Future'. Helsinki, Finland 19/11/2019 to 21/11/2019. https://efecs.eu/

- 14-15/01/2020. Brussels. ECS Brokerage Event. Combines the brokerage activities of the industry associations AENEAS, ARTEMIS-IA and EPoSS into one networking event dedicated to project proposals in the field of Electronic Components and Systems.
- https://ecscollaborationtool.eu/ecs-brokerage-event-2019.html

- ISS Europe. Industry Strategy Symposium. 1-3/04/2020 Brussels. https://www.semi.org/eu/connect/events/Industry-Strategy-Symposium-Europe#overview

References and key documents:

- ECSEL Website: www.ecsel.eu
- ECSEL Strategic Research Agenda 2019. https://www.ecsel.eu/sites/default/files/2019-02/ECS-SRA%202019%20FINAL.pdf
- ECSEL Strategic Research Agenda 2020. https://efecs.eu/publication/download/ecs-sra-2020.pdf
- ECSEL Multi-Annual Strategic Plan ("MASP") 2019. https://ec.europa.eu/research/participants/data/ref/h2020/other/legal/jtis/ecsel-multi-stratplan-2019_en.pdf

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

## 5.5 Mapping ESC – European Cyber Security PPP vs Shift2Rail

### g) Mention of railways at key documents

ECSO Strategic Research and Innovation Agenda WG6. June 2017 (link)

- Rail appears at the picture on "main thematic priority areas), in the box related to demonstrations on transport (p.9).
- There is a section on "Demonstrations for the society, economy, industry and vital services" with six areas, one of which is "Transportation". It address railways directly: considering railways as a safety critical application describing the sector in relation to cybersecurity (p.58-59); railway infrastructure, ECTS, communications, ERTMS (p.60-61); railway market (p.62); targeted users (p.63)
- The document analyses all types of EU projects. The ones mentioned that are related to railways are:
    - AMASS, H2020-ECSEL project; certification schemes (p.25)
    - X2Rail-1, Shift2Rail project, in relation to industry 4.0 (p.36)
    - SECRET, FP7, mentioned at the section on "Smart cities and smart building"; electromagnetic attacks (p.52; p.61)
    - PROTECTRAIL, FP7, set of railway security solutions (p.61)
    - SECUR-ED, FP7, public transport (p.61)
    - CYRail, S2R project, cybersecurity (p.61; p.90)
    - IT2RAIL, S2R Flagship project (p.61)

European Cybersecurity Strategic Research and Innovation Agenda (SRIA). June 2016 (link)

- "Energy network train transportation" mentioned in relation to "trusted hardware" (p.87)

European Cybersecurity Industry Proposal for a contractual Public-Private-Partnership (link)

It includes a section on "vertical analysis (applications)" describing seven areas. Inside this section, railways are mentioned:

- Inside the area of "Industrial Control systems", "trains" mentioned in relation to well-functioning of industrial products (p.28)
- Inside the "transport area", railways are mentioned several times:
    - "increase of the capacity, speed and safety of both passengers and goods rail transport systems" is mentioned as strategic challenge in the transport sector (p.31)
    - "In rail, the transport system again depends on a relatively limited number of technically sophisticated controlling assets (signalling systems) and the transport vehicles are large and relatively few. Regulation is again strong" (p.33)
    - "distinction between critical operational systems (e.g. railway-signalling systems, …) and informational or supervisory systems" (p.33)

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- Mention of "railway operation centres" (p.33)

Communication: Strengthening Europe's Cyber Resilience System and Fostering a Competitive and Innovative Cybersecurity Industry (link)

- It mentions "The Commission will also explore ICT security certification within infrastructure sectors (e.g. in aviation, railways, automotive)" (p.10)

**h) Mention of Shift2Rail at key documents**

ECSO Strategic Research and Innovation Agenda WG6. June 2017 (link)

- Mention of the "Shift2Rail Joint Undertaking Multi-Annual Action Plan, 2015" at a footnote: in relation to protection of railway communication channels (p.60); in relation to figures on future rail freight and passenger services demand (p.62); integration of services at European level (p.64).
- It mentions several S2R Projects: X2Rail-1 (p.36); CYRail (p.61; p.90); IT2RAIL (p.61)

European Cybersecurity Strategic Research and Innovation Agenda (SRIA). June 2016 (link)

- S2R is mentioned as one of Other important initiatives which could be linked to the ECS cPPP" (p.17)

Communication: Strengthening Europe's Cyber Resilience System and Fostering a Competitive and Innovative Cybersecurity Industry (link)

- "Shift2Rail" is mention on a footnote (p.13) in relation to synergies with sectoral PPPs.

**i) Members**

The European Commission and the European Cyber Security Organisation (ECSO) signed a cPPP on July 2016. Shift2Rail Members that are also members of ECSO are:

| Shift2Rail Member | ECSO members (web) |
|---|---|
| AVL List GmbH | ✓ |
| Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. IVI | ✓ |
| FUNDACION TECNALIA RESEARCH & INNOVATION | ✓ |
| INDRA SISTEMAS S.A. | ✓ |
| Siemens Aktiengesellschaft | ✓ |
| THALES | ✓* |

| UNIVERSIDADE DO PORTO | ✓* |
|---|---|

✓ Indicates that the Shift2Rail member is also member of the other entity.

✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. This is the case of:

- C3P - Competence Center for Cybersecurity and Privacy, University Porto ( Portugal )
- Thales SIX GTS France SAS ( France )

### j) Relevant information in relation to the structure

WG3 Sectoral Demand

Transport is one of the sectors targeted by ECS cPPP, including railways as part of it. With this regard, there is one ECSO Working Group very relevant: WG3 Sectoral Demand (Industry 4.0, Energy, Financial, Public Services / e-Government, Health, Transportation, Smart Cities, Telecom - Media & Content). This group serves to engage directly with users and has a sub-group on SWG3.3: Transportation (road, rail, air; sea, space) - Chairs: AIRBUS and LSEC. ECSO membership is required for participation at the group, but not for participation at the workshops.

The activities of WG3 are:

1. Mapping of effective sectoral and cross-sectoral market / users / industry needs, priority areas and taxonomy of challenges
2. Cooperation with EU associations of users and operators
3. List of hacks & attacks per sector
4. Exchange of cyber threat information
5. Common Application Platform for verticals

This group elaborates public sector reports, so far available for: financial services, health care, industry 4.0, smart cities & smart buildings, and energy networks and smart grids.

In this context, the SWG3.3 "Transportation", organised a workshop on 11 February 2019, inviting external (non-ECSO members) stakeholders from all transportation sectors to contribute to discussions. The SWG has written a report on the needs and requirements of the transportation sub-sectors, including air, sea, rail and road. On the occasion of the workshop, a Shift2Rail representative were in attendance and gave a presentation on the state of the art of the rail sector, in terms of digitalisation and cybersecurity. The report should be published soon.

WG6: SRIA and Cyber Security Technologies

This work group includes the coordination with other PPPs, JUs, Pilots on Competence Centres, EC projects and other initiatives, as well as the definition of Scenarios and priorities for Horizon Europe. It may be interesting, as ECSO indicated at the T4R D1.2. factsheet that ECSO membership does not currently cover the rail sector extensively, at least from the demand side, so engagement with user associations and PPP's at EU level are strongly welcomed to ensure that needs and requirements can be elicited from all relevant stakeholder groups.

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### k) Shift2Rail-ECSO cPPP Mapping

**Key Words: Cybersecurity**

Relation with S2R TD: TD 2.11 - Cyber Security

| | **ECSO Projects directly related to rail** | | |
|---|---|---|---|
| **Name** | Cyberwiser.eu   | | |
| **Domain** | Cybersecurity | | |
| **Related TDs** | TD 2.11 | | |
| **Relation with TDs** | There is a dedicated pilot test which will be developed inside a Rail Operator (Ferrovie dello Stato). EU and FFSS will select, according to specific needs of a railroad domain, a certain number of IT Systems (training assets) to be replicated under the SOC. FFSS Risk Management will provide a first assessment of the economics involved with a successful attack (cost of a data breach, business interruption etc.) and will provide the data to the training room to be used during the training. The training team will be selected and the game performed, considering a real-time cost/benefits analysis. | | |
| **S2R Common partners** | None | | |
| **Shift2Rail Projects related** | X2RAIL 1 | CYRAIL | X2RAIL 3 |
| **Common partners** | None | None | None |
| **Links** | https://cyberwiser.eu/ | https://cordis.europa.eu/project/id/786668 | |

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### l) Other information

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by ECSO is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | ECS |
|---|---|---|
| 1 | Automated train operation | ✓ |
| 2 | Mobility as a Service | ✓ |
| 3 | Logistics on demand | ✓ |
| 4 | More value from data | ✓ |
| 5 | Optimum energy use | ✓ |
| 6 | Service timed to the second | ✓ |
| 7 | Low cost railway | ✓ |
| 8 | Guaranteed asset health and availability | ✓ |
| 9 | Intelligent trains | ✓ |
| 10 | Stations and "smart" city mobility | ✓ |
| 11 | Environmental and social sustainability | |
| 12 | Rapid and reliable R&D delivery | |

Other information

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

The CyberSANE Project: https://www.cybersane-project.eu/project/pilot-scenarios/#cargo
Does not directly include rail as a transversal or a pilot, but it does include a pilot on "Container Cargo Transportation Service" applied to truck-port containers, which can be of interest for rail.

Events:

- 13-14 May 2020, Brussels, Belgium. CYBER INVESTOR DAYS IN BRUSSELS. Organised by ECSO and the EIT Digital Accelerator. https://www.eventbrite.com/e/cyber-investor-days-in-brussels-tickets-91588789535
- 2020 Workshop on the Economics of Information Security (Brussels, June 15-16, 2020). https://weis2020.econinfosec.org/program/call-for-papers/

References and key documents:

- ECSO website: https://ecs-org.eu/
- ECSO Work Group WG3: Sectoral Demand (Industry 4.0, Energy, Financial, Public Services / e-Government, Health, Transportation, Smart Cities, Telecom - Media & Content). https://ecs-org.eu/working-groups/wg3-sectoral-demand-industry-40-energy-financial-public-services-e-government-health-transportation-smart-cities-telecom-media-content
- ECSO Strategic Research and Innovation Agenda. WG6. June 2017. https://ecs-org.eu/documents/publications/59e615c9dd8f1.pdf
- European Cybersecurity Strategic Research and Innovation Agenda (SRIA). June 2016. http://ecs-org.eu/documents/ecs-cppp-sria.pdf
- European Cybersecurity Industry Proposal for a contractual Public-Private-Partnership. June 2016. http://ecs-org.eu/documents/ecs-cppp-industry-proposal.pdf
- Communication: Strengthening Europe's Cyber Resilience System and Fostering a Competitive and Innovative Cybersecurity Industry. https://ec.europa.eu/digital-single-market/en/news/communication-strenghtening-europes-cyber-resilience-system-and-fostering-competitive-and

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

## 5.6 Mapping of ECTP - European Construction, built environment and energy efficient building Technology Platform vs Shift2Rail

### a) Mention of railways at key documents

ECTP Strategic Research & Innovation Agenda (SRIA) 2021-2027. November 2019. (Document; Appendix)

- Mention of "length of railways lines" when talking about infrastructure networks (p.10).
- Mention of "railway" in relation to the lack of coordination between transport sectors when describing barriers (p.35).

This document includes several mentions to "transport":

- Transport infrastructures and infrastructure networks to transport people and goods (p.10); Policy framework for decarbonised transport and related infrastructures (p.16); New transport patterns (p.27); Multi-modal transport hubs and urban mobility infrastructures (p.28); Accessible and inclusive transportation (p.32).
- At the appendix, detail content of R&I topics is described, including state of the art, topic scope and nature of activities required. The ones related to transport are:
    - Optimal solutions to adapt existing infrastructures to new transport patterns (p.4);
    - Multi-modal transport hubs and urban mobility infrastructures (p.5);
    - Interactive operation and management of city assets (p.9);
    - New designs of buildings, infrastructures, multimodal hubs and public spaces for accessibility and inclusiveness (p.10);
    - Designs, materials and solutions to improve resilience, preparedness & responsiveness of the built environment to disruptive events (p.14);
    - Lifecycle-based asset management and holistic approach of infrastructures (p.15);
    - Digital decision-making tools on investment options (p.18);
    - Integrated Information Modelling at district and city level (p.20)

The high-tech building industry in support of the EU energy, climate and sustainability objectives. Towards a generalised European Low-Carbon &Resilient Built Environment. ECTP. FP9 POSITION PAPER (link)

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

– Railways are mentioned only once, when providing the length of railway lines. However, transport infrastructures are referred several times through the whole document.

ECTP Infrastructure and Mobility. FP9 2021-2027 POSITION PAPER (link)

– Mention of "length of railways lines" when talking about infrastructure networks (p.3)
– Mention of "underground trains and the railway networks" at the introduction (p.3)
– At figure 4.1, "rail" is mentioned at "priorities" "Level 3. Technological gaps" (p.11)
– "rail freight" mentioned at C7C, describing priority area C "long distance corridors" (p.17)

**b) Mention of Shift2Rail at key documents**

ECTP Infrastructure and Mobility. FP9 2021-2027 POSITION PAPER (link)

- Mention of "Shift2Rail" at the background as European initiative that share their vision partially or in its entirety (p.7)

**c) Contact with ERRAC**

According to the factsheet completed by ECTP on task 1.2 of TER4RAIL, ECTP described the following contact with ERRAC:

– ECTP had contacts with ERRAC at the time of the Roadmap for Cross-Model Transport Infrastructure Innovation (2013).
– After that a significant collaboration have been exploited with the railway sector in the H2020REFINET project, thanks to the participation as consortium member, of UIC. This allowed REFINET strategic documents, namely the Multi-Modal Transport Infrastructure (RMMTI) model, the Strategic Implementation Plan and its deployment strategy, to take into account needs and requirements of the railway sector as well.
– Moreover, ECTP as member of the TRA, jointly shares and discusses with ERRAC under this umbrella.

d) **Members**

Shift2Rail Members that are also members of ECTP are:

| Shift2Rail Members | ECTP |
|---|---|
| ACCIONA INFRAESTRUCTURAS SA | ✓* |
| Centro de Estudios de Materiales y Control de Obra S.A | ✓ |
| Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. IVI | ✓* |
| FUNDACION TECNALIA RESEARCH & | ✓ |

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

| | |
|---|---|
| **INNOVATION** | |
| **INDRA SISTEMAS S.A.** | ✓ |
| **TATASTEEL** | ✓ |
| **UNIVERSIDAD DEL PAIS VASCO** | ✓ |
| **UNIVERSIDADE DO PORTO** | ✓ |

✓ Indicates that the Shift2Rail member is also member of the other entity.

✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. This is the case of:

- ACCIONA Construcción
- Fraunhofer Building Innovation Alliance

### e) Structure

ECTP focusses on European Built Environment (including buildings, transport infrastructures and infrastructures for all utility networks -energy, water, communication services, etc.). It has five Committees:

- Active Ageing & Design
- Energy Efficient Buildings (E2B)
- Heritage & Regeneration
- Infrastructure & Mobility
- Materials & Sustainability

Each committee has issued a position paper in 2018: http://www.ectp.org/resources/publications

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### f) Shift2Rail-ECTP Mapping

**Key Words: Infrastructure, maintenance, management**
Relation with S2R TD: TD 3.6 - Dynamic Railway Information Management System (DRIMS) Demonstrator
TD 3.7 - Railway Integrated Measuring and Monitoring System (RIMMS) Demonstrator
TD 3.8 - Intelligent Asset Management Strategies Demonstrator (IAMS)

| | **ECTP Projects directly related to rail** | | | |
|---|---|---|---|---|
| **Name** | DestinationRail   | | | |
| **Domain** | Infrastructure, maintenance, management | | | |
| **Related TDs** | TD 3.6, TD 3.7,TD3.8 | | | |
| **Relation with TDs** | The DESTination RAIL project will develop management tools based on scientific principles for risk assessment using real performance measurements and other vital data stored in an Information Management System. This will allow for a step-change in the management of European rail infrastructure. | | | |
| **S2R common partners** | Slovenske zeleznice (SZ) | | | |
| **Shift2Rail Projects related** | IN2SMART | IN2DREAMS | MOMIT | Assets4Rail |
| **Common partners** | None | None | None | None |
| **Links** | http://www.destinationrail.eu/<br>https://cordis.europa.eu/project/id/636285 | | | |

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**Key Words: Infrastructure maintenance, track design, monitoring, power supply**

Relation with S2R TD:

TD 3.1 - Enhanced Switch & Crossing System Demonstrator
TD 3.2 - Next Generation Switch & Crossing System Demonstrator
TD 3.3 - Optimised Track System
TD 3.4 - Next Generation Track System
TD 3.6 - Dynamic Railway Information Management System (DRIMS) Demonstrator
TD 3.7 - Railway Integrated Measuring and Monitoring System (RIMMS) Demonstrator
TD 3.8 - Intelligent Asset Management Strategies Demonstrator (IAMS)
TD 3.9 - Smart Power Supply Demonstrator
TD 3.10 - Smart Metering for Railway Distributed Energy Resource Management System Demonstrator
TD 3.11 - Future Stations Demonstrator

| | **ECTP Projects directly related to rail** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Name** | Netirail | | | | | | | |
| **Domain** | Infrastructure maintenance, track design, monitoring, power supply | | | | | | | |
| **Related TDs** | TD3.1, TD3.2, TD3.3, TD3.4, TD 3.6, TD3.7, TD3.8, TD3.9, TD3.10 | | | | | | | |
| **Relation with TDs** | The work will address growing demand for already busy services, and future growth of under utilised lines, with technical solutions for track (including S&C), power supply and support of new smart services. | | | | | | | |
| **S2R common partners** | TCDD, SZ | | | | | | | |
| **Shift2Rail Projects related** | IN2TRACK | IN2TRACK 2 | S-CODE | IN2DREAMS | IN2SMART | MOMIT | ASSETS4RAIL | IN2STEMPO |
| **Common partners** | TCDD; SZ | TCDD; SZ | None | None | TCDD | None | None | SZ |
| **Links** | http://netirail.eu/ | | | | | | | |

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

### g) Other information

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by ECTP is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | ECTP |
|---|---|---|
| 1 | Automated train operation | |
| 2 | Mobility as a Service | |
| 3 | Logistics on demand | |
| 4 | More value from data | |
| 5 | Optimum energy use | |
| 6 | Service timed to the second | |
| 7 | Low cost railway | ✓ |
| 8 | Guaranteed asset health and availability | ✓ |
| 9 | Intelligent trains | |
| 10 | Stations and "smart" city mobility | ✓ |
| 11 | Environmental and social sustainability | ✓ |
| 12 | Rapid and reliable R&D delivery | |

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

Other information

- According to the factsheet completed by ECTP on task 1.2 of TER4RAIL, ECTP indicated in relation to their possible interest in the railway sector: "Both a technical point of view (e.g. Understanding how the construction sector can technically help/support the railway stakeholders) as well as from the point of view of networking and sharing the point of view of ECTP and the Infrastructure & Mobility Committee in terms of R&D&I priorities and target goals and objectives of the sector by 2030 and 2050."
- Their ECTP Conference 2018 (13-14 November), included a presentation from Network Rail on "The role of technology and innovation in achieving safe and efficient construction sites" at the "Construction innovation for the transport infrastructure of the future". http://ectp.org/fileadmin/user_upload/documents/ECTP/2018_Conference/ECTP_Conference_2018_Detailed_Programme.pdf

Events:

- ECCS Workshop "Circular Construction", 12 May, Brussels (BE). Presentation of the overall results of the PROGRESS project (Provisions for greater reuse of steel structures). http://www.ectp.org/fileadmin/user_upload/documents/ECTP/Miscellaneous_doc/Draft_programme_PROGRESS_WS_Brussels.pdf
- Fifth International Conference on Railway Technology: Research, Development and Maintenance, 7-10 September, Palma de Mallorca (ES). Ferrovial Agroman will lead the special session of "Railway Infrastructure Maintenance and Inspection". http://www.railwaysconference.com/
- Advanced Building Skins Conference & Expo, 26-27 October 2020, Bern (CH). https://abs.green/speakers-page / https://abs.green/files/user_upload/Sponsors_Exhibitors/Sponsorship_opportunities.pdf

*This is just informative of the type of events, be aware of possible cancelations due to coronavirus outbreak.*

References and key documents:

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)


- ECTP Strategic Research & Innovation Agenda (SRIA) 2021-2027 (November 2019): http://www.ectp.org/fileadmin/user_upload/documents/ECTP/Miscellaneous_doc/ECTP_SRIA_FINAL_20-11-2019.pdf
  ECTP SRIA 2021-2027 Appendix Document (November 2019): http://www.ectp.org/fileadmin/user_upload/documents/ECTP/Miscellaneous_doc/ECTP_SRIA_ANNEX_FINAL_20-11-2019.pdf

- ECTP / EeB cPPP contribution to the EC coordinated plan on Artificial Intelligence (June 2019)
  http://www.ectp.org/fileadmin/user_upload/documents/ECTP/Miscellaneous_doc/ECTP-EeB_AI-in-Industrial_Technologies_FINAL.pdf

- ECTP Infrastructure and Mobility. FP9 2021-2027 POSITION PAPER. http://www.ectp.org/fileadmin/user_upload/documents/I_M/ECTP_I_M_Committee_Position_Paper_v2018-03-14.pdf

- The high-tech building industry in support of the EU energy, climate and sustainability objectives. Towards a generalised European Low-Carbon &Resilient Built Environment. ECTP FP9 POSITION PAPER.
  http://www.ectp.org/fileadmin/user_upload/documents/ECTP/Miscellaneous_doc/ECTP_FP9_Position_Paper.pdf

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 82[illegible]NL)

## 5.7 Mapping of ERTRAC - European Road Transport Research Advisory Council vs Shift2Rail

### a) Mention of railways at key documents

ERTRAC Strategic Research Agenda 2010. Link.

- Mention of the rail sector in relation to other sectors that may be involved for the implementation of SRA (p.11).
- Mention of ERRAC in relation to "coordination and integration with other programmes" (p.12).

European Partnership under Horizon Europe Connected, Cooperative and Automated Mobility (CCAM) [draft 13 March 2020] Working document. Link.

- Mention of "railway crossings" (p.2) when mentioning interfaces with other modes.
- Mention of "last mile rail" (p.21).

ERTRAC Multi-Annual Implementation Plan for Horizon 2020. March 2013. Link.

- Mention of "rail" in relation to BIM and a generic European asset management method, under the heading "Advanced Infrastructure Management Systems" (p.10).
- Mention of "rail" in relation to opportunities that interchanges to the other modes may bring under the heading "debottlenecking the European key road links" (p.15).
- Mention of "rail" in relation to freight transport and multimodal interfaces (p.18).

The following roadmaps have been developed in collaboration with ERRAC and other European Transport Technology Platforms. They include several mentions to rail:
Long Distance Freight Transport. A roadmap for System integration of Road Transport 2019. Link. Elaborated by ERTRAC with the feedback of ALICE, ACARE, ERRAC and Waterborne. Several mentions in relation to "connectivity"(p.12; p.21); EU Standardization among Nodes (p.15); intermodal transport services (p.34-5).
Integrated Urban Mobility Roadmap. 2017. Link. Joint ERTRAC-ERRAC-ALICE Working Group on Urban Mobility. "light rail" (p.14); "unattended operation of urban rail vehicles" (p.23); "urban transport interchange" (p.43; p.67); rail station (p.45); services management (p.50); TEN-T (p.53); "seamless travel" (p.60); "intermodality" (p.60)

### b) Mention of Shift2Rail at key documents

No mention to the Shift2Rail JU has been found at ERTRAC strategic documents.

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

### c) Collaboration with ERRAC

According to the factsheet completed by ERTRAC on task 1.2 of TER4RAIL, ERTRAC identified the following common work performed in collaboration with ERRAC:

- Working Group on Urban Mobility (link): ERTRAC's working group that counts with the collaboration of ALICE and ERRAC. The group issued the "Integrated Urban Mobility Roadmap", 2017 (link).
- Joint work in the project SETRIS "Strengthening European Transport Research and Innovation Strategies" bringing together 5 Transport European Technology Platforms (ETPs) – ERTRAC, ERRAC, ACARE, WATERBORNE and ALICE –, issuing "Towards a fully integrated transport system. Summary of the SETRIS Project Outcomes and Results. 2018" document (link) and "A truly integrated Transport System for Sustainable and Efficient Logistics" (link).
- ERTRAC consulted ERRAC when preparing their new 2019 roadmap on "Long Distance Freight Transport, 2019" (link).
- Co-organisation of TRA Conference: https://traconference.eu, together with the European Commission, other transport technology platforms and the national host.
- Collaboration in relation to the Strategic Transport Research and Innovation Agenda - STRIA: For example, the work on the "Connected and Automated Transport Roadmap". Also issued together a position about the EC STRIA Roadmap on Connected & Automated Transport, to support more R&D efforts on topics in common to several transport modes.
- Cross-modal roadmap "Roadmap for Cross-Modal Transport Infrastructure Innovation" elaborated by ERRAC, ERTRAC, WATERBORNE, ACARE, ECTP.
- Participation at each other's Plenaries (e.g. Presentation of Xavier Aertsens, Director, ERTRAC at ERRAC plenary on the 29th of November 2019, available here, page 65 onwards).
- ERRAC has the category of "observer" at ERTRAC.

### d) Members

Shift2Rail Members that are also members of ERTRAC are:

| Shift2Rail Members | ERTRAC |
|---|---|
| AVL List GmbH | ✓ |
| Fraunhofer-Gesellschaft zur Förderung | ✓* |

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

| der angewandten Forschung e.V. IVI | |
|---|---|

✓ Indicates that the Shift2Rail member is also member of the other entity.

✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. This is the case of:

- Fraunhofer LBF

**e) Other information**

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by ERTRAC is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | ERTRAC |
|---|---|---|
| 1 | Automated train operation | |
| 2 | Mobility as a Service | ✓ |
| 3 | Logistics on demand | ✓ |
| 4 | More value from data | |
| 5 | Optimum energy use | |
| 6 | Service timed to the second | |
| 7 | Low cost railway | |
| 8 | Guaranteed asset health and availability | |
| 9 | Intelligent trains | |
| 10 | Stations and "smart" city mobility | ✓ |
| 11 | Environmental and social sustainability | |
| 12 | Rapid and reliable R&D delivery | |

Other information

- ERTRAC is promoting an **European Partnership** under Horizon Europe, named "**Connected, Cooperative and Automated Mobility (CCAM)**". Proposal submitted to the European Commission on 13 April 2020, available here. However, it seems not

to appear at the list of 49 “under preparation partnerships” available here. Rail is mentioned once through the document, in relation to “last mile rail to warehouse autonomous transport” when describing their collaboration with ALICE. ERRAC or Shift2Rail are not mentioned.

Furthermore, among the list of partnerships under preparation, there are two more related to road transport: “European Partnership on Mobility and Safety through Automated Road Transport” (MOSART) and “Towards zero-emission road transport 2ZERO”. None of their descriptions mention ERTRAC.

- The FUTURE-RADAR Project, Future Research, Advanced Development and Implementation Activities for Road Transport, 01/01/2017-31/12/2020, is the support action for ERTRAC and European Green Vehicle Initiative PPP EGVIA to create and implement the needed research and innovation strategies for a sustainable and competitive European road transport system. Cordis.

- There is a topic at the 2020 call for proposals of Smart, green and integrated transport for the setting up of a common European research and innovation strategy for the future of road transport (LC-GV-09-2020) that will be the coordination and support action of ERTRAC. EURNEX has been invited to participate as Associated Partner bringing in Railway Knowledge.

Events:
No further events are promoted at their website at this stage.

References and key documents:


- ERTRAC Website https://www.ertrac.org/
- Strategic Research Agenda. Input to 9th EU Framework Programme. 2018. https://www.ertrac.org/uploads/documentsearch/id52/ERTRAC-Strategic-Research-Agenda-SRA-2018.pdf
- ERTRAC Strategic Research Agenda 2010. https://www.ertrac.org/uploads/documentsearch/id21/ERTRAC_SRA_2010.pdf
- European Partnership under Horizon Europe Connected, Cooperative and Automated Mobility (CCAM) [draft 13 March 2020] Working document. https://www.ertrac.org/uploads/documentsearch/id60/public_draft_CCAM_Partnership_Proposal_13-03-2020.pdf
- ERTRAC Multi-Annual Implementation Plan for Horizon 2020. March 2013. https://www.ertrac.org/uploads/documentsearch/id20/ertrac-map-h2020_67.pdf
- Long Distance Freight Transport. A roadmap for System integration of Road Transport 2019. https://www.ertrac.org/uploads/documentsearch/id56/ERTRAC-Long-duty-Freight-Transport-Roadmap-2019.pdf

## 5.8 Mapping of Factories of the Future (FoF) - Public-Private Partnership vs Shift2Rail

**a) Mention of railways at key documents**

MADE IN EUROPE. Guidance Document. The manufacturing partnership in Horizon Europe (link)

- Cooperation with other European or international initiatives. When describing sector application-oriented initiatives, "trains" are mentioned as part of transport "transport (automotive, aerospace, space, trains, waterborne etc.)" (p.39).
- "Rail system" appears at the graphic on partnerships to which it relates (p.37)
- It mentions transport industries, at the Working Group on Excellent, Responsive and Smart Factories and supply chains (p.42).
- Transport is also mentioned in relation to the Green Deal (p.17).

**b) Mention of transport at key documents**

Factories of the Future Public-Private Partnership. Progress Monitoring Report for 2017 (link)
When describing the manufacturing sectors benefitting from the work performed in 2017 within the PPP, several transport sectors are mentioned: aerospace, maritime, automotive. Railways are not mentioned, but may be able to find synergies.

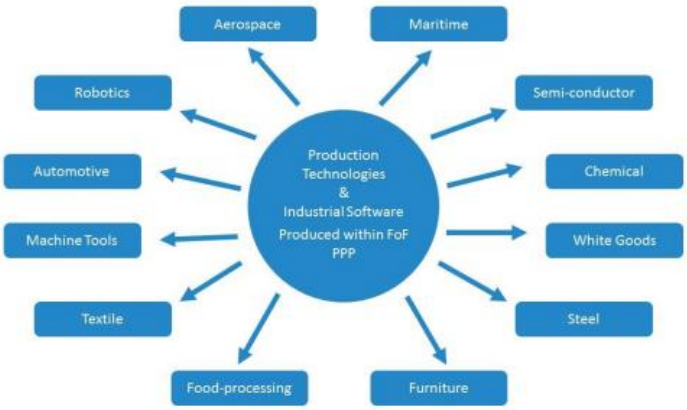



*Figure 2: Selection of sectors benefiting from the FoF PPP*

EFFRA VISION FOR A MANUFACTURING PARTNERSHIP IN HORIZON EUROPE 2021-2027 (link)
There is no specific mention to railways nor transport in this key document, as it focusses mainly on factory processes, but there are several enabling technologies and approaches that transversal to rail, these are (p.15-17):

- Advanced, smart material and product processing technologies, and process chains (additive manufacturing, joining, shaping, structuring, surface tailoring, etc.)
- Smart mechatronic systems, devices and components
- Intelligent and autonomous handling, robotics, assembly and logistic technologies
- De-manufacturing, recycling technologies, and life-cycle analysis approaches
- Energy and power supply technologies: storage, distribution and management solutions

- Simulation and modelling (digital twins) covering the material processing level up to manufacturing system, and factory and value network level
- Robust and secure industrial real-time communication technologies, and distributed control architectures
- Data analytics, artificial intelligence, machine learning and deployment of digital platforms for data management and sharing
- New business and new organisational approaches, including links with regulatory aspects such as safety, data ownership, and liability

It also mentions touching points with other PPPs: "This set of enabling technologies provides clear pointers to existing PPPs or initiatives that focus on particular enabling technologies, for example: photonics, electronic systems and components, 5G, Cybersecurity, Big Data and AI, Robotics, and HPC" (p.17).

FACTORIES OF THE FUTURE: MULTI-ANNUAL ROADMAP FOR THE CONTRACTUAL PPP UNDER HORIZON 2020:

There is no mention to rail in the documents, although it refers to the key role of transport many times:

"Manufacturing is also essential for realising all future products related to societal challenges (e.g. energy-related equipment, health products, transport, etc.)" (p.10)

"Manufacturing research is very relevant not only for European competitiveness, growth and jobs but also for realising all future products related to societal challenges (transport systems, energy-related equipment, health-related products and equipment, impact on environment, etc.)"(p.25)

"Co-evolution of products–processes–production systems involves engaging traditionally separate industries involving physical exchanges of materials, energy, water, and/or by-products 40 and requires an optimised interaction of manufacturing with transport and critical infrastructures." (p.50)

"Polymers, elastomers and advanced textiles are a large component of European manufacturing advantage, and new manufacturing methods and technologies are needed to realise the full potential of such high-performance materials increasingly used in applications such as transport, construction, protection, medical devices, flexible electronics and others"(p.65).

**c) Mention of Shift2Rail at key documents**

No mention to the Shift2Rail JU has been found at the strategic documents revised.

d) **Members**

The European Factories of the Future Research Association (EFFRA) is a non-for-profit, industry-driven association promoting the development of new and innovative

production technologies. It is the official representative of the private side in the 'Factories of the Future' public-private partnership.

Shift2Rail Members that are also members of FoF are:

| Shift2Rail Members | FoF |
|---|---|
| AVL List GmbH | ✓ |
| Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. | ✓ |
| FUNDACION TECNALIA RESEARCH & INNOVATION | ✓ |
| Siemens Aktiengesellschaft | ✓ |

✓ Indicates that the Shift2Rail member is also member of the other entity.

Siemens is member of the Board of Directors of EFFRA (link).

**e) Shift2Rail-FoF Mapping**

**Key Words: Rolling Stock, assembly process**

Relation with S2R TD: None

| | **FoF Projects directly related to rail** |
|---|---|
| **Name** | Sharework |
| **Domain** | Rolling Stock, assembly process |
| **JU Common partners** | FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V; ALSTOM TRANSPORTE SA |
| **Relation with TD/domain** | SHAREWORK technology will be demonstrated in four different industrial cases: for railway, automotive, mechanical machining and equipment goods sectors. The usability of the developed HRC solutions in different industrial sectors and company sizes will increase productivity, flexibility, and reduce human stress, to support the workers and to strengthen European industry. Introduction of a robotic co-worker in ALSTOM rolling stock's assembly line to provide a useful assistance to the worker improving the assembly duration, the human welfare and guaranteeing the suitable mounting order and quality. The robot delivers tools, parts and rivets to the worker in a static position and assist during the manufacturing process. |
| **Shift2Rail Projects related** | None |
| **Links** | https://sharework-project.eu/<br>https://cordis.europa.eu/project/id/820807 |

**Key Words: Rolling stock, new materials, composites**

Relation with S2R TD: TD 1.3 - Carbody Shell Demonstrator

| | **FoF Projects directly related to rail** | | | |
|---|---|---|---|---|
| **Name** | RECOTRANS  | | MAESTRO  | |
| **Domain** | Rolling stock, new materials, composites | | Rolling stock, new materials, composites | |
| **Related TDs** | TD1.3 | | TD1.3 | |
| **Relation with TD** | RECOTRANS project will create new manufacturing system for obtaining multi-material metal composites products suitable for the transport industry; automotive, truck and railway sector. | | MAESTRO aims to develop and combine with existing Selective Laser Melting (SLM) techniques five innovations that will constitute the basis of a highly competitive manufacturing value chain: (1) a single pre-process software for a numerical chain combining all mandatory steps and configurations of SLM together with its related pre- and post-processes, (2) Hybridization of SLM with MIM, (3) Adaptive process control of SLM, (4) system level integration of a modular platform, (5) open access to an easy-to-use demonstration platform to reinforce to EU leadership in AM. 4 end-users from key sectors: Semiconductors and their packaging (III-V LAB), Automotive (CRF), Space (GEMMATE), Railway (ALSTOM). | |
| **S2R Common partners** | FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V | | ALSTOM TRANSPORT SA | |
| **Shift2Rail Projects related** | PIVOT | MAT4RAIL | PIVOT | MAT4RAIL |
| **Common partners** | None | AIMPLAS - ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS | ALSTOM TRANSPORT SA | None |
| **Links** | https://recotransproject.eu/ | | https://www.maestro-project.eu/ | |

| | | |
|---|---|---|
| | https://cordis.europa.eu/project/id/768737 | https://cordis.europa.eu/project/id/723826 |

**f) Other information**

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by FoF is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | FoF |
|---|---|---|
| **1** | Automated train operation | |
| **2** | Mobility as a Service | |
| **3** | Logistics on demand | |
| **4** | More value from data | |
| **5** | Optimum energy use | ✓ |
| **6** | Service timed to the second | |
| **7** | Low cost railway | ✓ |
| **8** | Guaranteed asset health and availability | |
| **9** | Intelligent trains | ✓ |
| **10** | Stations and "smart" city mobility | |
| **11** | Environmental and social sustainability | ✓ |
| **12** | Rapid and reliable R&D delivery | |

Horizon Europe – **Made in Europe Partnership**

EFFRA is currently preparing the strategic research and innovation agenda (SRIA) for the Made In Europe Partnership under the next Research and Innovation Framework Programme Horizon Europe.

- Partnership Fiche here. In the field of "Currently identified links with other partnership candidates /Union programmes" it is mentioned "Rail Research and Innovation". However, specific mention to Shift2Rail is not made.
- Made in Europe Guidance Document: link.
- Consultation of experts and organisations open till 15th June. Link.
- Consultation of projects, open till 15th June. Link.

More information on projects

EFFRA has launched an **Innovation Portal** with information on the Factories of the Future projects launched since FP7, available at: https://portal.effra.eu/projects.

The following projects may be related / applicable to railway industry, but have no specific focus on rail:

- TWIN-CONTROL | Twin-model based virtual manufacturing for machine tool-process simulation and control. http://twincontrol.eu/ https://cordis.europa.eu/project/id/680725

- MEMAN | Integral Material and Energy flow MANagement in MANufacturing metal mechanic sector. http://www.meman.eu/ https://cordis.europa.eu/project/id/636926

- COMBILASER | COMbination of non-contact, high speed monitoring and non-destructive techniques applicable to LASER Based Manufacturing through a self-learning system. http://combilaser.eu/ https://cordis.europa.eu/project/id/636902

- HORSE | Smart integrated Robotics system for SMEs controlled by Internet of Things based on dynamic manufacturing processes. http://www.horse-project.eu/ https://cordis.europa.eu/project/id/680734

- SMARTLINE | Smart In-line metrology and control for boosting the yield and quality of high-volume Manufacturing of Organic Electronics. This project mentions to have a huge impact to transform the manufacturing processes for Organic Electronics Industry and for other Industries as Thin Films (e.g. functional films, antimicrobial and decoration coatings, barriers), Electronics, Wearables, Energy, Automotive, Transport, Space, Health, etc, to the Factory of the Future.

http://www.smartline-project.eu/
https://cordis.europa.eu/project/id/768707/es

Other topics covered by the FoF PPP that may be of interest are: skills needed for new manufacturing jobs; effective industrial human-robot collaboration; digital manufacturing platforms; etc.

Events:

- Industrial Technologies 2020. Mainz, Germany. 26-28 October 2020. https://www.indtech2020.eu/home
- PAST event: Factories of the Future for the Automotive Sector - Additive Manufacturing. Brussels, Belgium. 12th of March 2020. Jointly organized with ERTRAC and EGVIA

References and key documents:

- EFFRA Website: https://www.effra.eu/
- EFFRA Brochure: https://www.effra.eu/sites/default/files/effra_brochure_2018_eversion.pdf
- FoF PPP Website: https://www.effra.eu/factories-future
- EFFRA Innovation Portal: https://portal.effra.eu/projects
- EFFRA General Presentation: https://cloud.effra.eu/index.php/s/HMzoUdabiqvxjk3
- EFFRA VISION FOR A MANUFACTURING PARTNERSHIP IN HORIZON EUROPE 2021-2027 https://www.effra.eu/sites/default/files/190312_effra_roadmapmanufacturingppp_eversion.pdf
- Factories of the Future Public-Private Partnership. Progress Monitoring Report for 2017: https://www.effra.eu/sites/default/files/fof_cppp_progress_monitoring_report_for_2017_online.pdf

## 5.9 Mapping of SPARC - Public-Private in Robotics vs Shift2Rail

### a) Mention of railways at key documents

Robotics 2020 Multi-Annual Roadmap For Robotics in Europe. Horizon 2020 Call ICT-2017 (ICT-25, ICT-27 & ICT-28). Link.

- When giving examples of Civil applications for Robotics Technology, "railways" are mentioned under the item "Security monitoring of strategically important sites" (p.76)
- In the Chapter on key stakeholders, "rail" is mentioned at the item on relationship to other domains in relation to transport infrastructure (p.84)
- Looking at Current and Future Opportunities, "rail" is mentioned under Construction and Demolition, where a higher level of automation may be effective (p.95); in mining rail cars special emphasis is put on autonomous drive use (p.103)
- Rail freight mentioned under Multimodal freight transport, related to loading and unloading of rail platforms (p.141)

In general, some other documents include a mention to rail-ported robotic platforms.

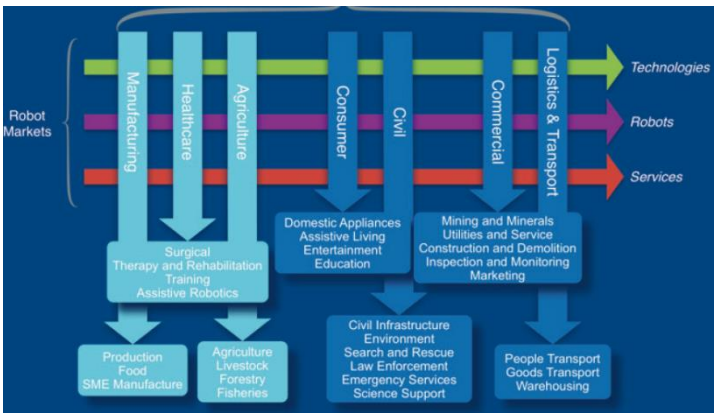
### b) Mention of Shift2Rail at key documents

There is no mention to the Shift2Rail JU at SPARC / euROBOTICS strategic documents.

### c) Mention of Transport at key documents

Strategic Research Agenda For Robotics in Europe 2014-2020. SPARC The Partnership for Robotics in Europe. Link

SPARC has identified 5 end user market domains, being one of them is "Logistics & Transport" (SRA, p.36). It covers the following areas: transportation of goods, transportation of people, logistics and warehousing. And it described as follows: "Autonomous and semi-autonomous robots operating within both public and private transport infrastructures, carrying people and/or goods. Robots operating in warehouses and interfacing with wide area transport infrastructures, or other internal transport systems".




The SRA also describes application scenarios for different market domains. In relation to the Logistics & Transport one, there is no mention of railways at the application scenario (p.58; p.66).

Strategic Research, Innovation and Deployment Agenda for an AI PPP. Link.
When talking about "AI Value Opportunities", it is written: "In transport, AI will impact both within the existing infrastructure but will also transform it. AI is already being used to identify the nature of journeys taken across a city, how flows of traffic change through the day and in different weather conditions. This has an impact on many different stakeholder groups, e.g. city planners learn how to improve the traffic flow and individuals can optimise their travel journey. AI also stimulates new businesses based on real-time traffic data that can reshape the city by on-demand transport services replacing personally owned vehicles, by enabling smaller swarms of delivery vehicles and by the removal of carparks from town centres."

d) **Members**

The public side of the Robotics Public-Private Partnership is represented by the European Commission – Directorate-General for Communications Networks, Content and Technology while the private part is euRobotics aisbl.

Shift2Rail Members that are also members of Robotics Public-Private Partnership are:

| Shift2Rail Members | SPARC |
|---|---|
| Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) | ✓ |
| Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. IVI | ✓* |
| FUNDACION TECNALIA RESEARCH & INNOVATION | ✓ |
| INDRA SISTEMAS S.A. | ✓ |
| Siemens Aktiengesellschaft | ✓ |
| THALES | ✓ |
| UNIVERSIDAD DEL PAIS VASCO | ✓ |

✓ Indicates that the Shift2Rail member is also member of the other entity.
✓* Indicates that a company from the same group / another section / related entity to the Shift2Rail member is also member of the other entity. This is the case of:

- Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE
- Fraunhofer Institute for Factory Operation and Automation IFF
- Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS
- Fraunhofer Institute for Manufacturing Engineering and Automation
- Fraunhofer Institute for Material Flow and Logistics
- Fraunhofer Institute of Optronics, System Technologies and Image Exploitation
- Fraunhofer IPA
- Fraunhofer IWU

**e) Structure**

The private side of SPARC, the euROBOTICS Association, works with a number of Topic Groups, whose list can be consulted here: https://www.eu-robotics.net/sparc/upload/topic_groups/list-Topic-groups-2017-september.pdf

Among them, there is a Domain Topic Group on Logistics and Transport, ROB4LOG-TG, http://web.itainnova.es/eurobotics/, in which rail is mentioned, coordinated by Jesús Alfonso, ITA (Spain).

There is also a Topic Group on People Transport (Michel Parent; Fawzi Nashashibi; Dr. Vicente Milanes), of which no more information is available.

**f) Shift2Rail-SPARC Mapping**

**Key Words: Infrastructure maintenance, infrastructure monitoring, BRIDGES**

Relation with S2R TD: TD 3.5 - Proactive Bridge and Tunnel Assessment, Repair and Upgrade Demonstrator
TD 3.7 - Railway Integrated Measuring and Monitoring System (RIMMS) Demonstrator
TD 3.8 - Intelligent Asset Management Strategies Demonstrator (IAMS)

| | **SPARC Projects directly related to rail** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | ESMERA<br>ESMERA BOOSTING ROBOTICS INNOVATION | | | | | AEROBI<br> | | | | | |
| **Domain** | Infrastructure maintenance and monitoring | | | | | Infrastructure monitoring, bridges | | | | | |
| **S2R JU common partners** | None | | | | | None | | | | | |
| **Related TDs** | TD3.5, TD3.7, TD3.8 | | | | | TD3.5, TD 3.7 | | | | | |
| **Relation with domain** | ESMERA CONSTRUCTION CHALLENGES<br>Maintenance of transport infrastructures (roads, railways) has a big impact on the quality of the service provided by transport operators, cost of operation and the safety of people and goods transported. The robots that can support this activity can be operated/supervised by trained personnel and may be operating in hazardous, or extreme environments where people may be at risk. Therefore, certification and validation of operation will be important elements in the deployment of this type of robot system. | | | | | AEROBI, driven by the bridge inspection industry, adapts and integrates recent research results in low flying unmanned robots with arms, intelligent control in robotics, computer vision and sensing, in an innovative, integrated, low flying, robotic system with a specialised multi-joint arm that will scan concrete beams and piers in a bridge for potential cracks on the surface or concrete swelling or spalling. The system is expected to be exploitable in the short term, will be field evaluated and demonstrated at two actual bridges. | | | | | |
| **Shift2Rail Projects related** | IN2TRACK | IN2TRACK 2 | Assets4Rail | IN2SMART | IN2SMART 2 | IN2TRACK | IN2TRACK 2 | Assets4 Rail | IN2SMART | IN2SMART2 | MOMIT |
| **Common partners** | None | None | None | None | None | None | None | None | None | None | None |
| **Links** | http://www.esmera-project.eu/<br>https://cordis.europa.eu/project/id/780265 | | | | | http://www.aerobi.eu/<br>https://cordis.europa.eu/project/id/687384/es | | | | | |

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

### g) Other information

Railway Innovation Capabilities

An indication on the Railway Innovation Capabilities that may be related to the activities performed by SPARC is provided at the following table:

| | RAILWAY INNOVATION CAPABILITIES | SPARC |
|---|---|---|
| 1 | Automated train operation | |
| 2 | Mobility as a Service | |
| 3 | Logistics on demand | ✓ |
| 4 | More value from data | |
| 5 | Optimum energy use | |
| 6 | Service timed to the second | |
| 7 | Low cost railway | ✓ |
| 8 | Guaranteed asset health and availability | ✓ |
| 9 | Intelligent trains | |
| 10 | Stations and "smart" city mobility | |
| 11 | Environmental and social sustainability | |
| 12 | Rapid and | |

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

| | reliable R&D delivery | |
|---|---|---|

Other information

- euRobotics contributed in 2018 to the Strategic initiatives of Digitising European Industry (DEI):
    - Robotics technology will contribute to the EC's digitisation strategy and to the development of new classes of products, processes and business models in all sectors.
    - Four Prioritizes Application Areas have been identified where networks of Digital Innovation Hubs are being created: Healthcare, Agri-Food, Inspection and Maintenance of Infrastructure, Agile Production.

- euRobotics and BDVA are jointly fostering **an European Artificial Intelligence Public Private Partnership (AI PPP)** under Cluster 3 of Horizon Europe. Some links:
    - Partnership Fiche: https://www.era-learn.eu/partnerships-in-a-nutshell/r-i-partnerships/european-partnerships-under-horizon-europe/partnerships-under-preparation/candidates-for-european-partnerships/11_aidatarobotics.pdf
    - Joint Vision Paper for an Artificial Intelligence Public Private Partnership (AI PPP) BDVA – euRobotics https://www.eu-robotics.net/cms/upload/downloads/VISION_AI-PPP_euRobotics-BDVA-Final.pdf
    - https://ec.europa.eu/digital-single-market/en/news/artificial-intelligence-public-private-partnerships-join-forces-boost-ai-progress-europe
    - https://www.eu-robotics.net/cms/upload/downloads/ppp-documents/AI_PPP_SRIDA-Second-Consultation_Version-June_2019_-_Online_V2.1.pdf

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

Other projects

Here below a list of projects that are not directly related to railways, but that due to its content, may be of interest, is provided:

- **Flourish Project**: multi-purpose agricultural Unmanned Ground Vehicle (UGV). http://flourish-project.eu/ https://cordis.europa.eu/project/id/644227/es
- **SecondHands Project**: its objective is to design a robot that can offer help to a maintenance technician in a pro-active manner. https://secondhands.eu/ https://cordis.europa.eu/project/id/643950
- **COMANOID Project**: Multi-Contact Collaborative Humanoids in Aircraft Manufacturing. http://comanoid.cnrs.fr/project-overview https://cordis.europa.eu/project/id/645097
- **RobMoSys Project**: model based development approach for robotics, that aims to coordinate the whole community's best and consorted efforts to realize a step-change towards an industry-grade software development European ecosystem. Siemens is part of the project. https://robmosys.eu/about/ https://cordis.europa.eu/project/id/732410
- **Project ECHORD++** (The European Coordination Hub for Open Robotics Development) will promote the interaction between robot manufacturers, researchers and users. Experiments on logistics are being developed inside the initiative http://www.echord.eu/
- **SciRoc** is an EU-H2020 funded project supporting the European Robotics League (ERL), whose aim is to bring ERL tournaments in the context of smart cities. A key novelty of the SciRoc project is the introduction of robots in smart cities in ERL challenges and, in particular, the ERL Smart Cities, whose aim is to show how robots will integrate in the cities of the future as physical agents living in them. .https://sciroc.eu/

The administrative and technical structure of some of the projects inside the SPARC partnership are peculiar, as they act as "facilitators" of other projects, issuing open calls for specific sectors or verticals.

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826055 (TER4RAIL)

- FERHL is partner of the AEROBI Project (link), which has been included at the project mapping section. This project also include partners from very different sectors, such as aviation, or infrastructure.

Events:
No further events are promoted at their website at this stage.

References and key documents:

- euROBOTICS website: www.eu-robotics.net @eu_Robotics
- SPARC website: https://www.eu-robotics.net/sparc/
- Strategic Research Agenda For Robotics in Europe 2014-2020. SPARC The Partnership for Robotics in Europe. 2013. https://www.eu-robotics.net/cms/upload/topic_groups/SRA2020_SPARC.pdf
- Robotics 2020 Multi-Annual Roadmap For Robotics in Europe. Horizon 2020 Call ICT-2017 (ICT-25, ICT-27 & ICT-28). https://www.eu-robotics.net/cms/upload/topic_groups/H2020_Robotics_Multi-Annual_Roadmap_ICT-2017B.pdf

  Strategic Research, Innovation and Deployment Agenda for an AI PPP. A focal point for collaboration on Artificial Intelligence, Data and Robotics Second Consultation Release. September 2019. https://www.eu-robotics.net/cms/upload/downloads/ppp-documents/AI_PPP_SRIDA-Consultation_Version-June_2019_-_Online_V1.2.pdf

# 6. Conclusion and Takeaways

The work of task 1.3 has shown the existing links and possible avenues for increased cooperation between non rail actors and the rail research community. These links range from relatively stable cooperation to lose links that have been established some years ago, in some cases no previous links existed. Importantly however thematic links exist to large extend with the railway sector in a large number of cases for topics such as

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Cybersecurity or new materials for example synergies that could be exploited with non-rail research are quite visible.

A valuable contribution has been made by the facilitation of dialogues and exchanges with actors that were not or only to a small extend collaborating with the rail sector. In addition to this, the cross-sectoral mapping of Shift2rail activities with projects of the non-rail European Technology Platforms and Public-Private Partnerships included in this deliverable provides a comprehensive scan of existing links in R&I priorities and ongoing projects between these entities and the rail sector.

As elaborated in previous deliverables among the most important topics for the rail sector will be issues such as 5G, automation, batteries, big data as well as artificial intelligence, automation, power sources and autonomous mobility.

To work on these topics the rail sector and ERRAC in particular could benefit from making use of the cooperation possibilities with organisations such as the 5G Public Private Partnership (5GPP), Alliance for Logistics Innovation (ALICE), European Cyber Security PPP (ECS) and several other identified in this report.

This deliverable is an invitation to make use of these existing opportunities and initiate collaboration in a targeted way choosing topics and stakeholders based on the mappings and also making use of the recently organized exchanges which in some cases provided an important first contact between non rail actors and the rail sector.

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# 7. APPENDICES

## 7.1 Appendix 1: References of available inputs from Task 1.1 and Task 1.2.

This appendix provides a list of the information collected through Task 1.1 and Task 1.2 of TER4RAIL that may serve as input in the development of Task 1.3. Rail Innovative Research Observatory is provided.

Deliverable 1.1. "A comprehensive map of rail innovative research and key rail stakeholders"

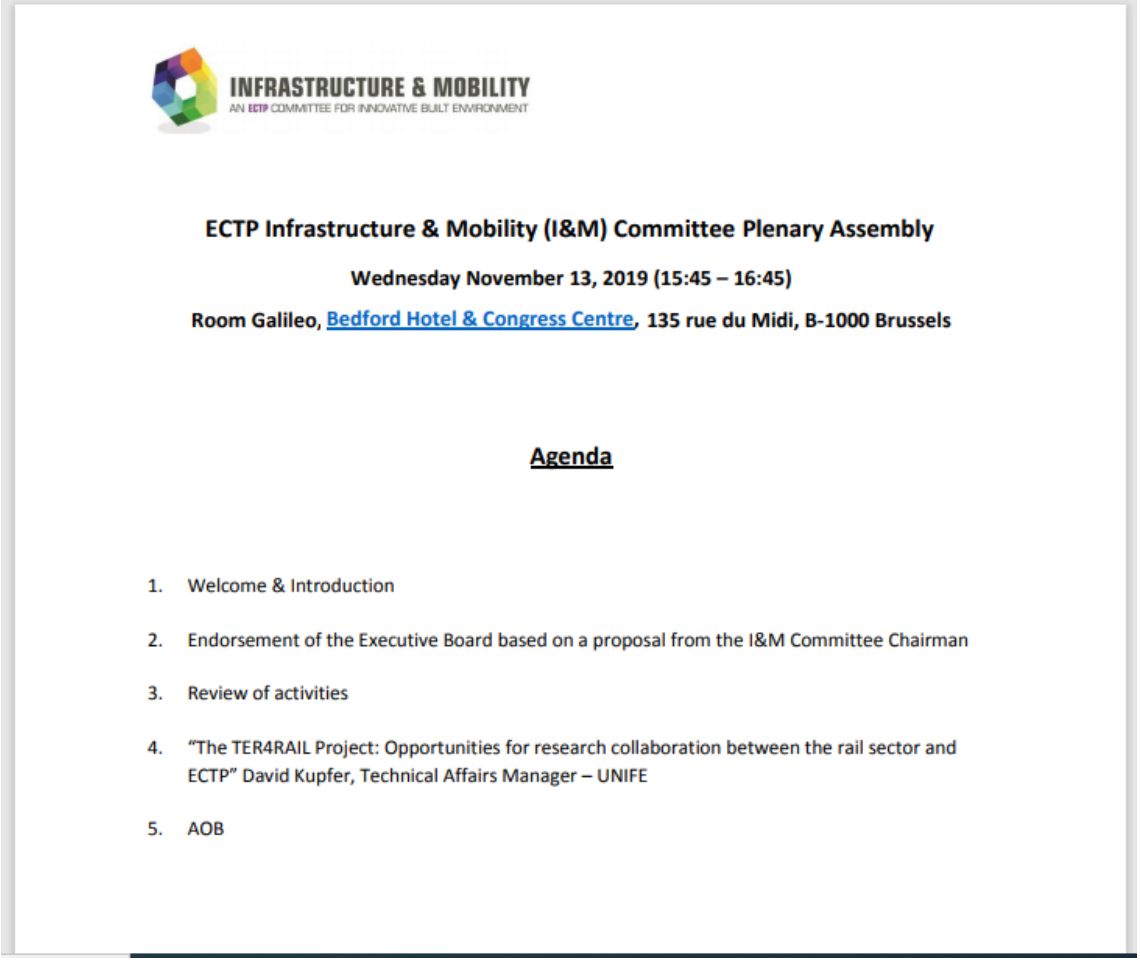
- Analysis of Rail Policy and Strategic documents. Available at T4R website.
- Mapping of research and innovation activities – Railway stakeholders. Analysis of results of on-line survey. Available at T4R website.
- Horizon 2020 Railway Projects scan (gather information on 179 rail-related projects) https://ter4rail.eu/2019/04/11/rail-project-scan/
- National Railway Projects Scan (gathers information on 381 Projects from 6 European Countries) https://ter4rail.eu/2019/10/08/national-rail-research-and-innovation-projects/

Deliverable 1.2. "Overview of the rail missions 2050".

- Report on the features of urban scenarios 2050 and technologies influencing the development of rail transport (page 22). Soon available at T4R Website.
- List of key priorities for rail and non-rail stakeholders in the framework of urban scenarios 2050 (Figure 2, Page 27). Soon available at T4R Website.
- Compilation of non-rail stakeholders (European Technology Platforms and Partnerships) factsheets. Soon available at T4R Website.
- Analysis of the factsheets received from non-rail stakeholders (European Technology Platforms and Partnerships) (page 13). Available at T4R Website.

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## 7.2 Appendix 2: ECTP Infrastructure & Mobility (I&M) Committee Plenary Assembly; Agenda with TER4RAIL presentation



INFRASTRUCTURE & MOBILITY
AN ECTP COMMITTEE FOR INNOVATIVE BUILT ENVIRONMENT

**ECTP Infrastructure & Mobility (I&M) Committee Plenary Assembly**

**Wednesday November 13, 2019 (15:45 – 16:45)**

**Room Galileo, Bedford Hotel & Congress Centre, 135 rue du Midi, B-1000 Brussels**

**Agenda**

1. Welcome & Introduction
2. Endorsement of the Executive Board based on a proposal from the I&M Committee Chairman
3. Review of activities
4. "The TER4RAIL Project: Opportunities for research collaboration between the rail sector and ECTP" David Kupfer, Technical Affairs Manager – UNIFE
5. AOB

## 7.3 Appendix 3: ERRAC plenary cyber security panel

29/11/2019, 11.30 – 13.00
THON Hotel Bristol Stephanie, Avenue Louise 91-93, B-1050 Brussels

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# Protecting Railways: R&D Priorities to tackle Cybersecurity Challenges of Emerging Technologies

A Panel discussion organized by the European Rail Research Advisory Council (ERRAC) and the TER4RAIL project

The future of rail is inevitably linked to the breakthroughs and changes that technology will bring, not only on a technical framework, but also on the customer´s needs and expectations. This situation is accelerating the pace in which new methods, tools and approaches are incorporated into a sector in which safety and security is a key issue.
This session aims to understand which will be the needs of a the future rail, that will be fully digitalized, open and connected with other transport sectors (and non-transport), where Artificial Intelligent, robotics and other technologies will play a significant role in the coming years in operation, maintenance and/or commercial issues, and with the possible disruption that quantum computing will bring.
In order to contribute to this aim, a panel of experts from the rail and cybersecurity sector will debate around the following three general issues:

1. How can R&I better address the cybersecurity challenges of an interconnected and smart railway system?
    - Which priorities for Shift2Rail2?
    - How to improve coordination of R&D for (rail) cybersecurity?

2. Cybersecurity as a transversal topic: which challenges and threats are railways facing? What can be learned from other sectors?
    - **Artificial Intelligence** - thanks to the pervasiveness of data collection by the Internet of Everything (IoE), the processing power and storage capacity offered by the cloud, pattern recognition and automatic decision will develop at great speed bringing new opportunities and risks. Artificial intelligence became the new frontier in cybersecurity.
    - **Quantum technologies**, where uncertainty is a key characteristic, may be used in both attack against current cryptographic protection methods, and in the development of new computational models for further acceleration of change

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3. Skills
    - **Training and awareness building** among railway staff and users and
    - **Attracting talent** for the railways

4. Adaptation and Change Management
    - **Speed of adaptation to news processes** and institutional framework

Selection of panellists:
Moderator: Alberto Parrondo, ERRAC

- Mihail Chirca, UITP
- Nina Hasratyan, ECSO
- Francois Hausman, Shift2Rail/UNIFE
- Christophe Gransart, IFSTTAR (tbc)



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## 7.4 Appendix 4: NEWOPERA : F&L Annual Conference in Naples marking 25th Anniversary

# Fri 15 Nov, 2019

| EU PROJECTS UPDATE | |
|---|---|
| 08:30 – 09:00 | Update on rail services and technology innovations in Europe in the light of silk road development and investments<br>• **Emilio Fernandez** President NEWOPERA |

| INTERNATIONAL TRADE: GLOBAL OPPORTUNITIES?<br>Positioning ourselves to trade effectively in constantly shifting international markets means reviewing our business models: how can we ensure local and global sustainability of our organisations to satisfy future customer, employee and shareholder needs? | |
|---|---|
| 09:00 – 09:45 | *Europe's evolving trading relationship with China and BRI; implications for the structure of international trade in the future?*<br>• **Professor Michele Geraci** International Trade Economist, Former Under-Secretary of State, Ministry of Economic Development GOVERNMENT OF THE ITALIAN REPUBLIC |
| 09:45 – 10:15 | Coffee kindly sponsored by Transporeon |
| 10:15 – 11:00 | *Assessing and managing risk in the world's most volatile environments; the role of the private sector and why it needs to stay*<br>• **Stephen Cahill** Director Logistics WORLD FOOD PROGRAMME |




TRANSPOREON
Delivering connections

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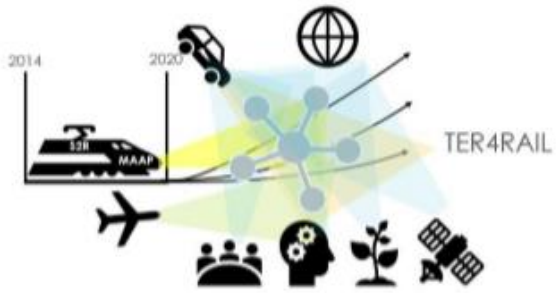
## 7.5 Appendix 5: UITP Light Rail Committee (12/11/2019)



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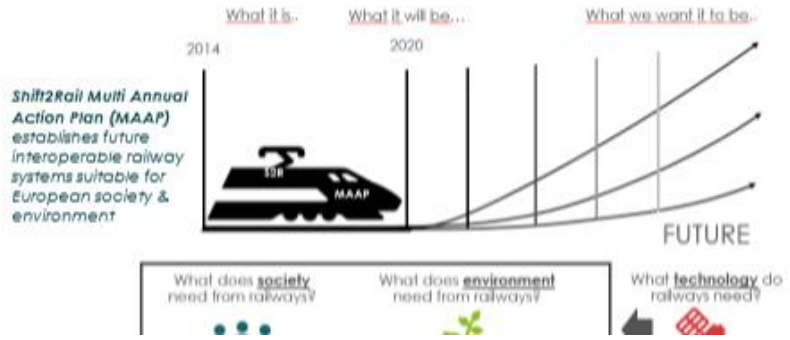
## OVERVIEW

TER4RAIL entails a coordination and support action to determine **transversal exploratory research activities** among different actors that are beneficial for **railways.**




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## NEEDS



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## 7.6 Appendix 6: UNIFE Technical Platform Agenda with TER4RAIL input, 09/12/19

**UNIFE Technical Platform**

**AGENDA**
**Monday 09 December 2019 - 10h30 - 17h30**

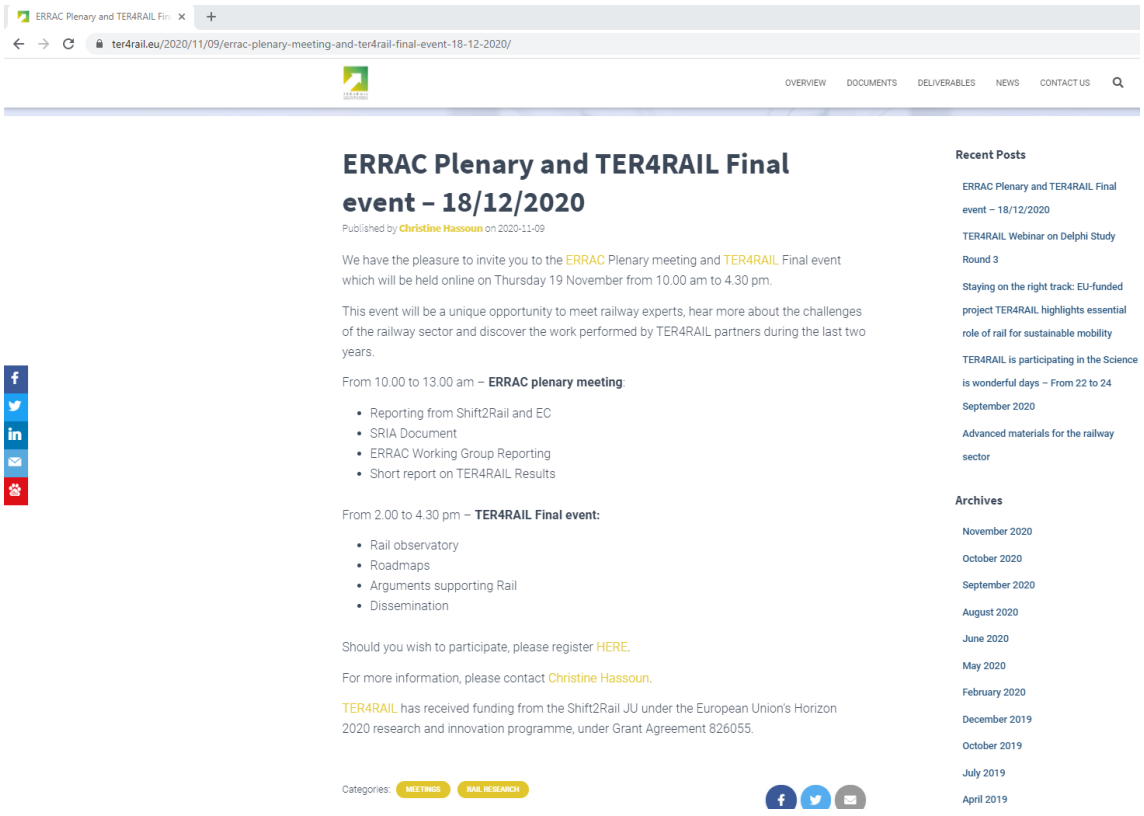
**Venue:**
**Maison des Associations Internationales (MAI)**
**Rue Washington, 40**
**B-1050 Brussels,**
**Belgium**

Meeting Room: Room Washington

| Item number | Time | Item | Speaker |
|---|---|---|---|
| | 10:00 | Welcome Coffee and Registration | |
| 1 | 10:30 | Welcome by UNIFE | P.Citroën |
| 2 | 10:40 | Presentation of the UNIFE Technical Affairs Unit Team and role of the UNIFE Technical Platform | N.Furio |
| 3 | 10:50 | Single European Railway Area: Implementation of the Technical Pillar of the Fourth Railway Package:<br>• Sate of Play (New European Vehicle Authorisation process, IA, One Stop Shop…)<br>• UNIFE SRG role<br>• Next steps | N.Shrimpton<br>D.Kupfer |
| 4 | 11:35 | New TSI revision system – Impact on UNIFE and UNIFE Members organisations | N.Shrimpton |
| 5 | 12:05 | Standardisation Activities:<br>• Rail Standardisation Coordination Platform for Europe (RASCOP)<br>• CEN-CENELEC & Rail Sector Forum<br>• UNIFE International Standardisation Paper | D.Kupfer |
| 6 | 12:35 | European Rail Research Advisory Council (ERRAC) Update:<br>• ERRAC 2030 Vision document<br>• ERRAC Activities – Working Group 1 (Work on the Mega-Projects)<br>• TER4RAIL - Project<br>• Questions & Answers | N.Furio<br>D.Kupfer |
| | 13:00 | Lunch | |
| 7 | 14:00 | Guest Speaker: Carlo Borghini (S2R Executive Director) + Questions & Answers<br>Presentation: Shift2Rail activities and Shift2Rail Annual Work Plan 2020 (including Shift2Rail 2020 Open Calls) | C.Borghini (S2R Executive Director) |
| 8 | 14:30 | State of Play of the next EU Research Framework Programme - Horizon Europe | N.Furio<br>T.Spanevello |
| 9 | 15:00 | Preparation of Shift2Rail 2: State of Play, Timeline, Role of UNIFE, UNIFE Contributions | N.Furio<br>All |
| 10 | 15:40 | Shift2Rail 2020 Open Calls:<br>• Following the presentation of Shift2Rail representative, discussion with UNIFE members (interests, role of UNIFE…) | N.Furio<br>S.Gogos<br>All |
| | 16:15 | Coffee Break | |
| 11 | 16:45 | DG Connect/DG Move – Digitization initiative: Cybersecurity, 5G and Blockchain/ High Performance Computing | M.Andreoni<br>N.Shrimpton |
| 12 | 17:15 | AOB | All |
| 13 | 17:25 | Wrap-up - Conclusions | P.Citroën |
| | 17:30 | *Closure of the meeting* | |

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## 7.7 Appendix 7: TER4RAIL Final event announcement on TER4RAIL website



ERRAC Plenary and TER4RAIL Fin ×

ter4rail.eu/2020/11/09/errac-plenary-meeting-and-ter4rail-final-event-18-12-2020/

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# ERRAC Plenary and TER4RAIL Final event – 18/12/2020

Published by Christine Hassoun on 2020-11-09

We have the pleasure to invite you to the ERRAC Plenary meeting and TER4RAIL Final event which will be held online on Thursday 19 November from 10.00 am to 4.30 pm.

This event will be a unique opportunity to meet railway experts, hear more about the challenges of the railway sector and discover the work performed by TER4RAIL partners during the last two years.

From 10.00 to 13.00 am – **ERRAC plenary meeting**:

- Reporting from Shift2Rail and EC
- SRIA Document
- ERRAC Working Group Reporting
- Short report on TER4RAIL Results

From 2.00 to 4.30 pm – **TER4RAIL Final event:**

- Rail observatory
- Roadmaps
- Arguments supporting Rail
- Dissemination

Should you wish to participate, please register HERE.

For more information, please contact Christine Hassoun.

TER4RAIL has received funding from the Shift2Rail JU under the European Union's Horizon 2020 research and innovation programme, under Grant Agreement 826055.

Categories: MEETINGS RAIL RESEARCH

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