



Development plans of Czech railway transport with prior research and development solutions required

Ondřej Jiroušek
Czech Technical University in Prague

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Development plans of Czech railway transport

- Priority aim: High Speed Lines
- Mission of TP (and its Scientific Board)
- Bring students to study RE field(s)
- National Railway Research Center (network)





Role of the Technology Platform

- Universities
- Research Institutes
- Design companies
- Industry
- Infrastructure manager
- Coordination (Scientific Board)
- Bring universities, research institutes, design companies together
- Database of experts, equipment and competencies





Priority areas of Technology Platform

- **High speed rail connections** in the Czech Republic
- Introduction of a **unified power supply system** in the Czech Republic
- **ERTMS** Rail Traffic Management System
- Management of railway infrastructure **maintenance**

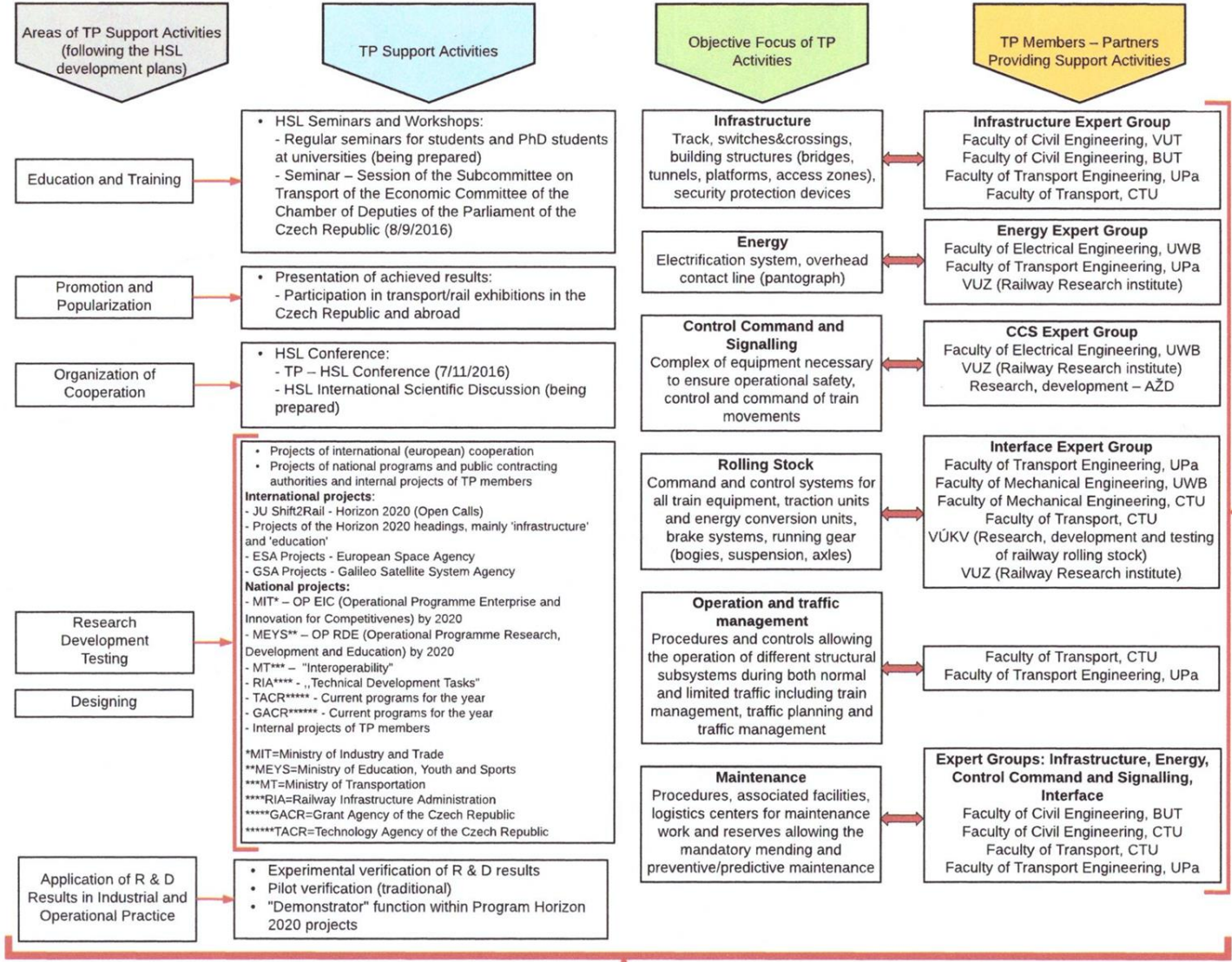
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CTU
CZECH TECHNICAL
UNIVERSITY
IN PRAGUE

TP Support Program to Accelerate the HSL Construction and Preparation of their Operations in the Czech Republic

Main Collaborative Partners:
Parliament of the Czech Republic, Chamber of Deputies
Ministry of Transport
Railway Infrastructure Administration





Selected topics – projects with the expected use of the results of their solutions for HSL Development in Czech Republic

a) Conceptual and operational economic starting points for HSL operation in the Czech Republic with the first selected themes:

- proposal and justification of the need for non-traditional benefits with the construction and use of HSL

b) Conditions and system prerequisites for high speed

- Rail traffic (interaction functions of the system - "vehicle, train - rail, infrastructure")
- Diagnostics of vehicle-track interaction at high speeds
- Dynamic driving effects at high speeds at railway subsoil
- Vehicle resistance of rolling stock under tunnel conditions at higher speeds

c) High-speed rail traffic and specific requirements for track maintenance and vehicle maintenance

- Predictive maintenance based on train-track interaction
- Use of high-strength materials to reduce demands on maintenance in high-speed rail
- Systems for continuous monitoring of the conditions of railway track
- in the framework of high-speed rail traffic



Selected topics – projects with the expected use of the results of their solutions for HSL Development in Czech Republic

A set of topics and related projects research and development solutions responding to technical requirements subsystems, in particular in accordance with European rules for railway interoperability

a) Rolling stock for HSL

- Efficient deployment of rolling stock for HSL implementation
- Technology for traction chains in HSL vehicles

b) Optimization of HSL energy

- Power traction system HSL
- Interaction of power supply system for HSL with power network

c) New HSL Infrastructure Design

- The new generation of switches – (BUT and U Birmingham joint project funded from H2020)
- Development and verification of HSL switchgear design
- Utilization of a new generation of materials in the sub and super structure for HSL

d) Signalling, telecommunication, information and automation technologies for HSL

- The static (infrastructure) part of the RS security device
- HSL Traffic Safety Devices
- Operational Specifications



Selected topics – projects with the expected use of the results of their solutions for HSL Development in Czech Republic

Selected topics ~ **industrial challenges**

- Railway superstructure, sleepers for high-speed rail traffic
- The use of a new generation of materials in the super- and substructure for the HSL
- The new generation of switches and crossings (Horizon2020 project)
- Development and verification of new HSL switchgear constructions
- Predictive maintenance for HSL, improved methods for assessment of track geometry quality
- Utilization of modern materials (geopolymer composites for repairs and reconstruction of railway concrete and reinforced concrete structures)
- HSL traction system, traction line for HSL
- Automatic Train Management (ATO)
- A fully compatible and fully equipped security system for ETCS
- Development of the "Radio Block Central" (RBC), as a basic component of ETCS Level 2
- Railway power supply system, hydrogen fuel cells vs batteries



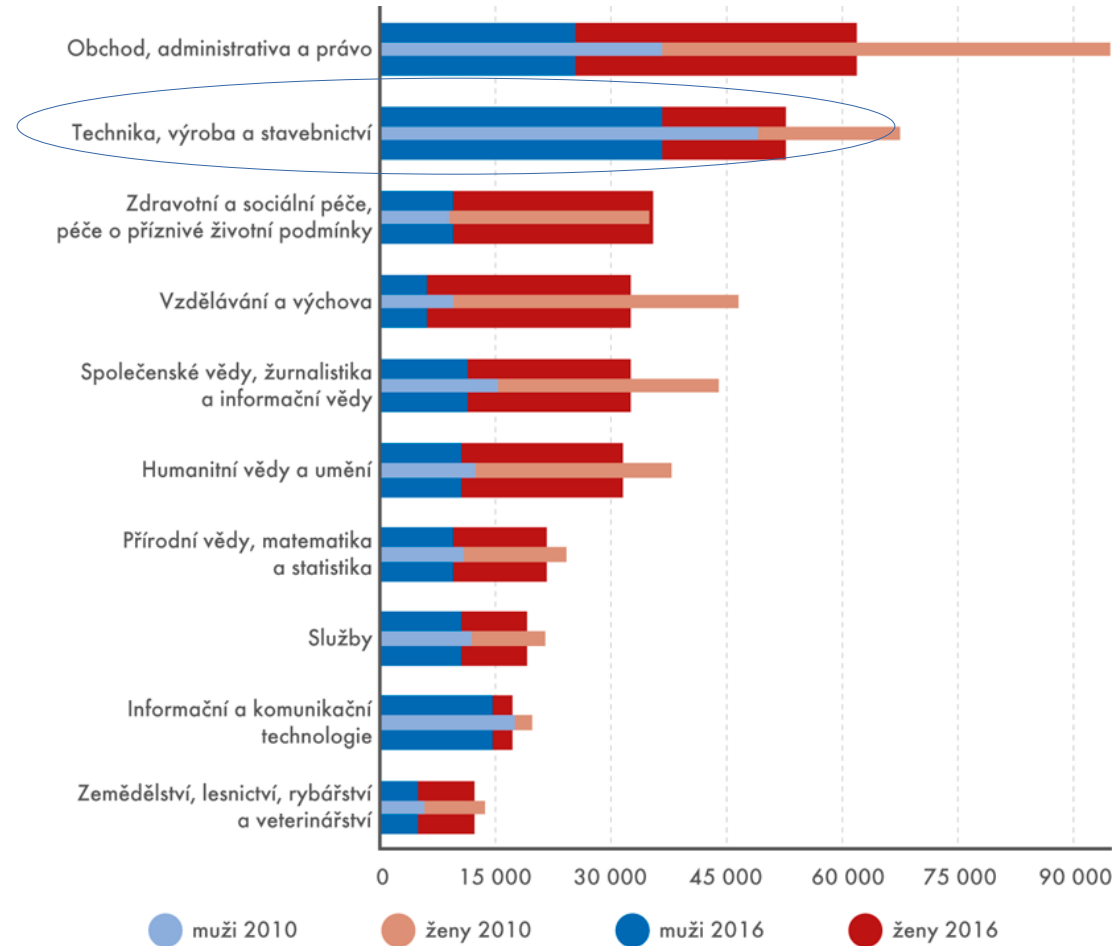
Selected topics – projects with the expected use of the results of their solutions for HSL Development in Czech Republic

- Selected topics ~ **technological foresight**
- Identification and knowledge of dynamic systems, estimation of unknown parameters and quantities, prediction of the development of quantities, decision making for fault and change detection
- Software Development Issues and Methods of Ensuring Quality for Security Critical Applications, incl. analysis and security assessment of software
- Testing and static authentication of these kinds of software in different ways, incl. generating and automated testing
- Diagnostics in large distributed network systems, especially storage, processing and visualization of diagnostic data



University Education, Engineering in general

- Stable decrease
- Even worse in 2017
- Engineering is the most affected branch of study
- Make the students attracted to engineering
- Make the Railway Engineering Attractive (Again)

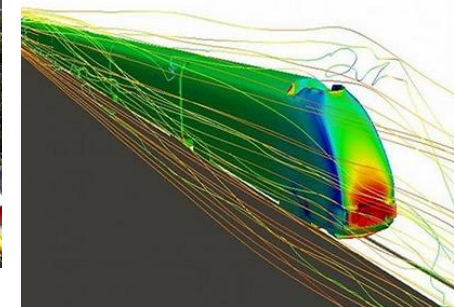
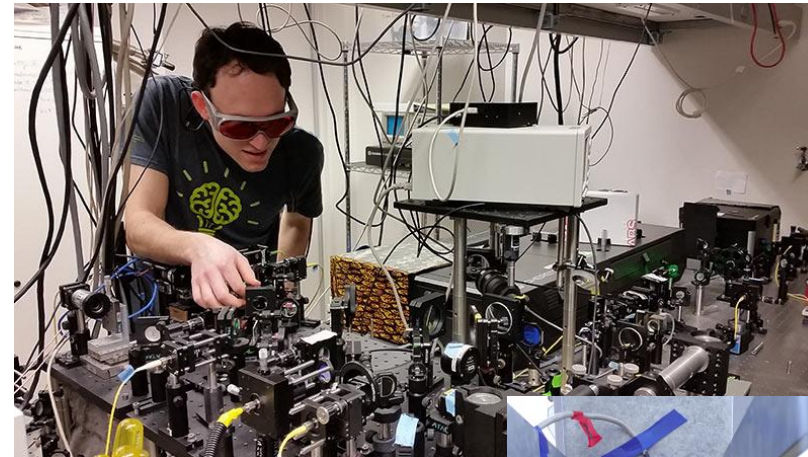


Number of public and private college students by ISCED-F



Make the Railway Engineering Attractive (Again)

- Reinforce the attractiveness of rail transport toward passengers and business
- Show railway research is competitive with rocket engineering
- Make the students attracted to engineering:
- Make them „touch“ the field – excursions, applied research, (well equipped) laboratories
- Bring the professionals to give lectures at seminars
- Projects





Popularization of the railway engineering

- .Coordination of regular and extraordinary seminars, lectures of practitioners
- .Excursion of university students to interesting workplaces (partners)
- .Final papers (and workshops) under joint leadership (lecturer and practitioner)
- .Competitions, rewards, prizes, meetings, popularization in general

Goal 1: Increase the number of high-quality graduates with the interest to remain in the field after university graduation

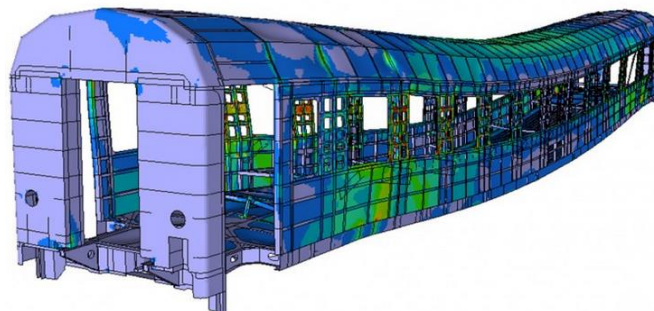
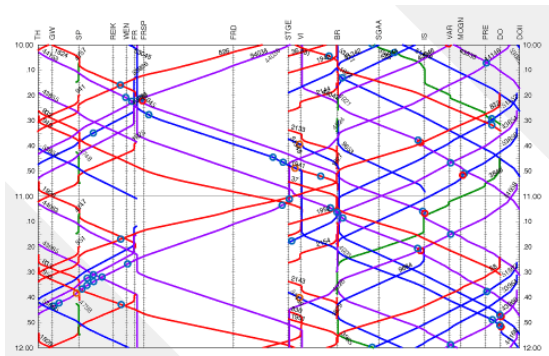
Goal 2: Applying R & D results to practice (faster deployment)





Education - concrete steps

- .Enhancing co-operation among Universities (Faculties)
- .Strengthening cooperation between universities and industrial partners (in particular through large **research projects**)
- .Emergence of new subjects responding to **current** needs and **challenges** (e.g. HSL issues)
- .Bc, Mgr and PhD **theses** topics offered from industrial partners (Joint leadership, project-oriented education)
- .Lectures by experts from abroad, **student exchange** within the Erasmus+ program with partner universities
- .**Popularize**, railway engineering is topical and perspective





Education - cont'd

- .Country-wide seminars
- .Summer schools (organized jointly by CTU, BUT, UPa, UWB & SZDC)
- .Railroad days
- .Week in Infrastructure
- .High-Speed Rail - current issues
- .All these events should be undertaken in cooperation with Industry (...) and National carrier (CD) and Infrastructure manager (SZDC)
- .(currently: funding these activities)
- .Internationalization of the studies





Challenges

- Students – numbers are important
- Joint effort: graduate certificate in Railway Engineering (?)
- Railway Engineering qualifications and training courses
- Postgraduate, Continuing professional development (?)





Universities: to make an impact

- .Students – numbers are important
- .Situation is similar in Prague, Brno, Pilsen, Pardubice, Prerov ...
- .We have initiated meetings with deans of all Technical Faculties related to Railway Engineering





Next steps: Meeting with the Deans

- Representatives (deans) of all Czech Technical Universities
- namely: CTU, BUT, UPa, ZČU, VŠLP
- Aim: identification of needs, funding possibilities
- Participants: TP, Unis, Ministry of Education, Czech Science Foundation (GACR), Technology Agency (TACR)
- Date already fixed: November 27th, 2018
- Towards establishment of Center of Competence





National Research Center

- .Goal: To establish a new National Research Center or Network of Research Centers
- .Real collaboration between academia and industry
- .Railway innovation, new technologies, laboratories, test-beds
- .Continuous education in the field
- .Center of Excellence, Center of Competence (tbd)
- .Infrastructure, Rolling Stock, Digital Systems, Testing, HSL
- .Model example: UK Rail Research and Innovation Network (UKRRIN)





National Research Center

UK Rail Research and Innovation Network (UKRRIN)

.Consortium of universities, in collaboration with existing industry testing and trialling facilities such as Network Rail's Rail Innovation and Development Centres

.Centres created in **Digital Systems** (University of Birmingham), **Rolling Stock** (University of Huddersfield, Newcastle University and Loughborough University) and **Infrastructure** (led by University of Southampton, University of Nottingham, the University of Sheffield, Loughborough University and Heriot-Watt University)



Digital System >



Rolling Stock >



Infrastructure >



Testing >

<https://www.ukrrin.org.uk>



National Research Center – goals and objectives

- .Readiness:** increase the capacity and capabilities of Czech rail sector to develop and deliver new and emerging technologies
- .Research and testing:** bring investment in rail innovation through this network of national research and testing facilities
- .Innovations:** increase Czech rail productivity and performance by delivering transformational innovations
- .Cooperation:** develop and maintain strategic relationships between academia, research institutes, design companies, rail industry and state organizations (ministries, infrastructure operator, national carrier)



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Thank you for your attention

Ondrej Jirousek
jirousek@fd.cvut.cz