
Shift2Rail

IP1
Cost-efficiency and Reliable Trains
including high capacity trains and high speed trains

General Overview

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Paris – 20th Novembre 2017

Agenda

- IP1 Context and Motivations
- IP1 Objectives & Challenges
- S2R IP1 Quick Overview
- 2018 calls for proposal

IP1 Context and Motivations

Innovation in rolling stock has faced several obstacles, such as:

1. **The long life cycle of railway vehicles**, which can last for more than 30 years tends to slow down the introduction of new developments;
2. Due to the **variety of operational environments across segments and different standards and solutions in different countries,** many innovations cannot be widely applied and it is not possible to apply economies of scale and to obtain an adequate return on the investment on new innovative developments;
3. The complexity of the whole railway system and the **fragmentation of responsibilities** makes preferable "service proven" solutions rather than new innovative ones

IP1 Objectives (1/2)

Fulfilling these objectives will guarantee that the Shift2Rail global objectives are achieved.

1. Line capacity increase
   - More space and weight available for passengers in each vehicle
   - Better control on the vehicles on the line (in terms of passengers/hour)

2. Operational reliability increase
   - Fundamentally more reliable technologies and components
   - Fundamentally simplified architectures, or architectures more suited to keep operation in case of failure

3. Noise reduction
   - ❑ Better calculation and design methods
   - ❑ Noise reduction oriented design

IP1 Objectives (2/2)

Fulfilling these objectives will guarantee that the Shift2Rail global objectives are achieved.

4. Railway system life cycle cost reduction
   - ❑ Reduction in the capital cost of the vehicle
   - ❑ Reduction in the need of vehicles for a given capacity
   - ❑ Reduction in the cost of maintaining the vehicles
   - ❑ Reduction in the cost of maintaining other parts of the railway system
   - ❑ Reduction in the consumption of energy

5. Mass reduction and energy efficiency
   - ❑ Reduction in the mass of the vehicle
   - ❑ Increase in the energy efficiency and reduction of energy losses

S2R IP1: Quick Overview

SYSTEM LEVEL

Technical Integration

System level Performance:

- Capacity
- Operational reliability
- Life cycle cost
- Energy efficiency
- Comfort
- ...

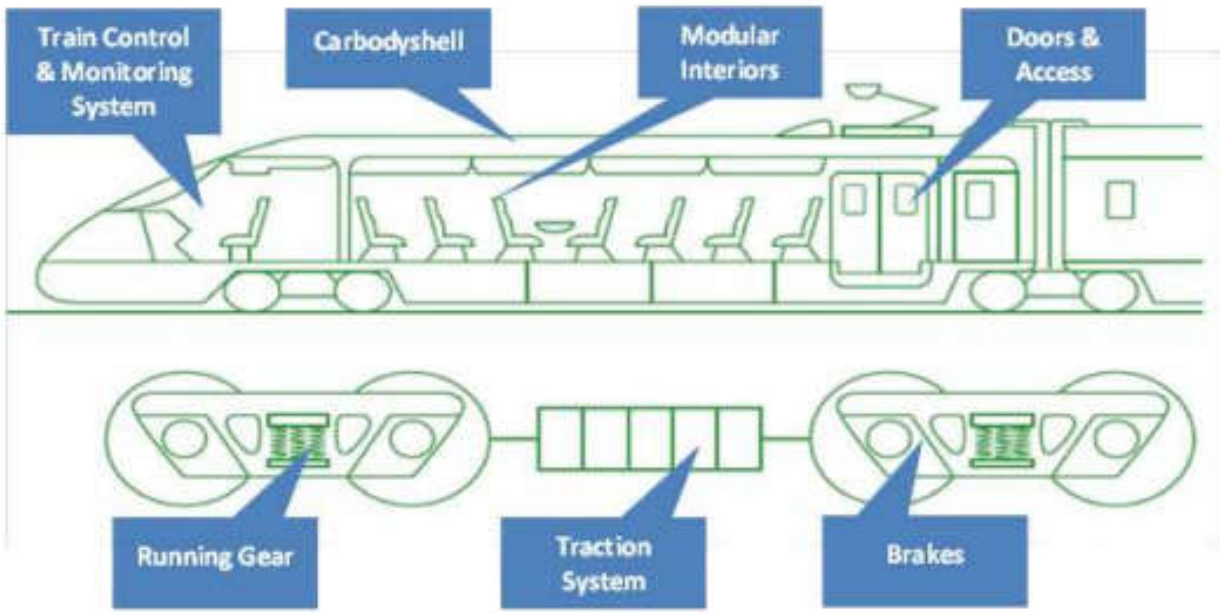
SUB-SYSTEM LEVEL

- New Technological opportunities
- Eliminate existing barriers for implementation of technologies from other fields

IP2 IP3 IP4 IP5

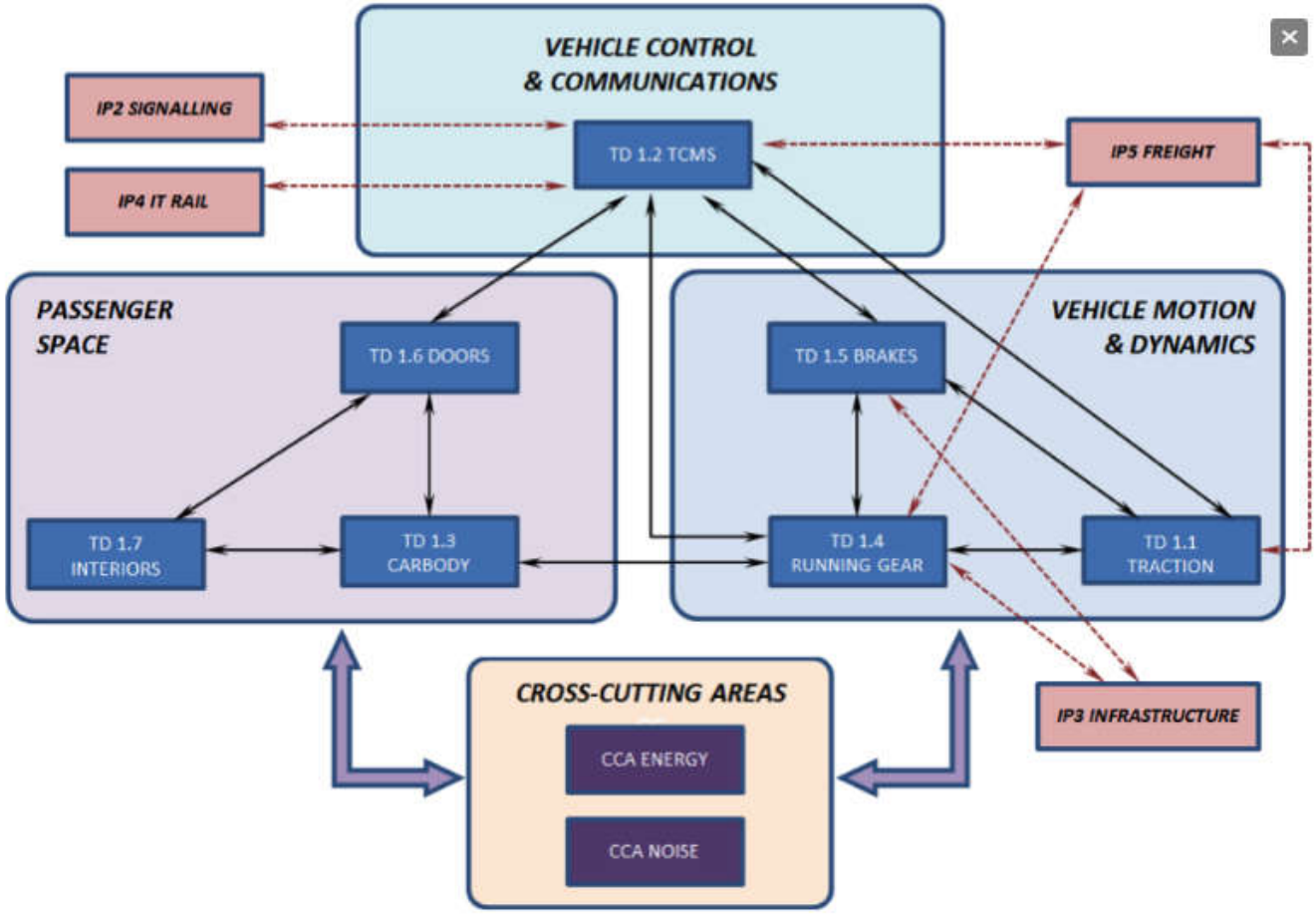
IP1 ROLLING STOCK

CCAs (Noise, Energy, ...)



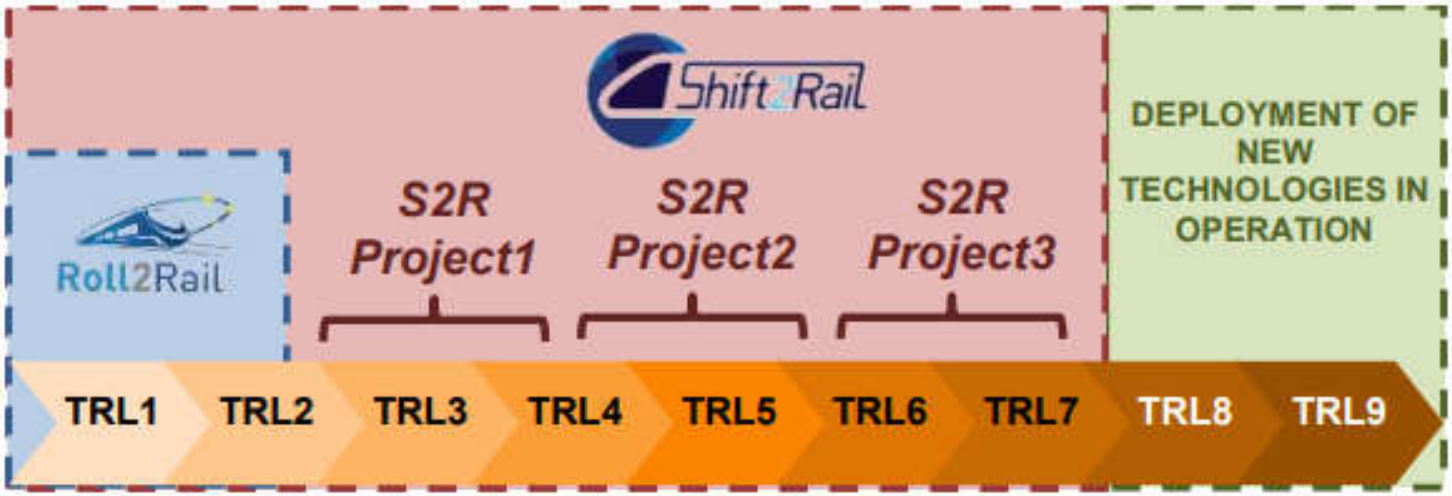
IP1 from functions to technologies

IP1 TDs and map of inter-relationships



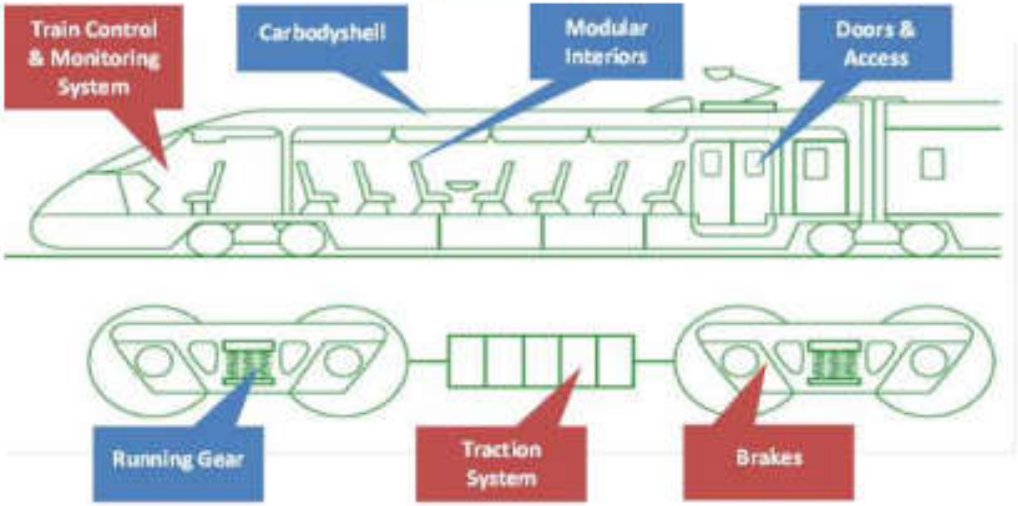
S2R IP1: Development Philosophy

- Technologies developed to reach real application just after S²R ends
- Each subsequent project increasing Technology Readiness Level compared to the previous one



S2R IP1: Starting Up

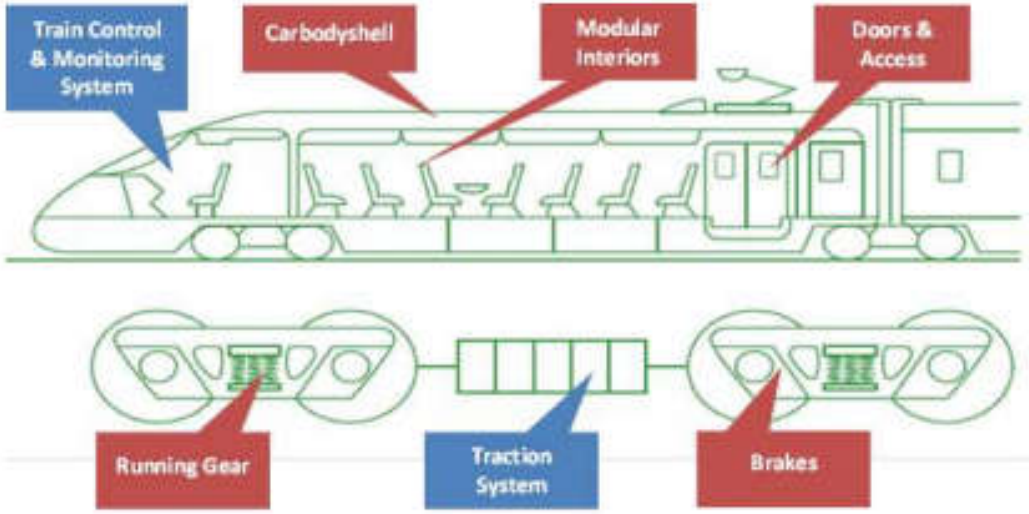
Starting 2016



Not all development lines can start on the 1st year

All activities starting within the first 2 years of S2R

Starting 2017



Shift2Rail

Lighthouse Projects

Roll2Rail

Projects 2015/2016

CONNECTA

PINTA

Complementary Project

Safe4RAIL

Projects 2017

Shift2Rail

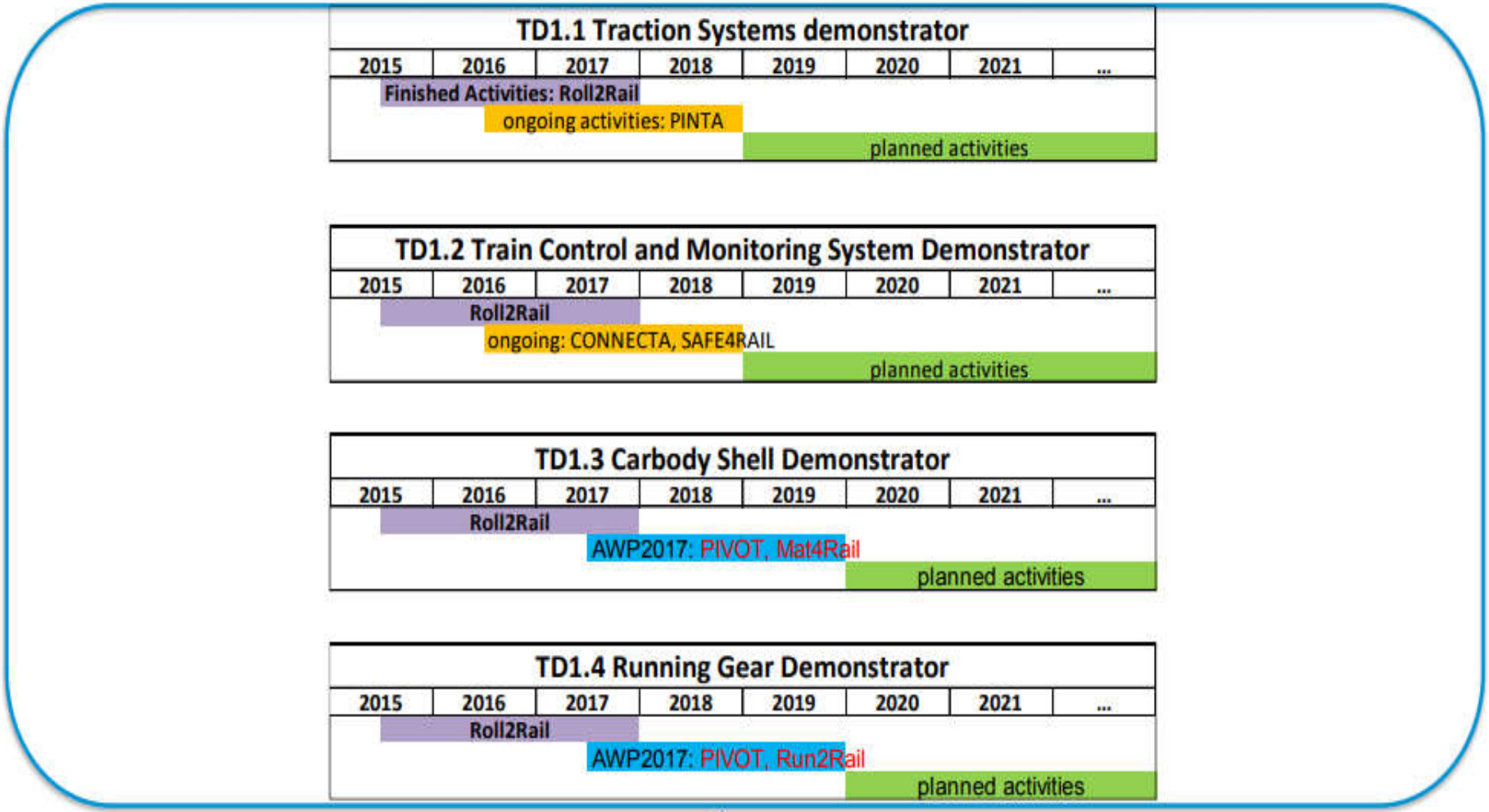
PIVOT

Complementary Projects

Mat4Rail

RUN2Rail

2018
2 projects
&
1 complementary project


TD1.1 Traction Systems demonstrator
2015
2016
2017
2018
2019
2020
2021
...
Finished Activities: Roll2Rail
ongoing activities: PINTA
planned activities
TD1.2 Train Control and Monitoring System Demonstrator
2015
2016
2017
2018
2019
2020
2021
...
Roll2Rail
ongoing: CONNECTA, SAFE4RAIL
planned activities
TD1.3 Carbody Shell Demonstrator
2015
2016
2017
2018
2019
2020
2021
...
Roll2Rail
AWP2017: PIVOT, Mat4Rail
planned activities
TD1.4 Running Gear Demonstrator
2015
2016
2017
2018
2019
2020
2021
...
Roll2Rail
AWP2017: PIVOT, Run2Rail
planned activities

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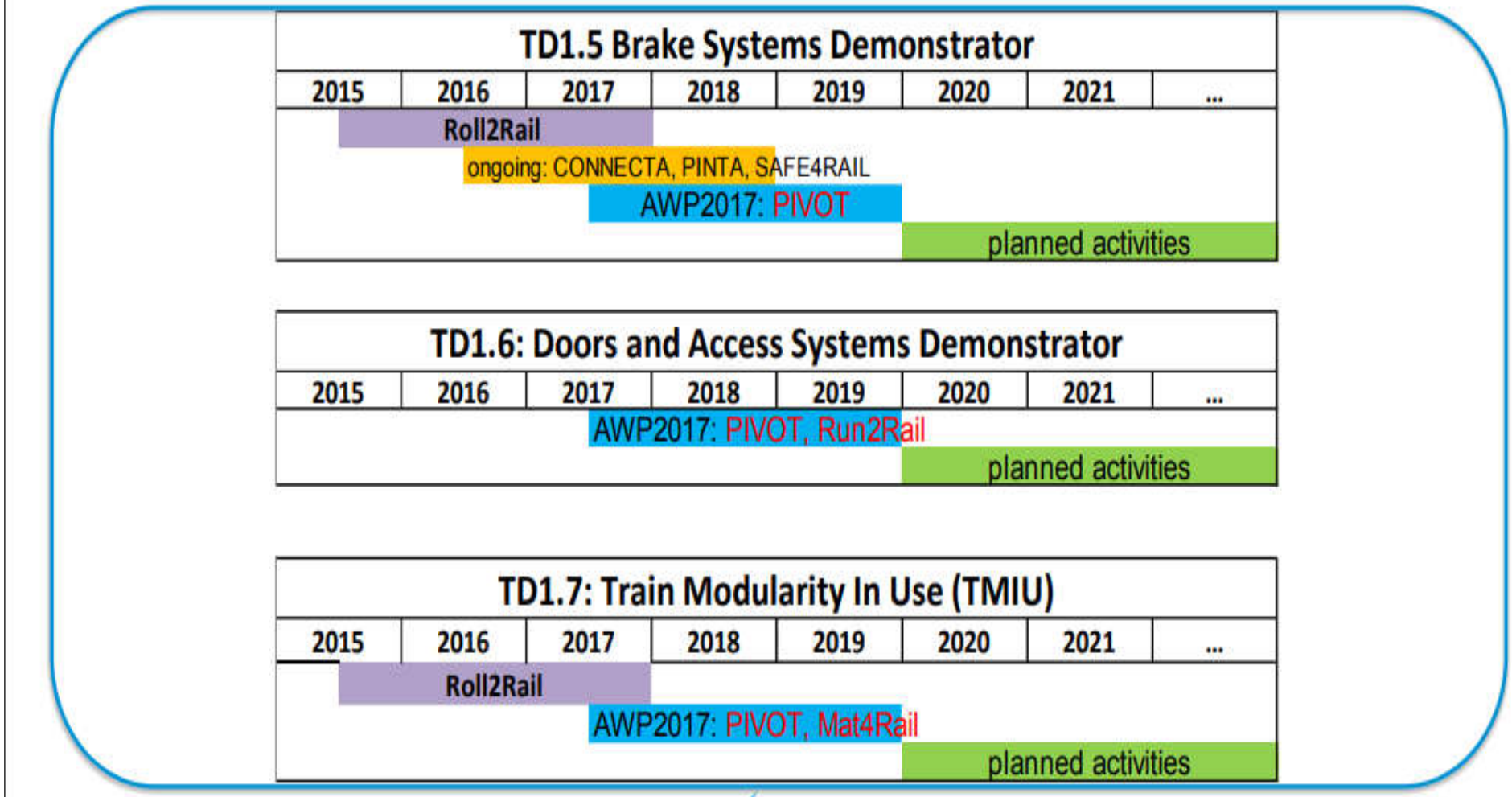
TD1.5 Brake Systems Demonstrator
2015
2016
2017
2018
2019
2020
2021
...
Roll2Rail
ongoing: CONNECTA, PINTA, SAFE4RAIL
AWP2017: PIVOT
planned activities
TD1.6: Doors and Access Systems Demonstrator
2015
2016
2017
2018
2019
2020
2021
...
AWP2017: PIVOT, Run2Rail
planned activities
TD1.7: Train Modularity In Use (TMIU)
2015
2016
2017
2018
2019
2020
2021
...
Roll2Rail
AWP2017: PIVOT, Mat4Rail
planned activities

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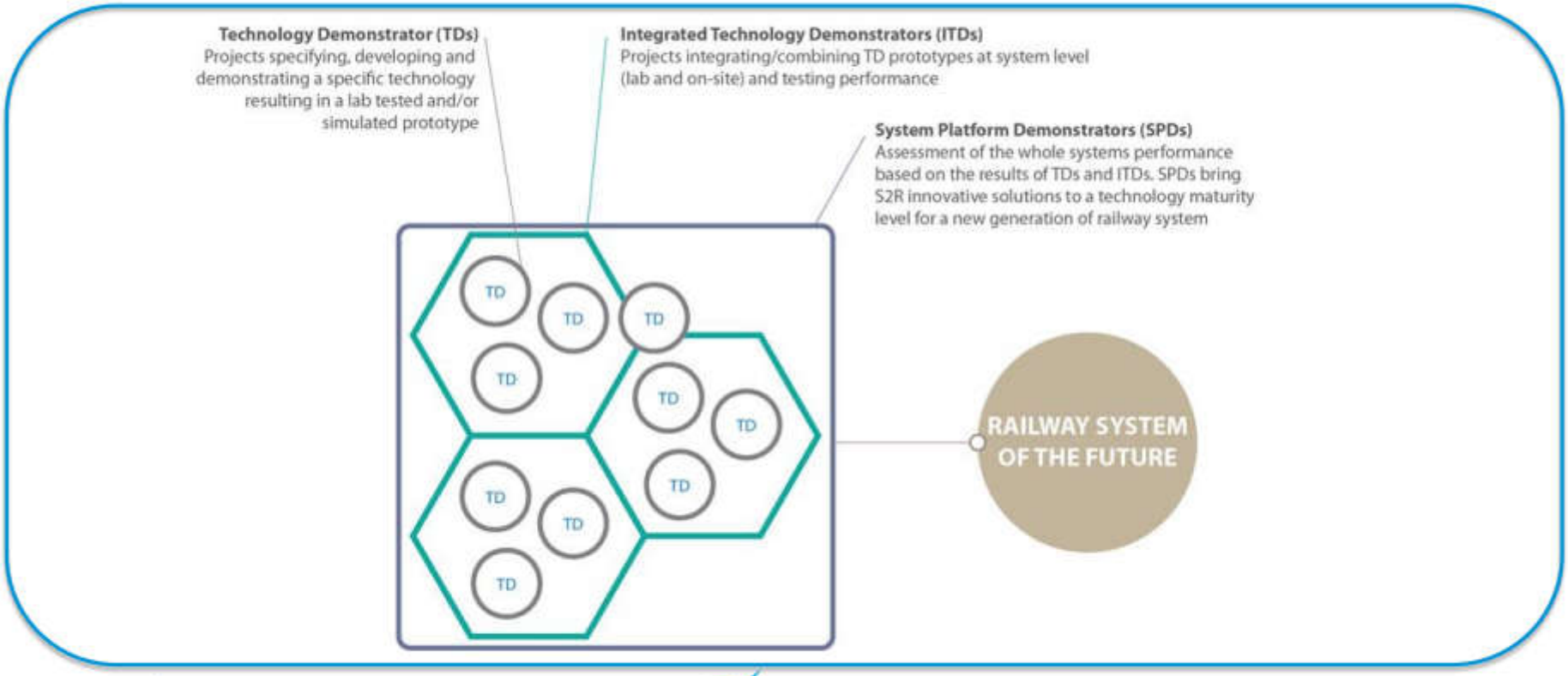
IP1 Projects Starting in 2016

AREA	SCOPE	TRL	CONSORTIUM
TRAIN CONTROL & MONITORING SYSTEM (TCMS) & BRAKING	• Feasibility studies for safety related communications: Technologies and architectures from other sectors • Technology and feasibility studies for functional distribution architectures. Tech. transfer from automotive • Technology and feasibility for virtual certification • Certification aspects for high safety braking electronics	TRL 2	**SAFE4RAIL** *(Open Call)* *Signature Pending*
	• Wireless TCMS for Train-to-train and Train-to-ground communications development • Drive-by-data: SIL4 TCMS for safety critical functions • Functional Distribution architecture • Virtual placing on the market: methodology and architectures • Safe control for brakes: high safety integrity level architectures for brake control	TRL 3/4	**CONNECTA** *(S2R Members)* CAF ALSTOM Ansaldo STS BOMBARDIER DB Faiveley KNORR-BREMSE SIEMENS SNCF

From TRL0 to TRL6/7



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Shift2Rail Joint Undertaking
White Atrium building, 2nd Floor
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www.shift2rail.org

New round

Call for Proposals AWP 2108

2018 calls for proposal

Call for proposals for S2R members (**CFM**)

S2R-CFM-IP1-01-2018 & S2R-CFM-IP1-02-2018

Topic number - IP	Topic name	Type of action and expected Technical Readiness Level (TRL)	Value of the actions (*)	Maximum S2R co-funding (*)	In-kind contribution (*)
S2R-CFM-IP1-01-2018	Development of technology demonstrators for the next generation of traction systems and adhesion management systems	RIA , TRL 5 to 6	28,534,203	12,680,600	15,853,603
S2R-CFM-IP1-02-2018	Implementing new technologies for the TCMS	RIA, TRL 5	10,576,058	4,700,000	5,876,058

2018 calls for proposal

Call for proposals non-JU members (**OC**)

S2R-OC-IP1-01-2018

Topic number - IP	Topic name	Type of action and expected Technical Readiness Level (TRL)	Value of the actions (*)	Maximum S2R co-funding (*)	In-kind contribution from non Members (*)
S2R-OC-IP1-01-2018	Technical solutions for the next generation of TCMS	RIA, up to TRL 4/5	4,000,000	4,000,000	n.a

OPEN CALLS

- Specialist technologies / tech. transfer
- Feasibility analyses
- New / blue sky approaches

CLOSE COOPERATION

MEMBER CALLS

- Architectures
- Technology application
- Demo-oriented activities

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S2R-OC-IP1-01-2018

S2R-OC-IP1-01-2018 Technical solutions for the next generation of TCMS

Specific Challenge:

The Train Control and Monitoring System (TCMS) is the brain and the communications backbone of the train, which has some essential roles on vehicle performance. The next generation of TCMS should include wireless capabilities, should provide seamless coupling, enhanced interoperability, throughput and reliability, should be built on a new architecture based on distributed functions with standardised interfaces, while supporting safety-critical and security functionalities, and should offer easier certification procedures and self-configuration.

Scope:

In order to address the challenges described above, the proposals should address all the following domains, in line with the S2R MAAP (TD1.2)

As a result of the activities carried out in the lighthouse project ROLL2RAIL (GA 636032) described in the public deliverables D2.5 and D2.7[31], in CONNECTA[32] (S2R-CFM-IP1-02-2016), SAFE4RAIL[33] (S2R-OC-IP1-02-2016) and X2RAIL-1 (S2R-CFM-IP2-01-2015) projects described in their public deliverables published so far, the following further research activities, reaching TRL 3-4, should be carried out for the wireless TCMS, based on LTE communication technologies:

a) Specification, implementation and validation of railway mobile LTE equipment (based on release 14[34]), supporting multicast transmission. This should include the impact analysis on the IEC61375-2-5 Ethernet Train Backbone Nodes (ETBN) and proposals for their modification.
b) Analysis of mobility and dynamic aspects of LTE equipment for wireless TCMS and the interaction of multiple cells in busy scenarios (e.g. main stations, depots etc).
c) Proposal for technical solutions to merge all on-board radio links (incl. signalling) taking advantage of the LTE equipment.
d) Participation in the interoperability wireless ETB tests of S2R-CFM-IP1-02-2018 in the laboratory demonstrator, by providing the required LTE expertise and hardware and technical support.
e) Exploratory work on the applicability of 5G and the seamless transition between LTE and 5G in the railway TCMS domain.
f) Evolution studies on how CONNECTA's Drive-by-Data concept (i.e. SIL4 TCMS) could be deployed through a wireless Ethernet Train Backbone.

S2R-OC-IP1-01-2018

The complementary action S2R-CFM-IP1-02-2018 will continue CONNECTA's activities so the proposals also should participate in the set-up of two laboratory demonstrators and in particular address the following activities (TRL4/5):

i. Provide train subsystem to be integrated in the virtual homologation's simulation framework and participate in combined tests including remote with hardware-in-the-loop for both demonstrators around

ii. Provide the implementation of network devices (i.e. modified EBTN and car switches) for integration into the Drive-by-Data concept based demonstrator architectures and participate in validation activities for both demonstrators around

[31] http://roll2rail.eu/Page.aspx?CAT=DELIVERABLES&IdPage=45291e18-8d8f-4fd6-99f8-5d4b7a519b9c
[32] http://projects.shift2rail.org/s2r_ip1_n.aspx?p=CONNECTA
[33] https://safe4rail.eu/news/deliverables
[34] Based on release 14 developed by 3GPP http://www.3gpp.org/release-14

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iii. Provide the implementation of a real train subsystem function to be integrated in CONNECTA (i.e. wireless TCMS, drive-by-data, functional open coupling) [35] functional distribution framework (i.e. Integrated Modular Platform) for both demonstrators around

In addition, proposals should carry out applicability studies (TRL 2) of the proposed technologies developed through CONNECTA for supporting the Virtual Coupling concept.

S2R-OC-IP1-01-2018

- Finally it is expected that the proposals include the organisation (including the required funding for two meetings) of a joint advisory group, which should include experts from 3GPP and 5G PPP amongst others.In addition, available results of the Shift2Rail projects ROLL2RAIL (GA 636032), CONNECTA (S2R-CFM-IP1-02-2016), SAFE4RAIL (S2R-OC-IP1-02-2016) and X2RAIL-1 (S2R-CFM-IP2-01-2015) should be considered.

The action that is expected to be funded under this topic will be complementary to the actions that are expected to be funded under the following topics:

- S2R-CFM-IP1-02-2018 Implementing new technologies for the TCMS
- S2R-CFM-IP2-01-2018: Advanced Signalling, Automation and Communication System
- S2R-CFM-CCA-01-2018: Virtual certification & Smart Planning

As specified in section 2.3.1 of the S2R AWP for 2018, in order to facilitate the contribution to the achievement of S2R objectives, the options regarding 'complementary grants' of the S2R Model Grant Agreement and the provisions therein, including with regard to additional access rights to background and results for the purposes of the complementary grant(s), will be enabled in the corresponding S2R Grant Agreements.

An indicative scheduling of the deliverables is suggested below[36]:

- Deliverable under item d) is expected by month 20
- Deliverables under item i), ii) and iii) are expected by month 24

Expected Impact:

Actions will support S2R-CFM-IP1-02-2018 to validate in a relevant environment (TRL4/5) and for two representative railway applications (i.e. mainline and urban), the following technologies:

- The Functional Distribution concept, together with the Integrated Modular Platform, leading to a reduction of LCC and improvement of operational reliability;
- The Virtual homologation simulation framework to enable further reductions in LCC.
- The interoperability of the proposed wireless Ethernet Train Backbone, to reduce LCC, increase operational reliability and capacity, by adding flexibility to the system.

In addition, activities on LTE equipment should close identified open points (TRL3/4) and bring enough matureness for allowing full scale demonstrators of the wireless TCMS from 2020.

Type of Action: Research and Innovation Action