



UK Rail Innovation COVID-19

Contributions from UK Industry



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Introduction

COVID-19 has had a major impact on the UK and around the world. Within rail, this has created a number of challenges, and has significantly impacted the industry. UK companies have risen to meet these challenges, providing innovative products and services to tackle a range of needs highlighted in this brochure, including;



Air filtration



Sterilisation and hygiene



Staff Solutions and Tracing



Social Distancing and Inclusion



Contactless Systems

This brochure represents a collaborative approach between KTN and Innovate UK to promote some examples of how UK innovators can contribute to the rebuilding and growth of rail in UK and around the world.

We welcome feedback on the challenges that you are seeing in your market and how we can continue to build and shape this document in future. Please feel free to contact any companies in this document directly or through KTN using the details below if you would like an introduction, or to discuss wider solutions.

*Please note that the businesses listed in this document are a small sample of companies in the rail sector that KTN are aware of. KTN invites contact from other companies working in the sector. This document is representative of information provided in September 2020: If you wish to connect and/or work with any of the companies in this document please note that KTN has not conducted any due diligence around any claims made.

Knowledge Transfer Network

Innovation challenges are global. This has been brought into stark relief by the COVID-19 pandemic.

In the transport sector, for example, rail systems around the world have changed with a sudden drop in passengers numbers and a need to rebuild public trust. We now have the opportunity to build back with more resilient, safer and streamlined networks, with high levels of passenger and staff satisfaction.



KTN exists to connect innovators with new partners and new opportunities beyond their existing thinking - accelerating ambitious ideas into real-world solutions. We need to innovate out of this crisis, but also to keep focus on key needs for transport, such as decarbonisation, digitisation and inclusion. The transport and rail specialists at KTN have worked with many companies within the UK who have generated some incredible solutions around these themes, with a COVID-19 focus, which are now ready to be developed and implemented within other nations and regions.

KTN can help you to identify solutions for the challenges within the industry directly, as well as signposting funding and opportunities for those developing solutions. We are here to ensure that, as rail systems and transport systems adapt globally, the best possible outcomes can be explored through global connections and partnerships across industries. With a focus on deep, long-term collaboration across nations, we aim to not only restore, but enhance our rail networks for the future.

Get in touch to see how we can assist.




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We have worked
in collaboration
with Innovate UK to
produce this brochure

Innovate UK

Innovate UK is the UK's innovation agency. Our mission is to drive sustainable economic growth through business-led innovation, by investing in innovation and giving innovative businesses of all sizes in all sectors access to the knowledge, partners, investment and markets they need.

We work across UKRI and with partners to drive sustainable growth by investing in high-potential entrepreneurs and businesses across the UK that have the ambition and potential to contribute to economic growth and society through innovation. This includes working with spin-outs and start-ups through to large businesses at the top of complex supply chains that can provide routes to market for the companies supporting them.

Our work is also key to delivering the UK government's Industrial Strategy, including the commitment of UK R&D expenditure reaching 2.4% of GDP by 2027.

In promoting our thought-leadership role as the UK's innovation agency, our work goes beyond providing finance for innovation. We help to create the right environment for entrepreneurs and businesses to innovate successfully, including an effective innovation infrastructure, introduction of a new strategy for innovation talent and skills, and support for increased, seamless collaboration with universities and the wider research base.

We provide strong regional engagement, forging closer links to Local Enterprise Partnerships and Growth Hubs, and partnering with Devolved Government administrations and their agencies. But we are also becoming more global in our thinking and helping UK businesses do the same. We will therefore enable access to international collaborators, investors and markets so British innovations can address global problems, attract international investment and grow the UK economy.



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Innovation Leads - Rail

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Theme 1

Air Filtration

Air filtration and heating, ventilation & air conditioning systems remain a key consideration around facilitating safe rail travel in light of the COVID-19 pandemic. As our understanding of the virus grows, affordable innovations in this area will be key to ensuring the safety of passengers and rail staff.



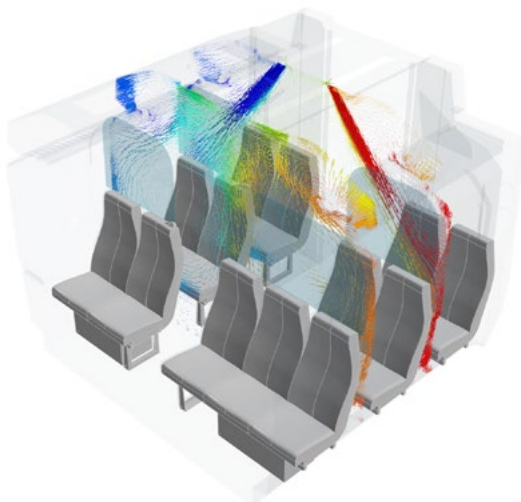
Norton Straw Consultants

Norton Straw is an independent engineering and management consultancy working across industries to solve niche design and operational challenges.

We work with the rail industry on topics such as: new route feasibility, reduced-order modelling of system performance, high fidelity simulations of internal and external airflows, and the strength and life issues of new metallic and non-metallic materials. Since the onset of the COVID-19 crisis, our team has been active in helping our clients to safely operate their products in a new normal.

Cabin Airflow Modelling

A UK Rolling Stock Owning Company has approached us and asked if we can support them to understand how to minimize COVID-19 transmission on board their trains. The client considered retrofitting train carriages with plastic shields in between seats. Norton Straw were asked to assess the effectiveness of such plastic shields in compartmentalizing cabin airflow. The project team worked together with the client to build a computational model of a train carriage from available CAD data and original technical drawings. Using Computational Fluid Dynamics we determined the baseline cabin airflow and the effects of: changing outflow vent location and fitting shields in between seats. On top of a summary report, the client received 3D visualizations compatible with VR technology which helped them understand much easier how well their proposed solutions worked.



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Air Sterilisation

Norton Straw have won a government grant to provide solutions to the COVID-19 crisis. In absence of a clear virus transmission method, air sterilization was proposed to address the problem of airborne transmission by removing any virus from recirculated air in ventilated environments such as train carriages. In three months, the team has used a combination of computer analysis and design for manufacturing considerations to size and develop an innovative concept.

By working closely with additive manufacturing suppliers, this concept was designed to be easily manufacturable, and is currently being built. The team is confident that this concept could be scaled up to suit airflow quantities which are recirculated through train carriages.

Rensair

Rensair offers rail systems hospital-grade air purification.

The COVID-19 crisis is posing serious challenges to the railway industry. By design, the nature of rail excursions puts travellers in poorly ventilated, confined spaces, which contributes to airborne transmission of the virus.

Regarding the rail sector and coronavirus mitigation, Dr. A. Smyth, programme manager at the Royal Academy of Engineering says:

“Good ventilation with a high provision of fresh air, and deployment of air cleaning technologies where this is not possible, help reduce the risk of airborne transmission.”

The Rensair patented technology offers rail systems hospital-grade air purification. Rensair, designed by the Danish ventilation engineer Henrik Hendriksen, is a supplier to the UK NHS (National Health Service) and trusted by Scandinavian hospitals for more than a decade.

The compact and portable Rensair units use the most advanced purification technologies, including HEPA13 filters and ozone-free UVC light. Rensair’s unique composition of the technology makes all the difference. The position of the UVC light directed on the filter surface puts trapped pollutants under constant exposure. This exposure breaks down the DNA and RNA, destroying all trapped pollutants.



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Rensair captures and inactivates more than 99.97% of airborne viruses, bacteria and other airborne pollutants, including coronavirus. Independent laboratories such as Eurofins, Norconsult and Oslo University Hospital document its success.

The unit's large air processing capacity (560m³/hour), no installation requirements, minimal maintenance, low noise levels, and air quality sensor make the unit ideal for the rail industry.

In light of COVID-19, Rensair's proprietary technology is now available to the rail sector and other businesses around the globe.

Theme 2

Sterilisation and Hygiene

Sterilisation and hygiene are central needs in preventing the spread of viruses and bacteria. In a rail context, this relates to both passengers and staff hygiene, as well as the cleanliness and sterilisation of surfaces and touch points. Ensuring cleaning systems are thorough, targeted at COVID-19 and proven to be effective is vital in ensuring passengers and staff are safe, as well as reassuring those who use our rail networks around the world.



Entex

Entex design and manufacture safety products for a range of different industries. We are a young company focussed on innovation and bringing modern solutions to new and existing markets.

We embrace the most current technologies and manufacturing techniques in order to stay ahead of the curve and provide our customers with innovative products.



Antiviral Decontamination Booth

The decontamination chamber uses ultrasonic technology to generate a dry mist of disinfectant which encapsulates the body, disinfecting your skin and clothing without leaving you soaking wet. To be used with our safe non-toxic HOCL disinfectant that kills Viruses, Bacteria or other Pathogens that might be carried by a person passing through the booth.

Designed for both temporary and permanent uses, the decontamination booth can be transported on a pallet and assembled very quickly. The booth has been independently tested using microbiology to show how effective it is at distributing the disinfectant and killing microbes on different surfaces.

The product is designed and manufactured in the UK and currently in use across a range of different sectors including office environments, construction and infrastructure sites and in the hospitality industry.



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Portable Disinfectant Room Fogger



The disinfectant portable room fogger generates a dry fog of disinfectant to fill an entire room and disinfect all the surfaces within the room as well as the air. Its high output fills rooms quickly without the manpower, simply set the timer according to the room size and leave the unit running. The small (2 micron) particles it generates remain in the air for long periods of time and fill the room completely meaning 100% surface contact is achieved including the hard to reach areas.

Can be used with our non-toxic HOCL solution which alleviates the need to wear respiratory equipment or cordon off the room when fogging. The portable fogger is perfect for decontaminating vessels, hotel rooms, offices, schools, bars and restaurants, killing viruses, bacteria and any other harmful pathogens.

The compact design and 100mm caster wheels and carry handles make the unit easy to move from room to room as well as up and down stairs. The unit is also designed and manufactured in the UK and is now in production.

Electrox Water Limited

Electrox Water Ltd manufactures Electrox Sterilising Water - an ecological disinfectant that kills viruses, bacteria, spores and fungi significantly faster than chlorine bleach and other traditional disinfectants.

- 80 x more effective than bleach
- No alcohol
- Non-corrosive
- Certified as non-hazardous
- pH neutral
- Hypoallergenic
- Low risk to health if swallowed
- No need to rinse after use

Electrox is made by passing an electric current through a solution of water and sodium chloride (salt) using our unique 4 chamber technology. This advanced, patented technology with its innovative production process creates Electrox – an incredibly effective disinfectant that eliminates 99.99% of viruses, bacteria, spores and fungi. It is a healthier, less environmentally damaging alternative to traditional disinfectants like bleach.



The active substance in Electrox is hypochlorous acid, which has been successfully tested for full virucidal activity as defined in EN14476:2013, therefore has activity against all viruses. This includes all coronaviruses and SARS-CoV-2.

Where Electrox offers greatest benefit to businesses in the UK and internationally is by combining the use of Electrox Sterilising Water with cold fogging – enabling areas large and small to be disinfected in a fraction of the time it would take to disinfect them manually. This saves businesses time and money. Fogging with Electrox can sanitise a huge range of businesses including care homes, retail stores, gyms and leisure centres, restaurants and bars, hotels and other accommodation-based businesses, schools and many more.

Electrox
STERILISING WATER

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Intercede Ventures Limited

Spectrum Virus Sensor – low cost COVID-19 virus cleaning verification system (SVS).



Developed initially for use in aircraft cabins by Intercede Ventures in collaboration with the University of the West of England, SVS is a low cost, quick and easy method of scientifically verifying fogging disinfection for COVID-19 and other pathogens in shared space. Proof of Concept trials have been thorough and successful. SVS is being launched in October 2020.

The system works equally well in railway and other applications. SVS sensors are made of biodegradable safely disposable materials and are used in association with a mobile phone app from which the results are interpreted and retained on a database.

The results can be printed for display or be electronically transmitted, as required by the user verifying cleaning and hygiene standards. Optionally the SVS user can provide access to the verified results to its passengers and other users of the disinfected public space by an associated app or by providing QR codes.

The SVS system is a low cost, scientifically-verified means of giving confidence to passengers, staff, and other users of space that the COVID-19 virus and other pathogens are being successfully eliminated. Customers contracting into the system receive a regular supply of disposable sensors, sensor reader hardware and access to discounted associated fogging supplies and fogging machines.

Full training and audit standard services are also included. Images show sensors placed within the space according to a matrix plan provided based on the volume and architecture of the space being sanitised.



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NoBACZ Healthcare Limited

NoBACZ Healthcare Ltd. is pioneering a novel platform for antimicrobial barriers.

Our formulations (patent pending) are applied as liquids that rapidly set to form solid coatings, preventing the ingress, transmission or carry over of pathogens. We have initially developed these as liquid bandages for the veterinary and human markets but are now expanding their use for high touch surfaces, such as those found in commercial premises and on public transport (e.g. train networks).

Importantly, these can be applied as a retrofit to existing surfaces to as a cheap and rapid “pathogen proofing” strategy. Importantly, all components used are approved feed or food additives permitting a broad range of safe and affordable uses. Coatings are applied as a liquid (spray or brush) on site and can cure within minutes without requiring any specialist training.

Stability and scale-up development are ongoing and we can progress to large scale manufacturing quite rapidly. We are also open to sublicensing opportunities, both locally and internationally.



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Sym-Wall Plant Engineering Ltd.

Aqueous Ozone Decontamination System (AODS) For Train Compartment Cleansing.

Sym-Wall Plant Engineering Ltd of the UK is developing a high-efficacy anti-pathogen decontamination technology, known as Sym-Zone™. The system is based on the delivery of a prescribed ozone-water “mist” which rapidly de-activates the pathogen on all contact surfaces in the occupied space.

The ozone mist is generated in situ from ambient air (oxygen extracted and purified) and water from a localised supply. Following the rapid de-activation process the ozone reverts back to breathable oxygen leaving no harmful or pollutant residues. Since no chemicals are procured or stored the operating costs of Sym-Zone™ are extremely low.

The technology is designed for widespread application and can be configured effectively for public transport, ambulances, aircraft cabins and care homes as well as large capacity arenas and cruise ships.


A particular application for Sym-Zone™ is the concept of a permanently installed “misting system” as a fixed utility within a train compartment. The system would comprise the in-situ “engine” delivering the de-activating aqueous mist through ceiling mounted “dispensers” as required during a regularized cleansing cycle. A typical cycle would require misting for a period of several minutes into an uninhabited compartment. Within a short time the pathogens would be de-activated and normal cleaning processes could proceed. This preliminary measure would also serve to protect the cleaning staff.

Effective elimination of the SARS-CoV-2 virus causing COVID-19 is a major challenge facing the global transport industry. The Sym-Zone™ technology addresses this in a radical way, allowing sustainable, flexible, cost-efficient, rapid and high-efficacy decontamination of a train compartment and providing added reassurance to passengers returning to the “new normal”.



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Managing Director

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Orion Eco Solutions

Orion Eco Solutions have years of experience in delivering environmentally friendly cleaning products for safe and effective cleaning in a wide range of applications, including Touch Shield - a coating that is 99.9% effective against a wide range of bacteria and prevents bacteria and viruses gaining access to nutrients, so they simply starve and die.

Touch Shield is non-carcinogenic, non-mutagenic, non-skin sensitizing, non-toxic and toy safe. certified and complying with BS EN 71.3 (toy safe).

Touch Shield has outstanding longevity in use because of its inherent low water solubility and resistance to UV light. (NB. Silver based competitive products are not UV stable, darkening and discolouring over a period of time)



The Touch Shield technology has been continuously in use on a wide range of product types for 16 years with no customer complaints regarding performance. The Touch Shield technology is widely used throughout the NHS and in many high trafficked public areas, in a multitude of product types such as furniture and joinery and plastics and rubber as both a coating and an EVA based masterbatch. Tested against CV-19 and proven to be effective.

The Touch Shield technology prevents transfer of pathogens from person to person and remains in place and active even after multiple washings.

- Can be applied to almost any surface material
- Does not migrate from the surface
- Does not transfer onto the skin and does not leach harmful toxins into the environment
- Is not poisonous
- It does not dissipate over time
- Physically controls the microbe on contact
- Does not create an environment for adaptive organisms and “super bugs.”



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Theme 3

Staff Solutions and Tracing

Staff are crucial to the safe running and maintenance of every rail network in the world. Keeping staff members safe and enabling them to effectively do their jobs during this challenging time is key to an effective and resilient network.

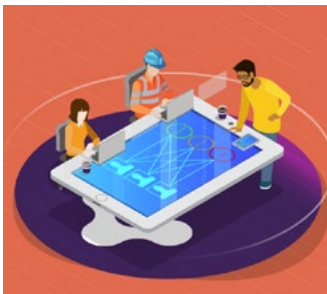


3Squared

We develop digital solutions to support the rail industry, helping customers to increase productivity, and reduce risk and cost.

Technology is transforming transportation and the world we live in. 3Squared has been at the forefront of that change because we understand how to use change and innovation in technology to deliver value.

Our flagship RailSmart® suite of software applications continues to positively disrupt the rail sector as more clients use the software. We are proud to have delivered our services to a broad mix of companies within the rail and rail construction sector and our experience enables us to harness the best ideas, practices and solutions to the benefit of every client.



Our products offer clients the ability to maintain safety critical roles and operations whilst observing social distancing. RailSmart® digitalises traditional processes and enables companies and their staff to carry out these processes in a safer manner.

For example our competency management tool, EDS, provides the ability to train and assess staff virtually (online) and our Engineering and Operations focussed products manage critical information safely, and support Internet of Things solutions to provide condition based analysis and proactive maintenance of assets.



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We are collaborative and believe in working closely with our clients, forming long term partnerships. This approach means we can respond quickly to the changing needs of our customers. Based in the North of England, UK we have the capabilities to support our clients across the whole of the UK and overseas wherever our clients need us.

Across the team we have a wealth of experience of working on international projects, and with international clients and would be happy to discuss how we can support international partners and clients.

For news and details of upcoming events, visit;

3squared.com/blog

RASIC

Rail Demand Information System is a national project being rolled out in record time to respond to the needs of the railway industry during the COVID-19 pandemic.

It provides the railway sector with a loading, boarding and alighting information for every train in the UK utilising mobile phone data. This enables new ways of monitoring and improving our performance and is pivotal in supporting Network Rail's duty of care with regards to social distancing and ensure a safe railway experience for all our passengers.

This new capability will enhance our understanding and management of passenger demand across the railway industry, including station crowding and interchange points with metro lines. The system is compliant with personal information and can be rolled out within three months in most areas of the world. API's from this system can be incorporated into existing systems or viewed through our existing portals.

The overall objective of this new capability is to improve passenger service provision and performance by enhancing our understanding & management of demand across the rail industry, to help:

- **Provide better information for passengers to support social distancing**
- **Geographical information**
Development of train plans
- **Train level information**
Aid operational control decisions
- **Passenger Behaviour**
Research passenger behaviour during (and beyond) the crisis and during times of disruption to provide an efficient and safe travel experience



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Canary Sentinel

Canary Sentinel: Digital PPE for the workplace

With businesses gradually re-opening, there is an increase in the number of people commuting by rail. This implies a higher level of risk for employees who will be directly exposed to growing numbers of passengers.

The current measures introduced in terms of physical PPE such as masks, social distancing and hand washing are difficult to enforce and don't take into account exposure that may have occurred outside of the work place but which could affect everyone in it if the employee returns to work and is pre-symptomatic.



With Canary Sentinel our mission is to enable continuous and personal health monitoring with dynamic alerts to identify early symptoms of COVID 19. Our system consists of a plug and play wrist worn wearable band and smart phone app. The wearable monitors a complete set of clinical parameters and looks for changes that may indicate onset of infection.

Our intelligent algorithms stored on the user's phone via our app create personalised base lines from vital signs to create alerts, COVID risk scores and provide an oversight of the user's general health condition and vulnerability. These reports are presented to the user via our smartphone app. Our user interface is so easy to understand so that even the most tech non-savvy user gains value from it. All assessments are private and are not shared with the employer.

In addition to the user facing module (wearable + app) we also provide a customised dashboard that can be used to visualise data such as heat maps indicating general health scores between departments and locations.

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Feature

Transport for London Consulting

Transport for London Consulting



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As Transport for London (TfL) we have nearly 20 years' experience of meeting the political, financial and practical challenges of improving London's transport system to create sustainable urban growth.

This, coupled with 150+ years' experience of running and developing London's rail network, including the London Underground, and 80+ years' experience of managing London's bus fleet, puts us in a truly unique position to advise cities and transport authorities who face many of the transport challenges that London has faced, and still faces today.

TfL Consulting provides this support internationally, applying our experience in planning and running the most integrated transport system in the world, and we are currently delivering on some exciting projects in Australia, India, North America and Europe.

But importantly, we know that there has been no challenge so monumental to complex public transport networks than COVID-19.

In London, our response to COVID-19 has three overlapping aims - enable customers to safely make increasing numbers of trips to

reach the places, events and activities they want to, encourage the wider recovery of London's diverse economy, and build back better to ensure the long-term success of London as a sustainable city.

Across our rail network, it is incredibly important for London's recovery that we provide a safe, clean, reliable and well-managed service. We have seen evidence of the effectiveness of our approach, with a recent survey suggesting that over half of Londoners are comfortable using the Overground and Underground, accompanied with steadily rising passenger numbers.

We receive numerous requests for support from governments and cities worldwide who want to achieve the same goals as we do, and we are ready to share our unique expertise in responding to COVID-19 with partners around the world.

In Focus: Social Distancing

The safety of our customers and staff is always our number one priority, so services across the TfL rail network must operate differently, and continue to operate differently, to enable social distancing.

Initially the UK's nationwide lockdown, beginning on 23 March 2020, meant that London Underground usage – which usually handles five million passengers per day - was for a time 94% lower than usual.

This drop in demand was matched with an initial reduction in service levels, which were also due to staff unavailability rising due to illness, isolation or shielding.



However, from May 2020 onwards, we made the decision to increase our rail service, and are now running nearly 100% services on all modes.

Increasing the train service has increased available capacity and has enabled social distancing to be more easily maintained across the network. Where a reduced service operates on a line, this has the potential to impact customer services, change customer travel patterns and will, if not effectively mitigated, lead to congestion and crowding and less potential for social distancing to be maintained.

Importantly, this was coupled with the work of our dedicated Travel Demand Management (TDM) team, who utilise a wide variety of channels to reach our customers with the latest travel advice and information. In the first instance these channels were used to deliver very strong and clear messages to our customers aimed at discouraging them from travelling, unless essential, where now the same channels are used to facilitate a safe return to the network.

Our world-leading TDM team understand the operational and customer impacts of passenger demand growth; use those insights to develop information, advice and tools to help customers avoid disruption where they have the flexibility to do so; collaborate

across the transport industry and Government to co-ordinate action; and ensure advice is carried across a wide range of communication channels.

In order to ensure social distancing across our network, usually used by millions of customers every day, the efforts of our TDM team were incredibly important to understand and predict quickly changing travel behaviours and drive home key safety messages.

Between March and June 2020, 38 million travel advice emails were sent to customers, 27,000 posters were installed, and over 500 stakeholders were engaged with.

In addition, our customer experience and operational teams planned, trialled and introduced new ways of working, one-way systems and queuing arrangements for all stations, and public information campaigns – with regularly updated advice - for staff and customers.

We also collaborated with major employers and businesses to ensure returning commuters and other customers travel off-peak to enable better social distancing and reduce pinch points.



In Focus: Sterilisation and Hygiene

Across our rail network, and indeed our entire public transport network, we have taken unprecedented steps to make our services cleaner than ever to ensure customers and staff experience safe, reliable and well-managed journeys and workplaces.

An inhouse team designed an enhanced cleaning regime in operation which uses hospital-grade cleaning substances that kill viruses and bacteria on contact and provides ongoing disinfection for up to 30 days. Key interchanges are cleaned more frequently, including during the day, and all regular 'touch point' areas, such as poles and doors, are wiped down with a strong disinfectant daily.

We are also trialling continuous UV cleaning of escalator handrails, and entire trains are also cleaned with a long-lasting anti-viral spray.

A thousand hand sanitiser points have been installed throughout the network, and partnership with Dettol will see a further 800 hand sanitiser dispensers installed in all 270 metro stations.

Public messaging with regards to hygiene via social media, new signage, posters and platform stickers has also been positively impactful, with mandatory face coverings for customers and staff, unless exempt, being widely taken up.

Investigations conducted as part of independent research by Imperial College, which studied several locations across the Underground, found them all to be free from coronavirus. We are now assessing what further research in this area might be useful in the future, and all this capability and experience is constantly evolving and improving with the everchanging impact of coronavirus in London.

In Focus: Contactless Ticketing

Recognising advances in technology and changes in consumer patterns, at TfL we realised the potential benefits of alternative payment methods early on. The Oyster card proved a resounding success, paving the way for the far more successful and detailed contactless system we use today.

At TfL, we have pioneered the use of contactless payments and as society moves towards becoming more and more cashless, especially with the onset of COVID-19, the use of contactless payments is set to only increase, and also provides a safer way for customers to pay for their journey.

In 2019 more than half of all journeys on London's transport network were made using contactless payment cards or mobile devices. Approximately 20% of all journeys are paid for using specifically mobile devices, such as phones or smart watches. Regular engagement with, for example, Apple Pay, Google Pay and Samsung Pay has resulted in further improvements to the customer experience and support the uptake of mobile payments.

Our contactless ticketing system automatically calculates the best value fare based on the customer's specific journey history and then charges them at the end of the day - ensuring customers always pay the best fare in the easiest and most convenient way. This means that customers could save money compared to existing tickets, plus customers using contactless also benefit from weekly capping.

Since its launch in 2014 more than 50 million different payment cards and mobile phones have been used on London's transport network.



The ease of payment is not limited to Londoners – cards and phones from more than 130 countries have been used, demonstrating how much easier it is for overseas visitors to navigate the public transport network.

The success of contactless in London is now leading to more world cities introducing the technology as a convenient method of paying for travel.

We have a partnership with Cubic Transportation Systems allowing them to adapt our contactless ticketing system worldwide. Since then, New York, Sydney, Miami and Boston have all announced that they plan to introduce contactless payments in the coming years.

Theme 4

Social Distancing and Inclusion

Social distancing to prevent the spread of the virus is a particular challenge in confined rail environments. In the UK, 1 metre plus has been the social distancing standard since June (2020); which can be difficult on rail. Inclusive, empowering solutions for staff and passengers around enabling this, and making safe decisions, are central to ensuring safe use and rebuilding public trust in rail.



Hive Logic Limited

Transporting containers involves a number of organisations including freight forwarders, deep sea and inland port operators, road hauliers and rail freight operators.

UK logistics lack integration to enable long journeys by rail and short journeys by road. Customers are faced with cost constraints combined with the unnecessary carbon footprint of road freight.



ecoloco® is a revolutionary, digital solution from HIVELOGIC Limited which integrates multimodal transportation. It transforms traditional logistics into a cost effective, eco-friendly solution offering huge efficiencies to purchasing departments. Trains for long journeys, lorries for final mile deliveries. Smart, container-based rail freight through inland ports with seamless onward road trips to consumers.

The ecoloco app will transform the UK freight logistics market into a digitally enabled, modern sector and support the decarbonisation of freight.



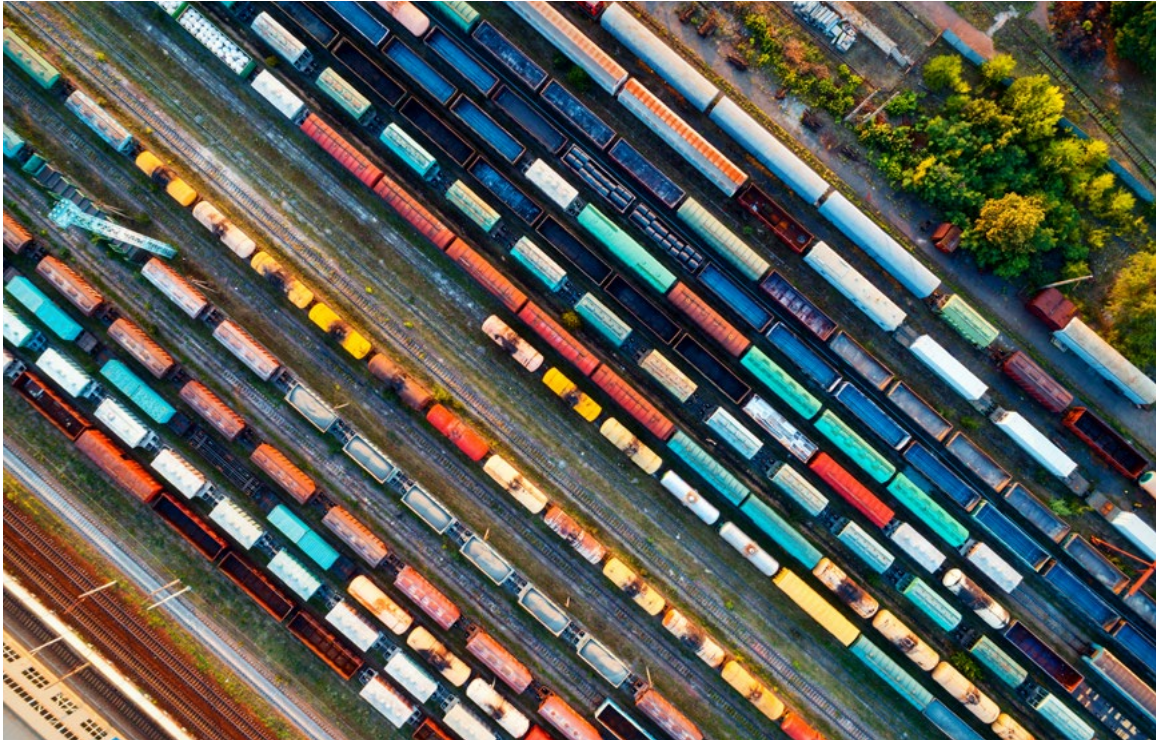
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In 2019 the UK government agreed to reduce all greenhouse gas emissions to net zero by 2050. Road transport is responsible for 20% of the UK's greenhouse gas. Action to decarbonise road transportation of people and freight is critical to meeting 2050 targets. Moving road freight onto the UK rail network will enable decarbonisation targets and reduce road congestion.

The UK imports 6,000,000 containers per year 90% of containers currently move on road (16% growth per year).

One freight train can move up to 60 containers, the equivalent of 60 HGVs. Existing rail capacity combined with new rail services from our seaports, will dramatically reduce greenhouse emissions and road congestion, whilst improving air quality and national productivity. Rail freight represents a 76% reduction in carbon over an equivalent HGV journey. Carbon reductions, improved customer service and reduced costs. Rail is an effective alternative to road.

The commercialisation of ecoloco will deliver a digital solution for UK freight operators, enabling a seamless integration between road and rail freight and reducing emissions and congestion. New technologies such as ecoloco will drive a greener, cost-effective and efficient future on our journey towards 2050.

The ecoloco business solution helps facilitate the increased logistics requirements as a consequence of COVID19 having pushed consumers to an exponential increase in online shopping. The ecoloco app helps facilitate cost effective transition from the road network onto rail networks making use of spare capacity on freight trains to provide an answer to this increased demand for distribution logistics. The ecoloco app enables direct access to rail freight capacity for freight-forwarders, all from a smart phone, tablet or pc. The app transforms what has been a traditional and elongated analogue logistics and distribution process into a seamless digital process with direct cost reductions and environmental benefits.

OpenSpace Group Limited

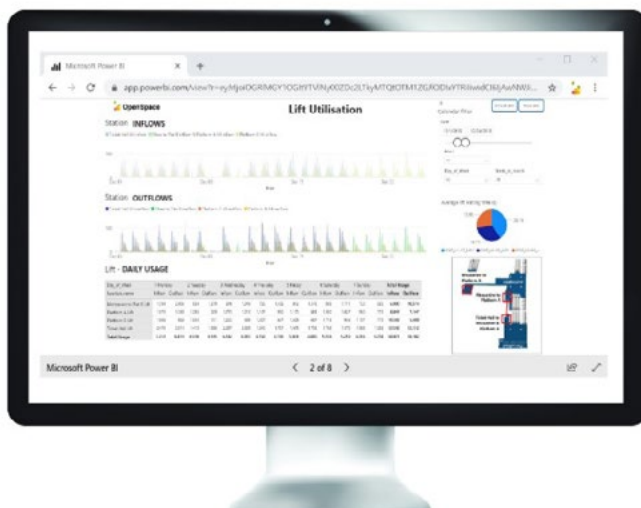
We build real-time cognitive digital twins for managing people-flow in mobility hubs and urban spaces.

We provide operators and designers with live passenger monitoring (including social distancing), next-level pedestrian simulation and AI-driven decision support through intuitive visualisations. Our solution helps operators manage social distancing and minimise the COVID19 transmission risk across the railway, as well as improve customer experience, enhance safety and reduce asset management costs.

Live COVID19 passenger monitoring and synthetic built-environments

With our technology, you can transform the physical built-environment into a synthetic world that comes alive with data:

- Capture real-time people movement and social distancing with computer vision technology
- Create a fully annotated 3D version of your station or airport in days not months
- Feed in and fuse disparate data sources e.g. train/bus/flight arrivals, Wifi analytics and gateline counts
- Next-level pedestrian simulation



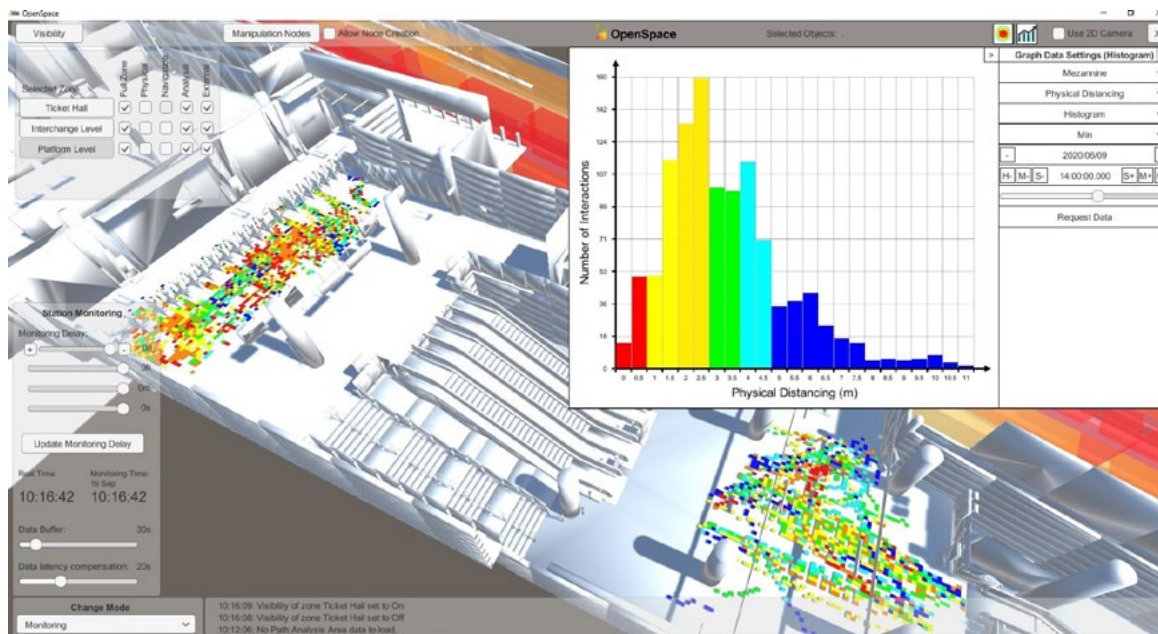
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Our pioneering fully validated solution is changing the science of people movement and leaps ahead of standard industry tools. We allow you to:

- Automate people movement surveys using computer vision technology
- Automate production of Origin-Destination matrices in real-time with AI
- Recalibrate simulations on the fly using millions of real-world data points
- Intelligence through intuitive data visualisations

Mobility hubs can be inefficient, unsafe and unenjoyable spaces to be in. Use the OpenSpace digital platform to remedy the situation with intelligent evidence-based crowd management via visualisations:

- Understand live, historical and future mobility hub performance
- Give stakeholders an immersive experience of your mobility hub with the latest VR technology
- Integrate easily with legacy systems and data

Block Dox Limited

PassengerCount™ is an innovative analytics platform that combines cutting edge sensors with data science to produce real time and predictive insights about passenger boarding/alighting; bus and train carriage occupancy and station/platform footfall as well as passenger density. All data is collected passively and anonymously.

In a post-COVID world, the main challenge facing transport operators is managing real-time and forecasting passenger demand whilst maintaining social distancing and ensuring the rail service is safe for commuters to use. With new social distancing and air quality measures being imposed, train operators have had to re-evaluate their current assumption-based approaches.

PassengerCount™ can be used on train carriages as well as on stations and railway platforms. Unlike existing technologies, PassengerCount™ includes several innovations:

- **Monitors air quality, temperature and social distancing**
- **Works in all light conditions including bright sunlight and complete darkness**
- **Unaffected by temperature (extreme cold/heat)**
- **Anonymous and passive**
- **Typical 99% accuracy**
- **Real-time & predictive analytics**
- **Interoperable with other systems via API**
- **Sabotage detection**
- **Ability to detect objects (luggage, bikes, pushchairs, wheelchairs)**

If you're looking for a solution to streamline your facility management operations, we've also got you covered!

Our state-of-the-art technology, BlockDox® helps you to manage your facilities more effectively. We can help rail operators across your back-office real estate and customer facing buildings understand space utilisation and optimise operational efficiency. Blockdox® is the smart building managers' intelligent choice.



Block Dox Limited

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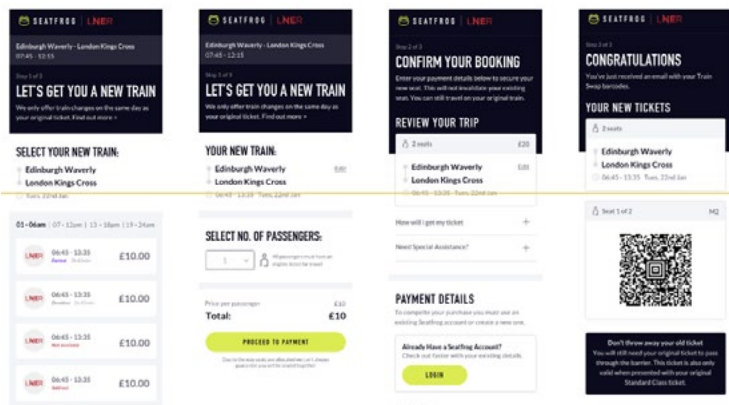
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Seatfrog

Seatfrog, the world's leading provider of upsell technology for rail companies is spearheading the way rail operators can facilitate flexible travel with their revolutionary new product, Train Swap.

Train Swap allows passengers to move their booking to an alternative service and rail companies to move passengers proactively, managing load across their network. Seatfrog's advanced machine learning balances pricing, availability and load, so that rail operators can charge a demand based fee and dynamically move passengers to alternative services when they need to. Passengers see greater value for money and a vastly improved experience compared to the traditional model. With the need for social distancing and capacity management this new product will digitalise both supply side and demand side levers.



With rail operators seeing a shift from 'normal travel', flexibility and comfort in these uncertain times is a top priority for most passengers; Train Swap allows rail operators to balance this with their own efforts to boost revenue and a return to volumes. Seatfrog's proprietary engine uses machine learning to forecast loads on each service alongside the cost of a new ticket, and then dynamically moderates the price of a swap to be higher on busy or more expensive trains, and lower on services which are less busy. Rail operators can also incentivise passengers to move to alternative trains, whether congested or disrupted, and offer a more comfortable experience on board, while boosting their bottom line with automation at scale.



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Esoterix

Flexible Rail Fares for the post-COVID World.

COVID-19 has accelerated the macro trend towards remote working. The once captive commuter needs enticing back to rail. Value for money and service level are key drivers. With growth not guaranteed, the industry needs to learn more about its passengers, what motivates and moves them, when and why.

Esoterix is developing a subscription season ticket that learns from and adapts to passenger choices. It is pre-paid and revenue safe; passengers are rewarded (points or rebate) at the end of the month based on the journeys they have (or have not) made.



With this comes the opportunity to influence travel choices to smooth network operations or, crucially during the pandemic, to meet public health objectives (e.g. encourage passengers to use quieter services).

Passengers enjoy total flexibility and personalised value. Operators receive optimised revenue for their objectives, insight into passenger choices and dynamic demand management.

This project scales a proof of concept trial designed in collaboration with Southeastern.

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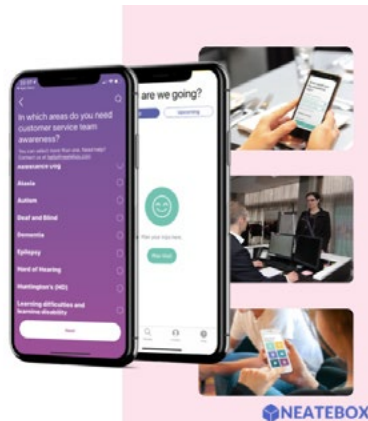
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Neatebox

Disabled people are becoming more and more mobile both alongside other travellers and increasingly independently and with this comes the obvious need to meet their diverse travel requirements both physically through adaptations and through face to face social interactions.

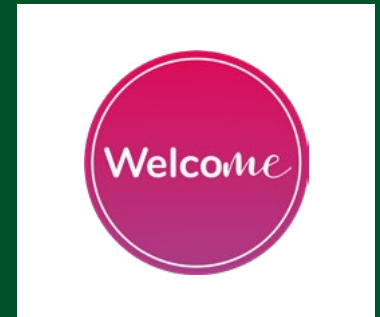
Ensuring that staff are aware of their responsibilities and providing them with the skills required to meet the needs of these passengers has always been challenging but with the advent of proximity aware, location recording technology it is now possible to envisage a future where every passenger receives exactly the support they need at the moment they need it in order to travel with confidence.

The WelcoMe Aboard Passenger Assist platform utilises smartphones location services to trigger notifications and the subsequent sharing of pertinent information amongst passenger assistance teams at the very moment it is required.



WelcoMe provides staff with general and specific information as well as ongoing disability awareness training and also increases confidence in the disabled traveller that their assistance needs will be met by knowledgeable and empathetic staff members. The system increases foundational relationships and builds confidence in disabled travellers whilst at the same time improving efficiency and dramatically reducing the possibility of negative interactions.

This innovative approach to passenger assist has been researched and trialled in the UK and is currently looking to build awareness and opportunities for proofs of concept around the world.



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Theme 5

Contactless Systems

Contactless travel greatly enhances the passenger experience; and in light of COVID-19, it also assists in streamlining journeys and reducing incidences of contact with ticketing infrastructure, therefore reducing the chance of viral transmission. It has also been a challenge for staff to check tickets, which has impacted revenue; systems to solve this are needed in both a safety and revenue context.



iProov Limited

Ticket and passport checks on railways and other means of transport have become much more challenging as a result of COVID-19.

Close proximity between staff and passengers has become undesirable, and indoor queues are to be avoided. Track and trace processes also require a more accurate knowledge of who is travelling – a ticket number is no longer sufficient to trace an individual who may have been exposed to infection.

For these reasons, iProov is leading the development of biometric passenger verification in the rail transport sector. A recently announced project with Eurostar, the UK's only international train operator, will deliver a complete solution to eliminate check-in procedures and exit border checks.

iProov's solution starts with the collection and checking of the passenger's personal identity at the time of ticket booking at home, or at any time up to departure. This simple yet highly secure self-service process, already proven in use by millions of people, ensures that personal document information is captured accurately, and that the passenger is indeed the rightful owner of the document. Kiosks at the station are available for those who have not enrolled beforehand.

When the passenger presents themselves, they collaborate to undergo a biometric face verification using a panel at the beginning of the entry corridor. If they are matched against a booked passenger, they can proceed without further ticket or passport checks to exit the national border.

The solution is integrated with the railway operator's ticketing system yet is designed for privacy to the highest standards. Whilst the biometric information is handled separately, the system gives the train operator visibility of true passenger identities for the first time.

With the collaboration of all the national authorities involved, this world-first solution can deliver contactless, fluid and fast transit of passengers from the station entry to the train itself. It's faster, easier and safer for passengers, and gives train operators a new capability to understand and safeguard their passengers.



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