

## **FOAK 2022 Rail freight**

**10039629**

### **Project title:**

Decarbonising Auxiliary Load in Freight Today

### **Public description:**

Freight locomotives have auxiliary electric power requirements which account for up to 10-15% of the total power demand, covering engine and traction motor cooling, safety and signalling systems and locomotive control systems.

These loads are currently serviced by an alternator on ubiquitous diesel ICE powertrains. This demand is persistent, requiring the diesel ICEs to remain

Whilst extreme traction requirements for freight operations restricts adoption of full decarbonised powertrains - unless compromises for traction power or range are made - no existing rail technology targets the significant auxiliary power requirements.

In response, G-volution have engaged a team cutting across the full UK supply chain to realise and integrate a first-of-a-kind system for on-board auxiliary power on freight locomotives, based on high energy-density fuel cells and a carbon neutral bio-LPG fuel system.

Whilst initially representing the lowest cost/technical barrier route to catalyse significant CO<sub>2</sub>, exhaust emission and diesel fuel savings in freight, this approach has potential to also substitute traction power in the long term, and supports the transition to green hydrogen as a rail transport fuel.

Through a live demonstration with a UK freight operator, the project will therefore prove that high-efficiency fuel cells, which are able to use a range of cleaner, greener, cheaper zero net carbon renewable fuels, can work in the rail environment and also stimulate significant commercial benefits for all operators, via reduced fuel costs and future environmental levies.

**SBRI: First of a Kind (FOAK) 2022 competition winners**

**Lead organisation: Project grant:**

G-VOLUTION LTD £378,514

**10037240**

### **Project title:**

Levelling up Freight

### **Public description:**

**Lead organisation: Project grant:**

3SQUARED LTD. £393,271

### **Background**

Rail freight is vital to Britain. It contributes almost £2.5bn to the economy and plays a big part in reducing congestion and emissions. Rail is more environmentally friendly than road, with every tonne of freight transported by rail producing 76% less emissions compared to road (RDG "Levelling Up Britain" 2021). The green benefits of rail freight are being driven heavily by the DfT with incentive schemes such as Modal Shift Revenue Support (MSRS) -- a £20m grant, which freight carriers can bid for a share of to support modal shift to rail. Despite widescale use of MSRS, finding new freight routes for additional trains is

- Road haulage is seen as easier and more accessible than rail freight, especially at short notice, for short journeys and for single containers.

- Highways are less regulated with no significant barriers to commercial participation, and therefore are free to use the latest technologies to develop and evolve solutions at a faster pace.

- Railway planning systems and processes limit the availability and visibility of freight paths (slots in the timetable which can accept a freight train) resulting in

Our innovative freight planning solution (PathPlanner) will make the use of rail for freight as accessible and easy to use as the road network. PathPlanner is specifically designed to overcome the current operational challenges and blockers that make moving to rail prohibitive.

### **Proof-of-Concept Demonstration**

In 2021, NR completed a £17m upgrade around Southampton to enable longer trains in/out of the docks. Completing April 2023, Solent Stevedores is investing c.£3m to strengthen their capability to receive and dispatch longer and more trains -- from 9 to 16 per day.

However, NR's business case did not include any understanding of capacity in/out of the port, so Solent Stevedores is currently unsighted as to how, or if, they can find the additional paths.

There are significant gains to be made if they can; 7 extra trains equate to:

- £12.6m additional revenue p.a.
- a reduction of 55,000 HGVs, and
- a reduction of carbon by 1,165 tonnes.

Our project will demonstrate a Proof-of-Concept solution at Southampton Docks that will facilitate Solent Stevedores, and Eddie Stobart Logistics (ESL) - 2 of our project partners - to find additional freight paths and transfer containers from HGVs to trains.

### **10038447**

#### **Project title:**

Transforming high-speed rail logistics

#### **Public description:**

Our project is to transform high-speed rail logistics combining a repurposed all electric passenger unit and bespoke consignment device technology to support the conveyance of parcels. This technology, offered alongside a new approach to using space at stations to create easily accessible city-centre distribution hubs, will enable the operation of a new high-speed non-letters parcels service.

The project meets the competitions challenge and scope through: Development and application of new technologies and approaches to rail, innovative reuse of existing rail assets (such as passenger rolling stock converted for light freight), repurposing of space at station hubs (which has been released due to changing passenger demand) and engagement with new to rail logistics operators to develop and grow new high-speed rail freight services.

Furthermore, the project is in support of permanent modal shift from road to rail, delivering rail freight growth, meeting future customer needs, and realising significant emissions reductions which supports the UK's low emissions target of a 68% reduction by 2030, compared to 1990 levels through modal diversion from road.

### **10039135**

#### **Project title:**

**Lead organisation: Project grant:**

VARAMIS LTD      £396,467

**Lead organisation: Project grant:**

Automating freight access right management and spot bidding using novel and modern software to drive modal shift from road to rail

HACK PARTNERS £322,420  
LIMITED

**Public description:**

Automating today's manual processes associated with access right management and spot bidding and wrapping these digital processes in an intuitive, integrated, modern, bespoke and scalable user system. The benefits of this innovation are not only cost efficiency but also enabling a much better experience to freight customers to drive modal shift.

**10039606**

**Project title:**

"Freight Skate" a self-powered freight bogie and platform

**Lead organisation: Project grant:**

TDI (EUROPE) £400,000  
LIMITED

**Public description:**

Governments have recognised that the continued dependence on the motor/freight vehicles is unsustainable and that modal shift to low and zero-carbon public transport solutions, both for passengers and freight, is essential if legislative commitments to Net Zero are to be met.

The Freight Skate provides a sustainable, low cost, reliable and high-quality rail freight experience which will drive down emissions and increase profits to freight companies and assist in bringing about the much-needed modal shift from road to train. To achieve this objective, it required us to use different ways of thinking across every aspect of the programme - design, supply, build and system implementation. This approach has yielded the desired results.

The skate chassis was originally designed with steering axles for passenger trains. It is a unique and tested design which we believe lends itself to operating as an independent 4-wheel unit that can be virtually coupled to form a platform for 10', 20',30' or 40' containers. The study would also allow us to optimise loading for 9'6" HC units; Three units could also be used to carry 2 x 40' containers. An individual unit would carry a 10' container.

TDI plans to commercialise the Freight Skate vehicle over the next 3 years, with the product entering freight terminal service in 2025.

**10039559**

**Project title:**

A rapidly deployable rail stress sensor for next generation freight monitoring

**Lead organisation: Project grant:**

PEAK TO PEAK £263,725  
MEASUREMENT  
SOLUTIONS LTD.

**Public description:**

As UK rail freight growth increases, a detailed live understanding of the network condition is essential and is driving the need for industry digitalisation in the form of real-time and in-situ condition monitoring. This is also a key enabler of automated networks and the adoption of autonomous vehicles.

In the UK many of the existing wayside rail measurement technologies (e.g. Weigh-in-Motion [WiM] and Wheel Impact Load Detector [WILD]) are expensive, time consuming to install, and permanent. Thus, the adoption of measurement technologies for improving service offerings is becoming increasingly important. Some proposed data streams are unmeasurable using commercially available technologies; other smaller rail sensors on the market only offer very basic measurements (such as vibration and temperature). Some can be achieved through strain gauging, weighbridges or manual inspection. However, Peak to Peak Measurement Solutions (PktoPk)'s solution is more robust, has longer term stability, is rapidly deployable, offers higher measurement frequency and is significantly cheaper/faster to deploy than any of the competing technologies. It builds on similar systems PktoPk have deployed to non-competing industries such as PktoPk proposes a novel technology to take key measurements using an ultrasonic array transducer mounted in a robust clamp that can be rapidly fixed under a rail of any gauge. Measurements will be taken in real-time and uploaded to a cloud platform. This solution is fast, portable and excellent value for money whilst providing tangible, reliable and cost-saving data. The system benefits to asset owners include; reducing possession duration, reducing inspection/maintenance downtime and providing rail operators with easy access to all the data streams listed below.

- Dynamic lateral and vertical force (L/V)
- Wheel-rail contact position and shape
- Wheel-rail interfacial stiffness
- Axle load/weight (ALM)
- Additional 'standard' measurements (temperature/noise/vibration)

The project will utilise PktoPk's close relationship with University of Sheffield, where the IP and right to operate is also shared, and will work with other local partners to create a demonstration of their novel technology to key rail stakeholders in a live rail environment. This event will also be broadcast with some international stakeholders who have already expressed their excitement about the demonstration.

## **FOAK 2022 Cost efficiency and performance priorities for a reliable railway**

**10037294**

### **Project title:**

EventGo - Intelligent Rail Service Demand Forecasting for Event-based Travel

### **Public description:**

#### **Aim**

EventGo will demonstrate a first-of-a-kind solution for accurately predicting how large visitor events impact demand for specific railway services, generating advance insight on rail capacity, and enhancing the ability of TOC planning teams to optimally plan and deliver railway timetables and services. Data-enabled decision-making is expected to improve overall TOC operational performance, as demand is more precisely matched with supply in order to realise new cost efficiencies, improve yield, and deliver enhanced customer experiences. The project outcomes address the competition's plan resilience and recoverability theme.

**Lead organisation: Project grant:**

YOU. SMART.      £249,946  
THING. LIMITED

## Challenge

Large visitor events create extreme demand peaks within the railway network. Though such events are often scheduled months in advance, accurately predicting how this demand is likely to impact a specific scheduled railway service is notoriously complex due to the lack of advance data about visitors' travel plans. In leu, TOCs often rely on best guess estimations. As recent UEFA Champions League finals in Pairs demonstrated, underestimating visitor travel can have severe consequences for an organisation's reputation, and visitor safety.

## Project

A mature EventGo prototype solution will be deployed by UK TOC planning team to predict how a series of sporting fixtures between January and March 2023 in the Yorkshire region are likely to impact time-tabled railway services. During this period, partners will investigate how advanced insight generated by EventGo can be exploited by planners to make intelligent adjustments to scheduled services, e.g., adding capacity to specific services to match high demand, to ensure optimal asset utilisation and deliver the highest level of customer experience.

## Value

Demonstration in a live railway environment allows partners to both verify the accuracy of the model's rail travel demand prediction, and to evidence the business value such intelligence can have on TOC operations. In addition, accrued results will facilitate product approval procedures and raise the visibility of the novel solution in the target market.

## Consortium

The project is led by You. Smart. Thing. ("YST"), a specialist in intelligent mobility solutions, and supported by two UK TOCs, a top-tier sporting institution and stadium management company, and regional government partners. Professional project management is provided by In The Round ("ITR"), a UK-based consultancy specialising large visitor events travel management.

## 10037862

### Project title:

NextGen Data-Driven Timetable Performance Optimisation Tool

### Lead organisation: Project grant:

ARTONEZERO LIMITED      £157,826

### Public description:

During the pandemic, the on-time reliability of services significantly increased due to the reduction in the number of services and passengers.

However, as passengers have returned to the railway performance has once again deteriorated. This has an even greater impact on the industry post-pandemic as passengers' expectations for services that are reliable and run on-time is even higher. Increased delays and passenger dissatisfaction therefore leads to an even greater decreased revenue from ticket sales.

Poor performance is in large part due to a poorly planned timetable that is often operationally unachievable or cannot handle minor perturbations. This is due to the timetable usually being planned with simulations and the method does not in how trains performing in reality at junction or stations.

Through years of working closely with performance, planning and operational teams, we've identified that by using granular train movement data and machine learning techniques, the actual performance of the existing timetable could be accurately calculated. This would enable planners with accurate information to make faster and better planning decisions that are based on real-world evidence.

Our Timetable Analysis tool will deliver automatically updated insights and recommendations to planners that is highly aligned to the planning process. Utilising both on-track (track circuit) and on-fleet (GPS and OTMR) data, the tool will provide an integrated view to both Network Rail and TOC teams.

Fundamentally this tool will result in a step change in the speed and quality of timetable planning, moving away from the use of limited simulations and anecdotal experience to a fully evidenced-based approach.

**10039201**

**Project title:**

Protection and Resilience for OLE using Computer Vision Techniques (PROLECT)

**Lead organisation: Project grant:**

ONE BIG CIRCLE LTD £247,115

**Public description:**

This project will utilise Computer Vision techniques applied to existing video footage and capturing a new type of video sensor to address two main challenges which are exacerbated by weather events and can result in the railway being closed. Providing means in which these type of challenge can be predicted and prevented will help provide the railway to become more resilient to weather. The following two areas will be addressed:

- Extreme hot weather causes OLE wires to extend and cause the tensioners to come into contact with the ground which can reduce tension and cause damage or event de-wirement. Utilising existing video footage this project will automatically identify OLE tensioners, position and measure them and generate an live asset map with current status level. This can be utilised as part of a digital twin model and fed into systems which are able to alert maintainers to the issue so they are able to take preventative action.
- Hot, cold and humid weather can also have an impact causing Corona discharge from electrical assets such as insulators. The Corona discharge is an early warning sign of potential damage and failure of the equipment and can be measured as part of a predictive maintenance regime to prioritise preventative maintenance activities. This project will install a UV Corona camera onto a measurement fleet or in-service train and enable automated data capture with real-time data transmission and processing. The results will be evaluated by experienced working groups to tune and amend the level of Corona events to ensure an

Both of these events can have very impacts on the railway in terms of delay, safety and customer experience. By providing tools which have the capability of preventing these from occurring the railway will have an increased resilience to the weather conditions.

**10038989**

**Project title:**

FEIDS - FOAS Enabled Intruder Detection System

**Lead organisation: Project grant:**

THALES GROUND TRANSPORTATION SYSTEMS £223,660

**Public description:**

Intruders in a railway environment and critical sites are a major problem for the rail industry, and one that can cause severe delays if not prevented. Conventional monitoring technology is low range, impractical and has a high deployment and operational cost. Instead, a system that can monitor the perimeter of a large area with minimal human supervision and can be used to direct rail staff to the correct location is required to introduce work efficiencies.

Thales' subcontractor Focus Sensors have developed the technologies capable of delivering a persistent perimeter detection system that can detect persons approaching a site before they reach the perimeter boundary and alert railway staff to their precise location. This will support railway staff to respond effectively and reduce delay minutes, insuring efficiency and cost benefits.

We propose to showcase a first-of-a-kind application of Focus Sensors' next-generation Fibre Optic Acoustic Sensing (FOAS) technology to deliver accurate and real-time information and alerts on intruders or potential intruders in a rail environment using our lateral-positioning technology developed for detection trains. This capability will enable security staff to rapidly respond to incidents and ensure intruders can be dealt with quickly and efficiently.

The FOAS-Enabled Intrusion Detection System (FEIDS) will use FOAS to detect objects moving near the fibre/perimeter, identify them and determine the distance from a boundary. This monitoring is both real-time and persistent, enabling alerts to be sent when a person or vehicle gets too close to or crosses a boundary. The high fidelity of the system means that an intruder's location can be determined to an accuracy of +/- 50cm, and this information is crucial to ensuring that on-site security teams are able to quickly and efficiently deal with the intruder.

This technology can be utilised both along sections of the railway and at specific, sensitive sites. Due to the long range and autonomous nature of the system, it drastically reduces the workload of railway staff. Staff will be provided with an automatic alert that will provide them with information on the nature of the intruder(s) and the exact location. This reduces the time for intervention, enabling trains slowed due to the risk to resume at normal speed quicker, lowering the impact of trespass. It also increases the likelihood of trespassers being stopped committing vandalism, which can disrupt operations, and reduces the likelihood of reoffending.

**10038342**

**Project title:**

Rail Flood Defender

**Public description:**

Rail Flood Defender will deliver a more reliable railway network that is safer for all stakeholders, and empower Network Rail (NR) and the UK to become global leaders in intelligent holistic rail drainage management. It will future-proof rail transport against the effects of climate change where more intense and regular rainstorm events are expected.

**Lead organisation: Project grant:**

University of Sheffield      £249,770

The project will explore principles of autonomous active flow control to reduce manual operations associated with protecting rail infrastructure from the effects of flooding. It achieves this by taking the latest advances in edge computing and applying it to real-time automation of mechanical and electrical equipment to control the flows in rail drainage systems, thus protecting the track drainage from being overloaded and flooded during rainstorm events.

[The importance of managing rail drainage infrastructure cannot be overstated. It is designed to carry stormwater safely water away from the track via a system of pipes and channels. When drainage infrastructure is compromised or inadequate, flooding can occur. Flooding causes delays to passengers and costs to asset](#)

The feasibility project will identify how the following benefits and sustainability opportunities can be delivered:

- Reduce risk of rail services being disrupted during rainstorm events
- Make the drainage design process more efficient
- Avoid capially and spatially expensive flood solutions (e.g. stormwater retention tanks)
- Provide a means for automated flushing to clear blockages (reduce manual)
- Reduce surcharging on adjacent rural or urban areas
- Explore additional opportunities such as rainwater harvesting for agriculture

**10039258**

**Project title:**

Optimal Prediction of Sand for Adhesion

**Lead organisation: Project grant:**

GOVIA                      £153,228  
THAMESLINK  
RAILWAY

**Public description:**

Train services are affected by seasonal variables particularly leaf fall between September and December. They can also be compromised by wet weather, icy and snowy conditions at a regional or very localised level on a particular route. Maintaining wheel-rail contact to ensure adequate and safe braking requires the use of sand in low adhesion conditions. Sand is dispensed to trains in response to a combination of train service plans and of weather forecast. However, not all trains are currently able to be replenished during overnight stabling and servicing with attendant risks of delays and damage to trains and infrastructure. Also, there is a high level of safety risk when sand replenishment on trains is carried out on a third-rail yard.

*"Optimal Prediction of Sand for Adhesion" (OPSA)* lead by Govia Thameslink Railway, the major Train Operating Company on third rail in the UK, will deliver a more efficient and cost-effective means of predicting the dispensing of sand to trains to ensure services are not compromised by adhesion losses and train sets are not required to be removed from planned operating diagrams because of inadequate on board sand supplies. The algorithm developed as a results of this project will base the estimates on an integrated framework that includes the forecast adhesion, track maintenance and the expected speed profile in order to capture the change in weather and the seasonal factors.



The algorithm developed represents a cost effective solution to predict the use of sand and schedule the maintenance of trains enhancing in turn safety and reducing the impact of delays on the timetable. The algorithm will be developed including direct measure of sand dispersion, braking, wheel slip and line speed diagram also accounting for human behaviour effects such as driving style. Govia Thameslink Railway has engaged with Cranfield University to deliver the disruptive innovation proposed in this project. The algorithm will enable a more efficient train scheduling improving public performance measure (PPM) addressing train delay targeting in particular the 25% of delay up to 15 minutes cause by several concurrent issues including train rescheduling and the National Rail Passenger Survey satisfaction.

**10038790**

**Project title:**

Unauthorised Cable Removal and Fault Triage (CRAFT)

**Public description:**

When cable thefts occur the operation of the railway, often in nationally critical locations, can be brought to a standstill with significant impact on passengers and freight supply-chains. Under extreme industry and public pressure, Network Rail must delay scheduled activities and scramble teams to effect repairs and get critical railway operational systems working again. Current technology may not be able to locate the break to better than a few km accuracy, meaning long periods of manual inspection are required to locate the exact position of the theft before the repair can be started. This wastes valuable time, increasing the effect of the theft on the efficiency of the network and creating cost for operators and delays

This proposal is for a technology solution, using existing trackside optical fibre cables, which can be used to locate cable thefts instantly to within +/- 1m. After a theft is reported or detected by other system, automatic analysis will pinpoint the location of the acoustic signatures of the theft activity. The location of the theft will be instantly displayed, both on a map overlay with geographical coordinates, and as a linear ELR, miles and yards track location. This will enable first-responder policing and security to be deployed sooner and more accurately. Secondly, with an accurately timed and positioned event signature, there is an opportunity for other parties with evidence collecting abilities (e.g. Forward Facing CCTV on trains) to more proactively, and possibly automatically, to retain evidence which may support prosecution. Thirdly the Network Rail engineering team will be given advanced information to allow them to attend the site with the right materials and As secondary activity we will enable location of optical cable by creating a companion georeferencing co-reference for the trackside fibre cable, so that faults and fibre issues can be located instantly to a more precise physical location. This provides a valuable tool for Network Rail's engineering teams, to reduce time for maintenance and fault finding.

**10036632**

**Project title:**

Trains with Brains(R)

**Public description:**

**Lead organisation: Project grant:**

FOCUS SENSORS £215,310  
LIMITED

**Lead organisation: Project grant:**

JR DYNAMICS £248,046  
LIMITED

Trains with Brains(r) aims to integrate data from a range of remote condition monitoring sensors into Network Rail's monitoring and planning systems/processes, to enable operations and maintenance teams to address key cost efficiency and performance priorities via more informed possession planning. This will be delivered via a head to toe monitoring solution, enabled via bi-directional integration between Transmission Dynamics and Network Rail.

**10038228**

**Project title:**

SBRI: FOAK 2022 Optimising Railway Possessions

**Lead organisation: Project grant:**

FRAZER-NASH      £232,226  
CONSULTANCY  
LIMITED

**Public description:**

One of the biggest challenges facing the railway industry is the complex process of planning and possession management. The logistics of diverting, blocking, or closing sections of track can have implications across the network. As the rail timetable becomes more congested, with increased services, there is more potential for disruption and less obvious times for possession. Delays on main-lines could result in huge fines, consequently delivering works and handing back possession on-time is vital.

In 2020/21, NR spent £1.6bn on enhancements, £1.9bn on maintenance, and £3.2bn on renewals (Office of Rail and Road, 2021). This translates into thousands of engineering works, most of these require possessions to allow safe, traffic-free worksites for maintenance activities (e.g. remedial works, inspections, maintenance and planned renewals).

Possessions result in both planned and unplanned disruption. Unplanned disruption can occur for many reasons; machine faults, access issues, staff planning, or wrong engineering train arrangement - all demonstrating the complexity of planning possessions.

Getting staff and equipment to worksites on time and minimising travelling distances are critical efficiency requirements. The barriers to this are mutual road and rail points, staff numbers and equipment types. Furthermore, engineering trains typically start in sidings which may be in remote locations due to available sidings being occupied during large possession works. Consequently, this cause issues in both timetabling and plans that ensure that engineering trains reach worksites at the correct time and in the correct formation.

With increasing traffic and reducing availability of possessions this problem is likely to be further exacerbated. Network Rail have identified a requirement to develop solutions for planning procedures such that possession efficiency is increased, resulting in the delivery of infrastructure maintenance work with minimal disruption and cost.

Combining Frazer-Nash's deep experience in optimisation of railway challenges and eviFile's possession management solution, we will innovate to develop a product that will support rapid planning and replanning of possessions through the application of optimisation and ML algorithms to identify potential optimal plans. Using wide-ranging railway possessions data we will research and adapt algorithms that will consider (for example) multiple scenarios, locations and types of work, and optimise and efficiently manage resources to ensure minimal impact to infrastructure traffic and capacity.

This will deliver possessions more efficiently, help plan work-activities during possessions more precisely, manage infrastructure access more efficiently, allow tasks to be planned more efficiently, and predict the impact of possessions on overall network performance more accurately.

**10037542**

**Project title:**

Portable Track Geometry Measurement System

**Public description:**

Rail incidents can take many forms and can result in many different types of intervention from temporary speed restrictions to full track closures. Many incidents either result from or cause track damage and in order to remove any speed restrictions or track closures engineers need to be confident that the track is in a safe condition. It is therefore common practice after many incidents where track damage is suspected or track repairs have been undertaken for Track Recording Vehicles (TRVs) to be required to run the track before passenger or freight vehicles are allowed to run the line again. However, the availability of these vehicles can cause significant delays to line reopening or removal of speed restrictions.

MoniRail has developed an in-service track monitoring system that can be permanently fitted to passenger vehicles and is currently on trial with Network Rail (NR) in Scotland and also fitted to 2 Eurostar vehicles on HS1. One potential use-case for the permanent system is for speedier removal of speed restrictions. However, even with the fixed solution delays are likely as track monitoring systems are only likely to be fitted to 1/3 to 1/2 of all vehicles, approx 1500 of 5100 vehicles.

This project aims to overcome these delays by providing track engineers with the first ever portable dynamic track geometry measurement system by modifying the permanent solution into a portable one that can be temporarily fixed to vehicles along with a lineside sensor array that can provide additional safety critical track information to the engineer. This solution will therefore provide immediate track information to track engineers such that can make informed decisions about the safety of the track and to what extent speed restrictions can be lifted or line re-opened.

**Lead organisation: Project grant:**

MONIRAIL LTD £249,148

**10038973**

**Project title:**

State of the Railway Compiler Data Solution (SORC-lite): open access real-time signalling data.

**Public description:**

**Lead organisation: Project grant:**

PARK SIGNALLING LIMITED £217,128

Our project seeks to support Network Rail in regaining understanding and ownership of key signalling asset information so that this data can be used to adopt new performance measures, identify bottlenecks within the rail network and target the 800,000 unexplained delay minutes that occur annually. The project combines a number of existing technologies to deliver the hardware, pipeline, analytics, and visualisation as a working demonstration. The data stores will also be available for use by train operators and the wider data analytics supply chain, removing some of the systemic blockers around access to data.