Innovate UK

Results of Competition: Accelerating Innovation in Rail Round 4

Competition Code: 1703_INNV_RAIL_1

Total available funding is £8.4m from Department for Transport

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
Incremental Solutions Ltd	RAPPORT - Real-time Accurate Positioning & Protection of Rail Transport	£146,623	£102,636
Network Rail Infrastructure Limited		£17,759	£17,759
Arriva Rail North Limited		£72,800	£36,400
Icomera UK Limited		£31,714	£19,025
Leeds University Institute Transport Studies		£39,482	£39,482

Project description - provided by applicants

RAPPORT is an industrial research project developing technology solutions to reduce disruption and delays in UK rail. Working in collaboration with key industry partners and academic institutions including Network Rail, Arriva Rail North, Icomera UK and Leeds University Institute for Transport Research, the RAPPORT project will develop and help bring to market a suite of innovative and revolutionary technology tools that will transform operational awareness of train locations and movements. Through the exploitation of enhanced location information and interactive mapping, RAPPORT will deliver useable tools with practical operational benefits. These include accelerating accident and emergency response times to rail incidents; providing supplementary information to signallers at User-Worked Crossings to enable more accurate train location awareness and better decision making; improving service recovery procedures by presenting deeper insights into real-time delays caused by incidents.By introducing innovative technology to existing systems provided by collaboration partners, the project will deliver a live trial of high value, low cost, state-of-the-art products with immediate use and benefit to the rail network, its users and moreover to the UK economy as a whole.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
GOBOTiX Ltd	Automatic Rail Vehicle Inspection & Anomaly detection using Machine Learning	£439,480	£307,636
Unipart Rail Limited		£166,630	£83,315
The Chiltern Railway Company Limited		£83,136	£41,568

Project description - provided by applicants

Routine train inspection and maintenance is a continuous activity ensuring equipment is maintained to an acceptable safety standard. Preventing failure of expensive major components (engines, gearboxes, wheel sets, axle bearings) and safely maximising their service life is key to an efficient railway. Continuous automatic inspection based on multi-spectral imaging and computer vision algorithms using specialist cameras, lights and software can be used to detect faults and anomalies before components overheat causing irrevisble damage. Gobotix Vehicle Underframe Examination System - VUES, will uses an array of multi-spectral cameras to detect and report changes and anomalies in the physical state of the underside of a railway vehicle as it passes over the system. Each vehicle is identified by reading its RFID tag and its history recalled. Then, machine learning techniques are applied on the data to detect anomalies and use trending to highlight components which are nearing the end of their service life. VUES holds statistics and can identify trends and has knowledge of standard and safe operating ranges of components. VUES will enable an engineer to access this information through a web application or GUI and take action before a problem becomes serious. VUES removes the need for manual routine maintenance inspection and allows inspection to be automated and thus carried out much more frequently.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
JR Dynamics Limited	Project Smart Oil Plug	£700,967	£490,677
Unipart Rail Limited		£135,958	£67,979
Project description - provided by applicants			
Project Smart Oil Plug aims to provide real-time data analysis and reporting, to enable Train Operating Companies to move away from excessive precautionary gearbox maintenance regimes and instead schedule informed predictive/preventative gearbox maintenance, reducing costs and increasing the reliability of railway operations nationally and globally.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Trucktrain Industries Limited	Fast Frequent Fulfiment (F3) by Rail/Intermodal	£112,277	£78,594
Newcastle University		£28,479	£28,479
The Railway Consultancy Ltd		£5,405	£3,783
Preston Solutions Limited		£21,722	£15,205
Inno4less Ltd		£22,849	£14,821

Project description - provided by applicants
Research on UK rail timetables, terminal operations and financial models indicates that a fundamentally different integrated approach is essential to facilitate any realistic future rail/inter-modal participation in traffic governed by demanding fast, frequent fulfillment requirements. Rail has as a minimum, to match and outperform road based systems on cost, productivity, service response, agility and availability (24/7 mandatory) and endow real quantifiable commercial advantages to shippers, owners and operators through the adoption of the new methods being proposed. Innovative train technologies and operational models are a major component to achieve this. These technologies include rapid terminal handling and improved road fleet asset management to support the high aggressive productivity targets which are essential to underpin the economic case for this new model of operations. Linked cargo and resource planning and management systems are a a central component of this initiative. The project is built around the simulation of very intensive short train operations linked to terminal operations for the rapid loading and off-loading of containers, pallets and roll cages for onward delivery. This phase will be linked to economic and commercial modelling to validate the simulation and test the concept in the face of changes and disruption. The project will also examine evolving requirements and not seek to merely replicate current practice. The emphasis is on high value time sensitive cargo, fast frequent fulfilment and to meet the demanding and evolving imperatives of shippers.If this project is successful, a high-performance bi-directional validation train may be deployed to demonstrate to users and potential users that it can be technically, operationally and financially viable and become a routine integral part of complex national logistics systems. The emphasis is on high value time sensitive cargo, fast frequent fulfilment and to meet the demanding and evolving imperatives of shippers.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
TBG Solutions Limited	RAS for train fluid servicing	£272,951	£191,066
Brunel University London		£114,901	£114,901
The Chiltern Railway Company Limited		£30,000	£0

Project description - provided by applicants

This project will carry out proof-of-concept tasks necessary for the development of a robotic autonomous system (RAS) for fluid servicing of passenger trains. It will be designed by a collaborative team from TBG Solutions and Brunel University London with support from Chiltern Railways. The need for such a system is demanded by the expected 100% growth in rail passenger traffic over the next 30 years and consequent massive increase in train servicing demand. We will apply robust engineering design research to map out the RAS performance over the range of train port locations and representative environmental conditions. We will design a RAS interface that has greater throughput and zero spillage and cross-contamination of ports. Safety will be an important design aspect to provide for the optimum robot-human co-working environment.While the rail industry has not yet followed industries such as automotive in exploiting RAS developments, it can be an innovative solution to the increasing refuelling requirements of expanding train fleets.The application of RAS technology in this area will have a role to play in improving the service provided for the consumer. The project will serve to contribute to greater acceptance of RAS in the working environment with consequent economic and job quality benefits.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Citi Logik Limited	Real-Time Train Occupancy Service	£429,507	£300,655
Buzz Radar Limited		£75,152	£52,606
Transport Systems Catapult		£98,328	£98,328

Project description - provided by applicants

The project aims to build the UK's first Real-Time Train Capacity Platform which will be made available to passengers and industry staff to help them better plan their journeys and management processes.It aims to equip passengers with better information regarding the onboard conditions of incoming trains and intends to equip TOCs and station staff with real-time capacity information."When a passenger is more informed of the capacity conditions of a train in advance of boarding it, they are then able to better plan their journey. They have the choice to wait for a quieter train, with available seats or travel outside of peak hours. We believe we will witness changes in passenger behaviour, demand shifts between peak and inter peak" - Transport Systems Catapult"Using our expertise in analysing anonymised mobile network data (MND), Citi Logik will count passengers phone signals on trains and alert passengers, through our platform, on how busy the rail route network is in real-time. We believe that this information will also help station staff in managing unforseen busy periods" - Citi Logik Ltd

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Milne Research Limited	Passenger Experience & Innovation Infrastructure to make the UK rail the best in the world	£255,000	£178,500
Costain Limited		£519,000	£259,500
IBM United Kingdom Limited		£148,000	£74,000
IfM Education and Consultancy Services Limited		£70,000	£70,000

Project description - provided by applicants

The rail industry is growing fast but passenger experience within stations is often poor, particularly for the disadvantaged. But, without engaging passengers to innovate and develop solutions, the track record of success are low. The project, led by Milne Research with Costain, IBM and Institute for Manufacturing, aims to solve this problem by developing a digital & physical industry-wide innovation infrastructure for passenger engagement and innovation – Passenger Engagement and Innovation Infrastructure (PEII). Firstly, passengers need a physical interface so we will build Innovation Hubs at London Bridge and Euston stations enabling passengers to input their ideas and problems or trial and test real innovations in-the-making such as signage systems or seat designs. Often more imporant is process innovation such as making it better and easier to find your train, book or change a ticket - even letting someone know the toilets are not working! Secondly, for industry to be able to engage with passengers at the scale necessary, unlocking the power of IT is essential. Therefore, the innovation hubs will be kitted out with interactive touchscreens, VR booths and headsets etc. The entire digital innovation infrastructure will be accessible through the web, social media and integrated into a range of travel apps. In this digital world, passengers can continue to be engaged – also rewarded and recognised for their contributions. This is an industry first and we look forward to working with all passengers to help make UK rail the best in the world.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Haydale Composite Solutions Limited	Composite Cable Sleeper (CoCaSl)	£129,232	£90,462
Oxford Plastic Systems Limited		£125,130	£75,078
Testsure Technology Ltd		£24,403	£17,082

Project description - provided by applicants

The market opportunity and innovation in this project is for a novel means of routing and protecting cables in the ballast bed. Cables need to cross the rail lines as part of the signaling and power systems and the current cable crossing methods can be a weak link in the system causing signaling failures. Damaged cables cause network delays, do not enhance the customer experience and result in significant lost productivity for the UK workforce. Some current methods of protecting cables disrupt the tamping process which leads to maintenance delays and can result in less than optimum tamping as manual tamping sometimes must be used. Thermoplastic sleepers will be developed that will reduce the cost of installing, maintaining & managing the infrastructure at the same time as providing an engineered solution that is both recyclable, sustainable & reduces carbon emissions compared to concrete solutions. The sleepers will provide enhanced cable protection compared with orange tubes and will provide a simple, low cost solution for cable management. The sleeper will improve on the current state of the art by providing a lightweight, easy to handle, non conducting, cable carrying sleeper.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
TTI Testing Limited	ON-TRACS: Rapid Rail Tension Measurement System.	£294,771	£206,340
TraXion-NDT Ltd		£165,989	£116,192
Project description - provided by applicants			
Most modern rail installations use a 'continuously welded rail' which, because of the lack of expansion joints, is laid with a pre- tension as determined by the temperature extremes to be experienced. In order to maintain safe operation during service it is necessary to have a method of measuring residual rail tension (or compression) in situ. Current methods are time consuming and invasive, limiting their application. A prototype will be built which demonstrates a new method to produce a much faster, non invasive and more convenient method.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Proxad Ltd	Onward Journey Planner Assistant	£85,271	£59,690
Snap Out Limited		£69,146	£48,402
ManagePlaces Limited		£51,024	£35,717
University of Surrey		£82,040	£82,040

Project description - provided by applicants

This project will address the need to assist rail customers with their onward journey by having suggestions provided to them, in a personalised and relevant way in advance to their arrival at the destination station. Rail customers are aware that there are a range of transport options available to them once arriving at the station, but assessing and deciding on the most relevant, based on price, timing and personal preferences, can be challenging.The Onward Journey Planner Assistant will test a software prototype, based on existing technologies, in a realistic, simulated environment to develop a new technology using existing and live data and existing processes in rail. The industrial research will explore how different components of existing rail systems and the prototype software can interact to develop the current systems to improve customer experience through the provision of personalised onward journey options. The outcome of the research is to evaluate how the technology can be scaled-up and be commercially exploited.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Technical Software Consultants Limited	Track Inspection by Autonomous System (TrakSys)	£397,611	£278,328
Centre for Advanced Transport Engineering and		£117,974	£82,582
TWI Limited		£215,341	£215,341
Project description - provided by applicants			
TrakSys aims to produce high-value, low-cost railway innovations – enhancing large scale, vehicle mounted railway track inspection with localised automated inspection. The innovation lies in creating an autonomous vehicle with state of the art inspection capability to generate more information. Combining this information with position data to form a map of scanned areas, and also linking measurements to locations within those areas will support enhanced value from inspection. This will provide a much richer and more accurate depiction of the condition of track sections. The system makes provision for integration with other information systems within stakeholder organisations to close the loop between inspection and decision making. The approach supports better defect and damage management across the organisation, leading to improved safety for travellers and employees and more efficient, productive rail networks.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Arriva UK Trains Limited	Interactive Locations and Intelligent Digital Signage (iLIDS)	£217,461	£108,731
Enable International Limited		£482,223	£337,556
Rail Safety and Standards Board Limited		£209,494	£209,494
University of Surrey		£84,949	£84,949

Project description - provided by applicants

The Platform-train-interface (PTI) sits at the centre of every passenger rail journey made. Unprecedented rail demand and near continuous heavy-duty vehicle traffic are making the safe and efficient management of the PTI increasingly challenging and expensive. At the same time, overcrowding is leading to suboptimal journey experience for customers. The aim of this project is to deliver an innovative solution for influencing passenger flow at the PTI, whilst respecting industry realities regarding cost and practical implementation requirements. The concept is based on the innovative use of real-time data, and information relays, including station infrastructure and signage as a 'responsive user-interface', intelligently guiding passengers along the PTI to achieve more optimal boarding and alighting operations. The consortium contains a unique blend of human factors, PTI operational protocol, big data analytics, cyber security and rail product development expertise to create a scalable Interactive Locations and Intelligent Digital Signage (iLIDS) solution. A proof-of-concept prototype will showcase iLIDS ability to positively affect passenger movement in real-time, completing a technology innovation that will ready for market entry in 2019.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Ciberdine Limited	BETTER - adaptive personalised journey intelligence platform with flexible ticketing	£559,444	£391,611
Iblocks Limited		£198,881	£139,217
Newcastle University		£72,050	£72,050
Project description - provided by applicants			
The BETTER project aims to revolutionise the customer experience through stations by developing the 1st passenger-focused platform combining integrated flexible ad hoc ticketing with personalised multi-modal adaptive journey intelligence using AI reactive/predictive analytics of real time travel data based on the travellers' preferences and travel history.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Vivarail Ltd	Towards Realising Accelerated Innovation in Novel (TRAIN) Battery Technologies	£408,017	£285,612
Valence Technology		£156,291	£109,404
Petalite Limited		£351,888	£246,322

Project description - provided by applicants

Viva rail has produced a proof of concept hybrid train which has been shown to be reliable, energy efficient and cost effective. This work was self-funded and delivered in a very timely and effective way. The TRAIN project will be delivered in a similar way with close cooperation between the partners. Vivarail and our partners Petalite and Valence, provide lightweight versatile cost-effective rail solutions including units that can run as DMU (diesel multiple unit), EMU (electric multiple unit), battery, or battery hybrid depending on power supplies available. Battery technology will incorporate advances from other sectors. The TRAIN project will develop innovative rapid charging technology and static energy storage to exploit low-rate cheap energy for high-rate charging. Two battery modules hang under each carriage and operate independently or in conjunction with other energy sources (electric). The solution provides significant operational savings, CO2 and noise reductions, and reduces maintenance demands to minimise out-of-service time. This project will fully develop innovative designs and validate them for production. Outputs include: Modular battery pack to suit specific applications; Rapid charging unit operating at approximately 600V; Integration of hardware/software; Static charging evaluation; Test train with prototype technologies: Duty cycle demonstrations and performance assessment.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Cubic Transportation Systems Limited	Improving Card Tap Compliance	£382,220	£191,110
Maynard Design Consultancy Limited		£107,234	£75,063
University of Portsmouth		£20,095	£20,095

Project description - provided by applicants

Incomplete journeys (where passengers forget or are otherwise unable to touch their card on a ticket validator at beginning or end of journey) are an issue for passengers and operators alike, leading to passenger frustration, revenue loss and additional administration costs for the operator. This project addresses this issue by taking a human-centred approach in designing and implementing an innovative reminder system which will prompt individual passengers who are identified being at risk of having missed a tap. Improved passenger experience will be an immediate benefit of this system, however, indirect benefits such as increased uptake of smart ticketing and capacity improvements are also foreseen. Having gained an understanding of the reasons behind incomplete journeys, the project will design and test user interface concepts and then deploy and test the most compelling candidates into a live station for an extended pilot. We will gather feedback throughout the pilot duration and work in an agile way to improve the concept in a quick but controlled fashion. Combining cutting edge vision based tracking technologies with existing validator systems and novel feedback mechanisms the project outcomes will be applicable in a much wider scope, in particular around innovation in gateline technology and future ticket detection systems.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
In Touch Limited	TrackWater: Supporting High-Value, Low-Cost Rail Network Drainage Asset Management	£590,734	£413,514
Lancaster University		£116,174	£116,174
Transport Systems Catapult		£58,201	£58,201
Network Rail Infrastructure Limited		£48,189	£48,189

Project description - provided by applicants

The rail network relies on an extensive system of trackside drains to remove surface water and minimise the risk of flooding and damage to the network. Failure to maintain the drainage infrastructure can have significant cost and safety implications for the parent asset; such as delay minutes, poor track geometry, line closures and the likelihood of earthwork failures. Our focus is on improving the performance of the rail infrastructure's drainage system - a critical, yet often overlooked element of the network infrastructure in order to help "design, build and operate railway infrastructure at reduced cost". Our approach is to leverage previous work on an innovative self-learning system for maintaining drainage networks in the highways sector and adapt this technology – including the IoT sensor network, data models and decision support system - for use in the rail sector. This represents a major advance in the state of the art as it will address key challenges identified by Network Rail and enable proactive maintenance of trackside drainage assets. Our consortium includes Network Rail as a challenge owner, InTouch Ltd as a technology supplier and primary route to market, and a strong science base consisting of the Transport Systems Catapult and Lancaster University. The resulting system will be tested on 14 miles of Network Rail test track.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DW Windsor Limited	Dynamic light for wayfinding & management of passenger flows at stations	£702,626	£421,576
Urban Control Limited		£112,126	£67,276
University of Nottingham		£129,992	£129,992
Rail Safety and Standards Board Limited		£41,213	£41,213

Project description - provided by applicants

The UK Rail Industry has identified that efficient passenger flow in stations has the potential to deliver benefits of £258m by improving capacity, enhancing customer experience and efficiency savings. Research has shown that lighting can influence behaviour and speed of movement of people. Modern LED lights have the potential to incorporate a range of functions that can be used for wayfinding and crowd management. DW Windsor is a UK lighting manufacturer and Urban Control a UK based smart cities company that provides Internet of Things-based control systems. DW Windsor and Urban Control are collaborating on an innovative project to develop dynamic lighting to improve the customer experience at stations. A consortium of Nottingham University, Railway Safety and Standards Board (RSSB) and the Centre for Sensors and Imaging Systems (CENSIS) will undertake research, trials and evaluate the benefits of this new technology to demonstrate the return on investment (ROI).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Far-UK Ltd	BRAIded Novel beam STructures with Opportunities in Railcar Manufacture BRAINSTORM	£140,345	£98,242
Composite Braiding Limited		£103,969	£72,778
TDI (Europe) Limited		£84,244	£58,971
University of Warwick		£140,445	£140,445

Project description - provided by applicants

Driven by the rail industry's challenges to industry and academia known as the 4Cs - reduce Cost and Carbon emissions and improve Capacity and Customer satisfaction - project BRAINSTORM aims to develop and demonstrate the applicability of braided composite structures to a novel, lightweight, modular railcar solution. With extensive expertise and knowledge in rail, automotive, bus and aerospace, project partners TDI, Far-UK, CBL and WMG provide a radical approach to rail vehicle lightweighting, as well as leading to significant opportunities for exploitation and creation of a UK-centric supply chain in this industry.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Bellvedi Limited	Optimising the flow of information in the rail industry to create efficiencies, reduce disruption and provide current and correct	£284,826	£199,378
Tracsis PLC		£377,030	£188,515
TransPennine Express Limited		£117,488	£58,744

Project description - provided by applicants

Train Planning, service management and rostering are critical to the effective management of the train service – their delivery impacting all areas of operational performance. They are therefore key areas where improvements can be focussed, with a recognised need to modernise the operational systems used (many still reliant on manual processes and legacy solutions) and highly siloed practices. APPROACH: Through the collaboration of Tracsis, Bellvedi (both established technology suppliers to the Rail sector) & Transpennine Express (TPE) as a Train Operating Company, the consortium seek to address these issues through the development of the first fully integrated and automated cloud based solution for planning, managing and reviewing resources across the entire train planning and operations process - providing a SINGLE SOURCE of information for controllers from rolling stock diagrams to human resource planning & work allocation. If successful in development, the impact to the UK Rail industry will be significant incluidng 1.Reduced staff costs through optimal staffing & resource planning 2. A consolidation of core information - reducing delays/cancellations & service recovery time 3. Improved communication throughout the network including real time updates - conveyed automatically to all relevant stakeholders in both normal and abnormal periods of operation. With the need for the solution fully validated across the market a 12 month project will now ensue with market entry in 2019. Potential for deployment both in the UK & Internationally & across wider transport applications.

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