

Railway Innovation – the University contribution

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Contents of presentation:

- Overview of RRUKA and its predecessor RRUK
- The University contribution to Innovation
- The Academic Response to the Railway Technical Strategy
- Conclusions

Setting the scene ^[1]

The UK spends **4% of the world's Gross Expenditure on R&D** on **6% of the world's researchers** who are authors of **8% of the world's research articles** and reviews.

These papers attract **11% of the world's citations** and so create **14% of the world's highly cited output**.

They include **17% of the world's research papers with more than 500 citations** and **20% of those with more than 1000 citations**.

Its **average research impact** now surpasses that of the **USA**.

[1] Global Research Report UK, Jonathan Adams, Thomson Reuters 2011

But – Impact on industry has not been quite so good.

UK research has mixed performance in knowledge transfer ^[3]

UK researchers have a low and declining share of patents compared with other research-intensive nations .

The UK's proportion of articles that are co-authored by researchers in both academic and corporate sectors is relatively low compared to other major countries.

Cross-sector co-operation within the UK has been identified as a weakness in the country's innovation system.

[3] International comparative performance of the UK Research Base – 2011, A report prepared for the Department of Business, Innovation and Skills

Pre privatisation – BR Research world leading

Pockets of excellence in a few Universities



RRUK formed 2003 - EPSRC funding – consortium of 7 Universities
3 Themes, 12 funded projects, Industrial advisory group
RRUK2, 2007 10 further projects 2 new partners

2010 RRUK-A founded

Core activities funded by RSSB
and Network Rail

Now 35 University members



Aims of RRUK-A:

The Association is a partnership between the GB rail industry and Britain's Universities

The aim of the Association is to be an effective bridge between industry and universities leading to:

- the support and facilitation of railway research in academia
- a common understanding of research needs to support the rail industry and its future development
- the identification of research, development and application opportunities in railway science and engineering
- dissemination of research findings to appropriate industry stakeholders.

RRUK-A – a partnership



Industry

Universities

Risks of poor collaboration:

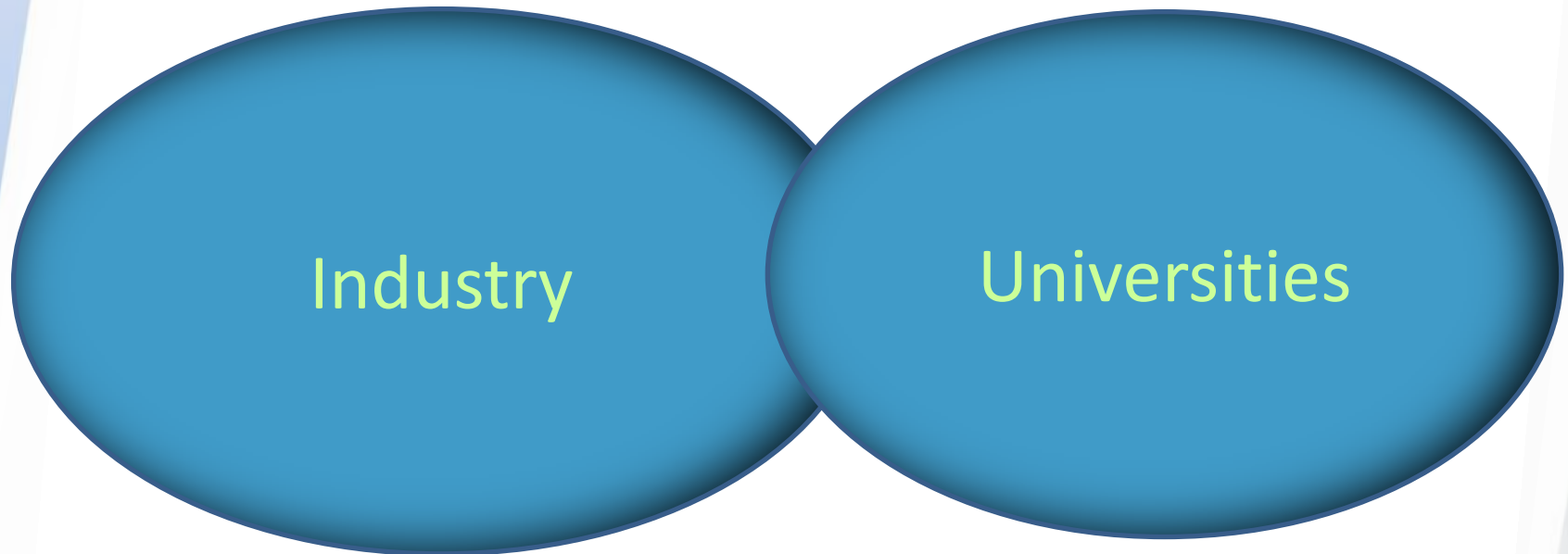
For Industry

- Loss of potential expertise (and solutions)
- Missed opportunities

For Universities

- Dangers of working in isolation
- Loss of funding

RRUK-A – a partnership



A study undertaken for TSB^[1] found that projects involving industry and two or more academic partners gave an average return of £9.67 per £1 of government funding compared with £4.22 for projects with no academic partners.

[1] Public and corporate economic consultants TSB 29/09/11

RRUKA
has
grown...
...and is
open to
new
members

Imperial College
London

Cranfield
UNIVERSITY



Rail
ResearchUK
ASSOCIATION

THE UNIVERSITY of York

Sheffield
Hallam
University

UNIVERSITY OF
CAMBRIDGE

University of
HUDDERSFIELD
inspiring tomorrow's professionals

University of
Salford
MANCHESTER

DE MONTFORT
UNIVERSITY
LEICESTER

UNIVERSITY
of
GREENWICH

Manchester
Metropolitan
University

The University
Of
Sheffield.

UNIVERSITY OF
BIRMINGHAM

Coventry
University

UNIVERSITY OF
LIVERPOOL

University of
Kent

The University of
Nottingham
UNITED KINGDOM • CHINA • AFRICA

Department of
Architecture &
Civil Engineering | UNIVERSITY OF
BATH

Swansea University
Prifysgol Abertawe

UNIVERSITY OF LEEDS

Queen Mary
University of London

THE UNIVERSITY OF
WARWICK

UNIVERSITY OF
SURREY

University of
Reading



MANCHESTER
1824
The University of Manchester

UNIVERSITY OF
Southampton

University of
Strathclyde
Glasgow

UNIVERSITY OF Hull

CITY UNIVERSITY
LONDON

Loughborough
University

Newcastle
University

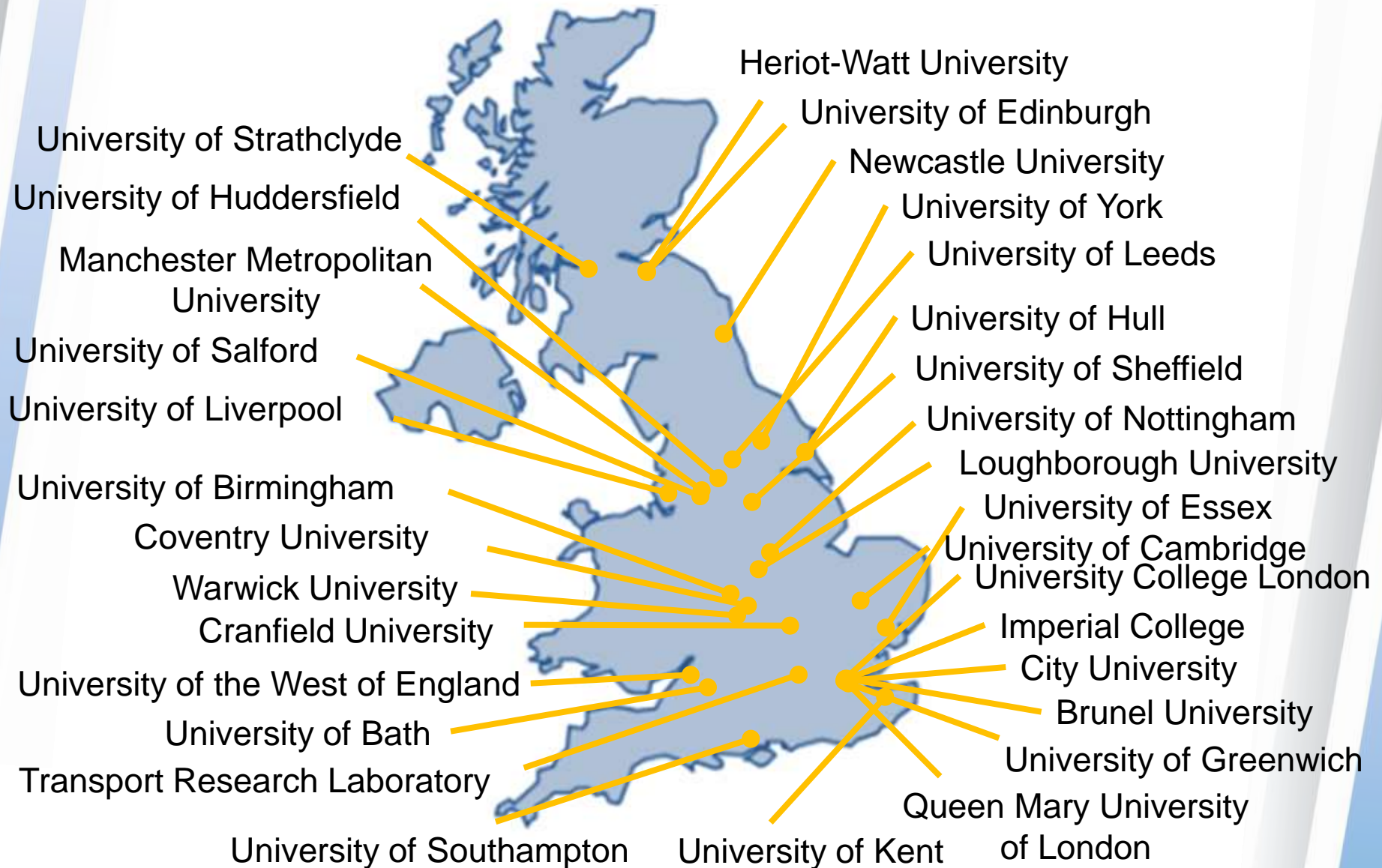
UCL

University of Essex

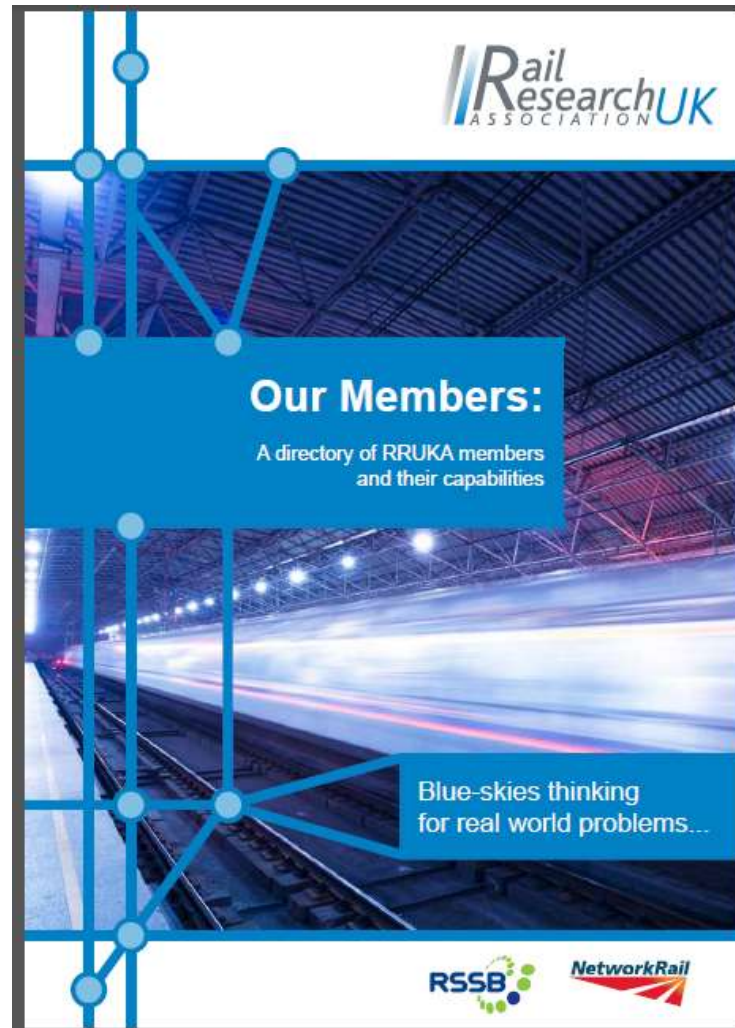
Brunel
UNIVERSITY
LONDON

UWE
BRISTOL
University of the
West of England

Academic members



Capability statement



RRUK-A

Key activities

Pure Research (25 years)

New ways of thinking

Next generation technology

Specified by academia
Supported by industry
Funded by research funders

Applied Research (5 years)

Problem solving

Development of tools

Improved methods

Specified by industry
Funded by industry

Types of RRUK-A Event

- “Blue skies” events
 - University-led, sharing an understanding of the issues, opportunities and state of knowledge on particular subjects
- Problem-Solving Events
 - Industry-led, seeking solutions to known problems in the railway domain
- Networking Events
 - Bringing industry and academics together for facilitated exploratory discussion

An example event, sponsored by ATOC:

The half cost train

a back to basics look at train design and specification

- Speakers were:
 - Louise Shaw (ATOC)
 - Nick Hortin (First ScotRail)
 - Nick Swift (Eversholt Rail)
 - Josef Doppelbauer (Bombardier Transportation)
 - David Clarke (DfT)
 - Simon Weeks (Rolls Royce)
- Plus 20 academics from mixed background
- 15 other industry participants

Half cost train – funded feasibility studies

RSSB offered £100k for feasibility studies that came out of ideas formulated by workshop participants. These were peer-reviewed and three projects plus one iCASE studentship, co-funded with EPSRC, were selected to be funded by the evaluation panel:

- Economic incentives for innovation: A comparative study of the rail and aviation industries (University of Leeds, University of Loughborough, Imperial College London)
- Commonality And Standardisation of Processes for cost-Effective Rolling stock (Newcastle University, Imperial College London, London Underground, TATA Steel, Scotrail (First Group). Alstom)
- Design for control of railway vehicles and its business case impact (Loughborough University, Salford University)
- Enabling the Development of Lightweight Railway Bogies Through the Use of Novel Technologies to Control Fatigue Life (University of Huddersfield) – the iCASE studentship

24/7 feasibility studies

RSSB offered £100k for feasibility studies that came out of ideas formulated by workshop participants. These were peer-reviewed and four projects were selected to be funded by the evaluation panel. These all proposed new approaches to the issues faced, including:

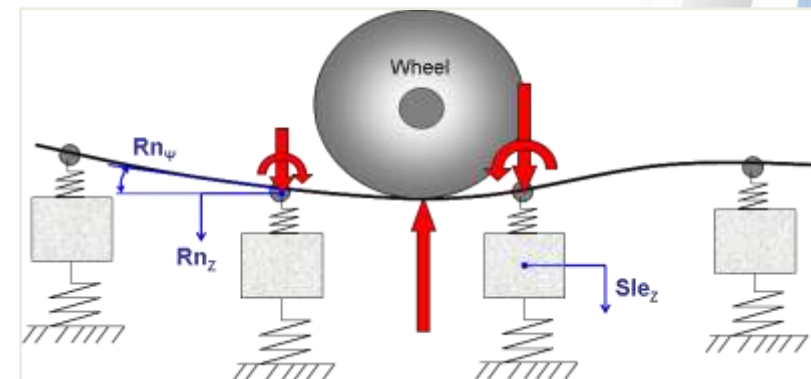
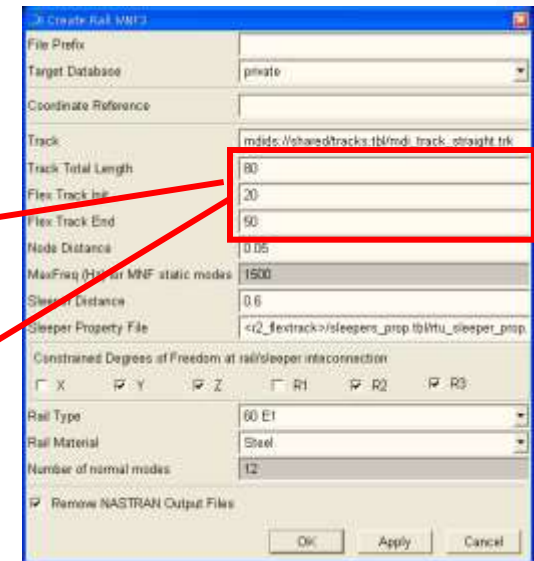
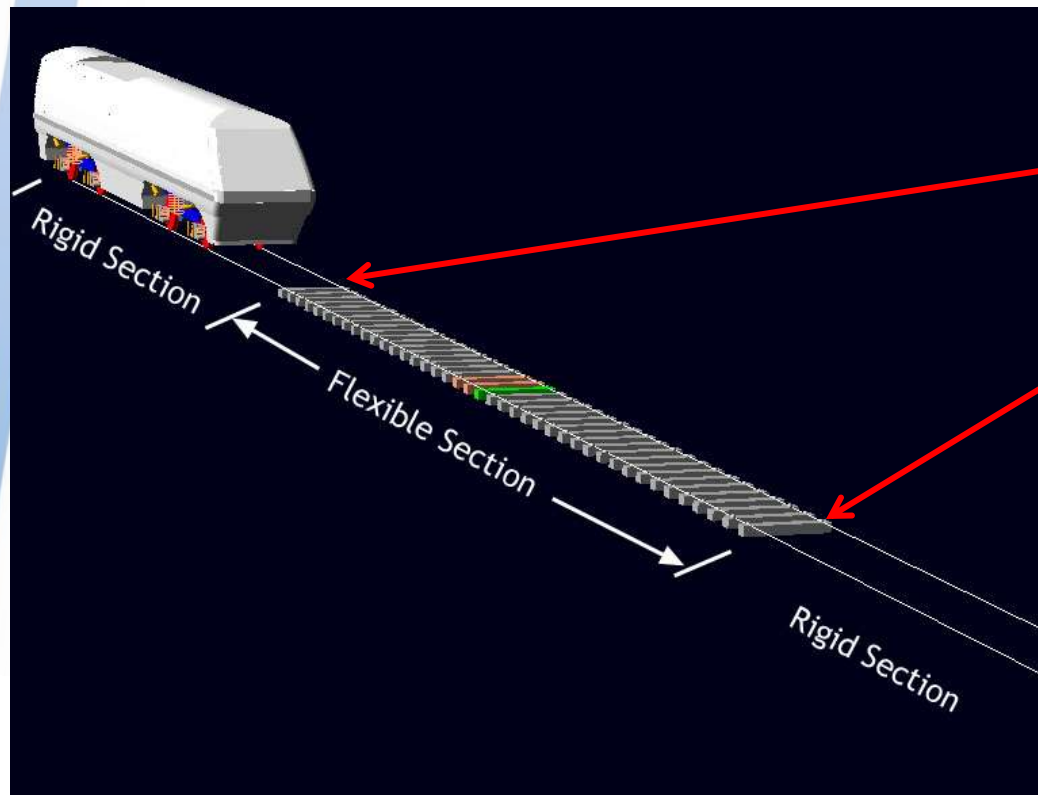
- Optimisation of possession authorisation requirements through the use of lean systems design and communication technologies (led by Coventry University),
- Effective use of data to improve decision making for maintenance (led by Queen Mary University of London),
- Embedded sensor technologies for improved remote condition monitoring (led by Manchester Metropolitan University)
- Maximising effective working times on possessions (led by University College London).

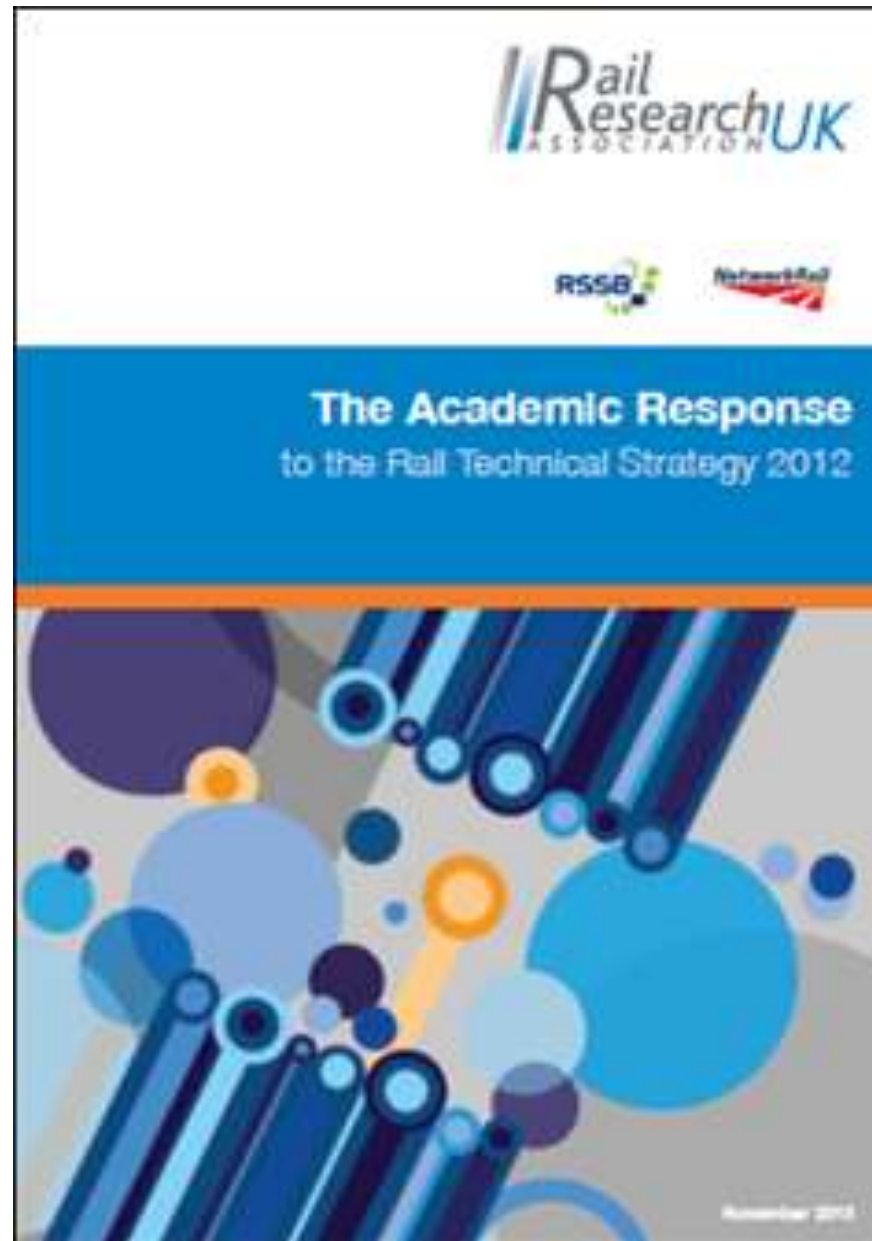
Case Study:

University of Huddersfield 'Flexible Track System Model'

Built in VI-Rail (MSC Adams) as a plug-in

- Automatic creation of ballasted/slab track forms
- Calculation of vehicle-track interaction forces





The aims of the 'ARRTS'

- To support the railway industry's future ambitions as set out in the RTS 2012
- To ensure alignment of university research with the long term vision of the industry
- Specific objectives:
 - to identify future research directions consistent with the implementation of the RTS 2012
 - to identify any critical gaps in the current UK research capability
 - To provide a document that can be referred to by universities when they apply for research funding



The development process

Endorsement

“Academia provides the railway with key partners in developing and taking forward delivery of the Strategy”

Jerry England, Chair of TSLG

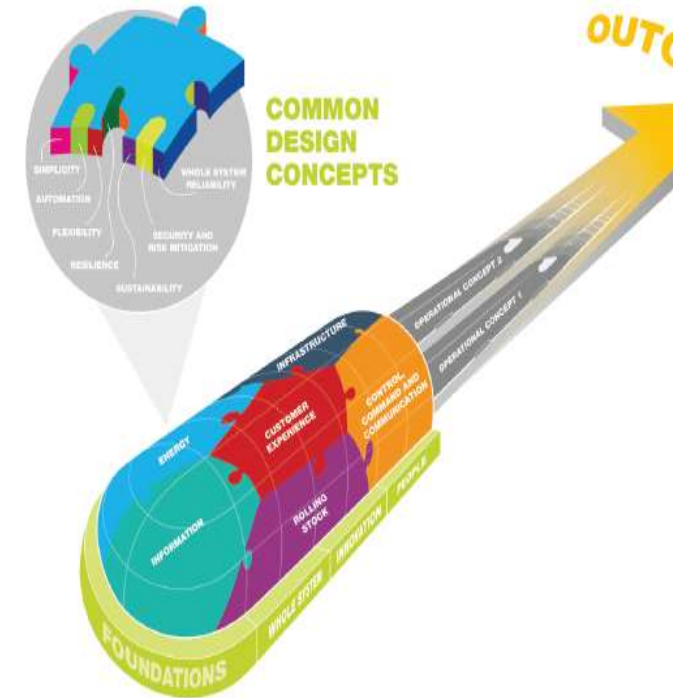


What it is not:

- The ARRTS is not a literature review or a summary or critique of previous research
(It does however attempt to include one 'Landmark' project' for each topic as an example)
- The ARRTS does not try to anticipate the expected research or its outputs
(but does identify the directions most likely to deliver the requirements of the RTS)

Document Structure

- Introduction
- Cross cutting issues
- Main themes
 - Control Command and Communication
 - Energy
 - Infrastructure
 - Rolling Stock
 - Information
 - Customer Experience
- Research as a sector of the rail industry
- Conclusions



Within each theme we ask / answer:

- What we already know (Current rail-related research knowledge and capability)
- What we know somebody knows (relevant knowledge elsewhere)
- What we think we need to research and what could be achieved (research requirements and impact)
- What we need from industry
- Other ways in which academia can help

Research tables:

	Research subject	Type*	TRL	Contribution to the RTS
1	Capacity definitions and metrics	C	4	Fundamental requirement
2	Whole system modelling, simulation and emulation	S	3	Fundamental requirement
3	Optimisation	S	3-4	Reliable and resilient CCC systems
4	Methods for train location	C	3-5	Reliable and resilient CCC systems; widespread use of ATO
5	Levels of autonomy	B	1	Beyond the current RTS horizon
6	Platooning trains	B	2	Consistent with the long-term RTS vision
7	Vision for next generation train control	B	1	Reliable and resilient CCC systems; widespread use of ATO
8	Human aspects of the transition from DAS to ATO	S	4-5	Reliable and resilient CCC systems; widespread use of ATO
9	Vehicle-infrastructure communications technology	S	3-4	Reliable and resilient CCC systems; high-speed, high-bandwidth communications networks
10	Video sensing of environment	S	3	Various contributions to system reliability

* Concept type:-

Collaborative: Partnership with industry to meet medium-term RTS requirements

Strategic: New academic input required to enable industry's longer-term plans

Blue Sky: New idea that needs formative academic research

Research subject	Type*	TRL	Contribution to the RTS
1 Cross-cultural studies of rail customer experiences in different cities and countries	C	0-3	(Socio-) Demographics
2 Examine the scope for systems thinking throughout the industry, along with genu-	B	0-3	Integrate access, end-to-end journey, ticketing, passenger and freight customer information

Research subject	Type*	TRL	Contribution to the RTS
1 Materials	B	2	Carriage layouts that make best use of the available gauge and the capabilities of new materials; rolling stock is mass and energy efficient and engineered for flexible use under

Research subject	Type*	TRL	Contribution to the RTS
1 Vehicles: Light weighting	C	1-5	More energy efficient rolling stock
2 Vehicles: Aerodynamics	S	1-5	Lower resistance to motion and quieter vehicles
3 Vehicles: Drives	C	1-5	Improved traction performance
4 Vehicles: Brakes	B	1-3	Enhance mission and passenger performance

Research subject	Type*	TRL	Contribution to the RTS
1 Access to data already collected on the railway	C	3-4	An enabler of research projects across multiple areas
2 Asset management with	C	4-5	World class asset management: asset fail-

Research subject	Type*	TRL	Contribution to the RTS
1 Open architectures	C/S	3-4	Supports ubiquitous data concept
2 Data modelling and ontology	C/S	3-4	Reuse of data
3 Understanding passenger movements/feedback from customers	C	4-5	Supports improvements in information and customer satisfaction
4 Increased resolution positioning (GIS)	C	4-5	Key to a number of themes within the RTS
5 Business models for open data	C	4-5	Underpins developments in this area
6 Data mining and algorithms for data analysis	S	4-5	Key in turning data into useful information
7 Showcases for open data	C	4-5	Development of a showcase to highlight benefits
8 Visualisation and human factors	S	4-5	Ensuring solutions are usable

Next steps:

Release of ARRTS

- Via RRUKA
- Through TSLG



The research landscape is constantly changing and it is intended that this will be a living document which will be updated regularly as research findings are delivered and as industry needs change.

Conclusions:

- Universities, are well placed to contribute to the development of innovative products and methods but the real benefits of this activity can only be realised in partnership with the railway industry.
- RRUKA is coordinating this activity and there is already evidence of strong collaboration developing between Universities and Industry and useful outputs are starting to emerge.
- However, there are identified gaps in research capability which if addressed will strengthen the contributions that Universities can make in realising the vision set out in the Rail Technical Strategy.

Thank you!

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