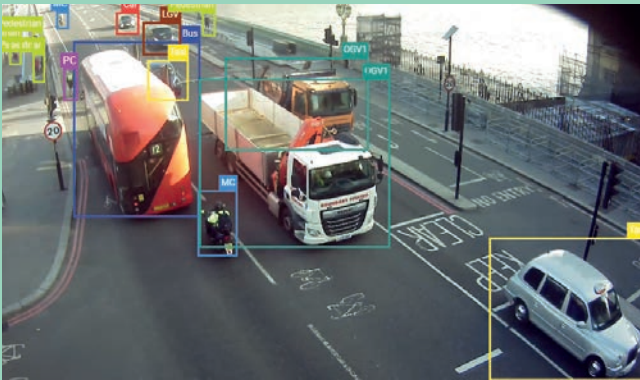


## R&D infrastructures case studies

### CASE STUDY

#### VIVACITY LABS: DEVELOPING AN AI TRAFFIC MANAGEMENT SYSTEM ON THE STREETS OF MILTON KEYNES AND MANCHESTER



Photos used with permission from Vivacity Labs

Vivacity Labs is a London-based startup that combines artificial intelligence (AI) and the Internet-of-Things to improve transport networks. With Innovate UK funding, it opened a first-of-a-kind manufacturing facility in Bletchley in 2017 to build, test and produce sensors. These sensors were then deployed in a real-world environment, across Milton Keynes, where they delivered up-to-the-minute city-wide transport data as well as a testbed for further AI development. Following this demonstration project, Vivacity Labs have won contracts with multiple clients both in the UK and internationally.

Its current focus is in developing an artificial intelligence traffic light optimisation system in a living lab in Manchester where they are now managing traffic lights in the real world and already demonstrating 30% reductions in traffic delays compared to existing systems. The company adapted its technology to help anonymously analyse social distancing behaviour for the Department for Transport in response to COVID-19.



### CASE STUDY

#### SIEMENS: LIVING LABS FOR THE INTEGRATED ENERGY SYSTEMS OF THE FUTURE



Photo © Tyseley Energy Park

Siemens is developing new technologies and services for future global distributed energy systems. Siemens has found that the use of living laboratories can offer opportunities to evaluate new business models, customer acceptance in real environments and accelerate their market introduction. Siemens has a number of collaborations across Europe, including: Aspern, Vienna; Project Triangulum in Manchester; and Project Ruggedised in Glasgow. More recently, Siemens has started to partner with several UK universities to test technologies across their campuses, facilities and student accommodation, while supporting them to reduce energy costs and carbon footprint. The data and learning from the projects are also being shared with the universities for use in teaching. Deploying the technology in different types of accommodation, new and old, that is representative of the housing stock is essential to developing a technology that can work globally.

## CASE STUDY

### ITM POWER: WORKING WITH REGULATORS TO SAFELY ROLL OUT NEW HYDROGEN REFUELLING STATIONS



Photo used with permission from ITM Power

ITM Power is a Sheffield-based company manufacturing electrolysers for enabling green hydrogen solutions, including fuel stations for zero emissions transport. ITM built its first prototype hydrogen refuelling station in 2007, and the first public facing station in 2014 with support from the UK government's Hydrogen Transport Fund.

ITM Power worked closely with local authorities, BCGA, the Energy Institute and Ofgem to develop a code of practice for deploying this new technology. With a proven roll out model, ITM Power has since built ten more public-facing stations in the UK, Europe and North America. The first station helped put them on the radar of Linde, a global engineering company that has since acquired a minority stake and established a joint venture to deploy large-scale electrolysers in industrial processes.

## Investment case studies

### CASE STUDY

#### **SPIRIT AEROSYSTEMS BELFAST (PREVIOUSLY BOMBARDIER): DEVELOPING AN AWARD-WINNING AIRCRAFT WING AND SUSTAINING HIGH-VALUE JOBS WITH LOAN AND GRANT SUPPORT FROM GOVERNMENT**



Photo used with permission from Spirit Aerosystems

In 2006, Bombardier saw an opportunity to develop the only purpose-built aircraft for the 100 to 150 seat market. The aircraft, which entered service in 2016, became the Airbus A220 in 2018. Bombardier Belfast developed the aircraft wing using advanced composites to reduce weight by 10% compared to a metallic wing and improve corrosion resistance for greater efficiency and easier maintenance. Bombardier secured a £100 million loan from the UK government and £20 million in grants from Invest NI and, in total, invested more than £520 million in the development of the new product. This included a purpose-built 600,000 square foot facility in Belfast to house wing production, from receipt of raw material right through to despatch of assembled product.

Spirit AeroSystems recently acquired Bombardier's Belfast operation to diversify and strengthen its portfolio, including the addition of the composite wing programme for the Airbus A220 aircraft family. Looking towards the recovery of the aviation industry following the impacts of the global pandemic, Spirit has long-term plans to expand its Belfast wing manufacturing and assembly facility to accommodate future ramp-up activity on the programme, which will support jobs both within Spirit and its supply chain.

### CASE STUDY

#### **CCm TECHNOLOGIES: GRANTS SUPPORTING THE DEVELOPMENT OF CARBON CAPTURE, UTILISATION AND RESOURCE OPTIMISATION TECHNOLOGY**



Photo used with permission from CCm Technology

CCm Technologies has developed a carbon utilisation technology – capturing carbon dioxide and waste streams to be converted into materials for use in fertilisers, plastics and energy storage. It started in 2012 and are now reaching scale-ready commercialisation. The development of the technology has been funded through Enterprise Investment Scheme equity and grants from the UK and Canada.

In 2020, CCm Technologies, in partnership with Severn Trent, won £1 million from BEIS and the Carbon Trust to develop a waste-water recycling process using captured CO<sub>2</sub> to stabilise nitrogen, phosphate and organic chemicals held within waste streams at Severn Trent, turning them into sustainable plant nutrients.

Access to grant funding has enabled CCm Technologies to develop the technology, tailor a product for interested customers and infill various aspects of the technology as it prepares to move to commercial contracts. Non-financial support from Innovate UK was also hugely valuable, with support to create exhaustive financial models and a four-minute video building credibility with large organisations and good communication of complex engineering solutions. In July 2020, CCm announced a commercial contract with Yorkshire Water to recovery nutrients, primarily ammonia and phosphorus, from effluent discharge.

## CASE STUDY

### **SURREY SATELLITE TECHNOLOGY LTD: BRINGING GOVERNMENT IN TO GRASP AN OPPORTUNITY WITH SMALL SATELLITES**



Photo © ISRO/Antrix

Surrey Satellite Technology Ltd (SSTL) identified a market opportunity for small satellites in Earth observation. It proposed a constellation of affordable microsatellites to provide timely images and information supporting disaster relief, not readily available from large satellites. The UK government agreed to support the project with funding to catalyse an international consortium across six countries to collaborate on building a constellation of six optical Earth observation microsatellites. Working with users to help define image specification for disaster relief was crucial, enabling SSTL to clarify key basic needs to bring the cost and size of the satellites down to something achievable while still delivering useful information. From idea to delivery in orbit took five years.

Commercially, the project was a huge success and allowed SSTL to build six satellites and receive export orders for the next generation satellites from the partner countries. It helped expand its market and build long term relationships with international partners, raising the visibility of the UK space community internationally.

## People case study

### CASE STUDY

#### VENTILATOR CHALLENGE UK: ASSEMBLING THE SKILLS TO DELIVER VENTILATORS TO THE NHS IN RECORD TIME

Following a call from the UK government to supply the NHS with ventilators in March 2020, Dick Elsy FREng, Chief Executive of the High Value Manufacturing Catapult, assembled a consortium of 33 significant UK industrial, technology and engineering businesses. The consortium brought together expertise from across the aerospace, automotive, motorsport and medical sectors and the wide range of skills needed to deliver the endeavour, including:

- Smiths and Penlon, the two medical device manufacturers at the heart of the consortium. The Ventilator Challenge UK consortium scaled-up the Penlon ESO2 Emergency Ventilator device, which modified proven clinical equipment, and the Smiths paraPAC Plus™. Both businesses brought expertise in the ventilator design space and an understanding of the clinicians' and regulators' requirements.
- Airbus in Broughton, Ford in Dagenham, GKN Aerospace in Luton and Cowes, McLaren in Woking, Rolls-Royce in Filton and STI in Hook, Smiths Medical in Luton and Penlon in Abingdon adapted manufacturing facilities and trained staff to produce and assemble the ventilators at speed.
- Siemens Healthineers supported the project with medical engineering and regulatory expertise to gain rapid MHRA regulatory approval.
- Siemens provided digital design skills and technology, including the use of digital twins for rapid problem-solving to deliver the project at speed.
- UK-based Formula 1 teams brought a rapid engineering problem-solving capability and culture to drive the pace of the project.

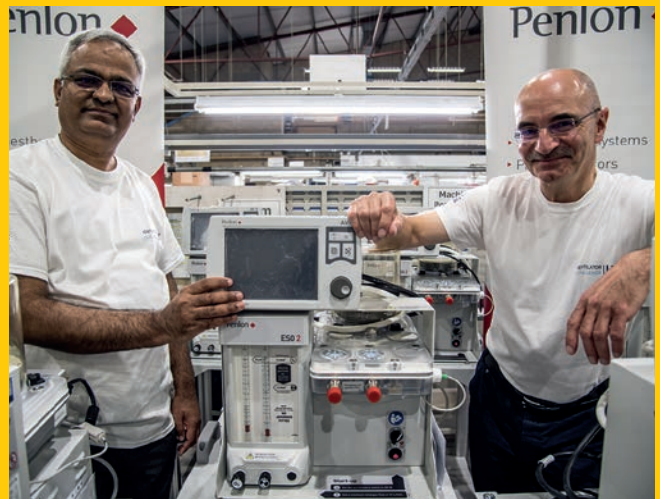


Photo © thisisjude.uk 2020

- Accenture was responsible for accountancy across the collaboration. A cloud network was built and used to track the progress of parts through the supply chain and manufacturing facilities.
- DHL supported project by setting up a complex logistics network that saw them implement an end-to-end supply chain in only 1.5 weeks. Despite global competition for parts and lockdown challenges during the pandemic, the supply chains of the different organisations also became key to delivering parts across the consortium. The consortium sourced parts from more than 22 countries, with the furthest distance travelled by a single part being 5,226 miles.
- Microsoft HoloLens mixed reality headsets were used to capture the highly specialised ventilator production process to train and upskill the consortium's new 3,000+ workforce in multiple manufacturing sites across the UK and to aid in adhering to social distancing guidelines.

The Ventilator Challenge UK consortium delivered 13,437 ventilators to the NHS by July 2020, reaching a peak production of 400 ventilators a day.

## Partnerships case studies

### CASE STUDY

#### **DARKTRACE: CUSTOMERS WITH AN APPETITE FOR INNOVATION TO DEMONSTRATE NEW AI PRODUCTS**



Photo © Jonathan Browning

Darktrace has developed pioneering, autonomous machine learning software designed to detect and defend against cybersecurity threats. One recent product, Antigena Email, was developed over 18 months by a team of 20: prototyping the algorithms and then engineering a robust, secure and scalable product packaged in a well-designed user interface. Darktrace has a cohort of 'early adopter' customers central to the development of its products. These customers are willing to provide a real-world environment for Darktrace to roll out its products, try out the solutions that have been developed and fix emerging problems. The R&D costs at Darktrace amount predominantly to staff salaries and are financed through revenue, R&D tax credits and external investors.

### CASE STUDY

#### **PROJECT ESCAPE: BUILDING A UK SUPPLY CHAIN FOR ELECTRIC CAR COMPONENTS TO COMPETE IN A GROWING MARKET**

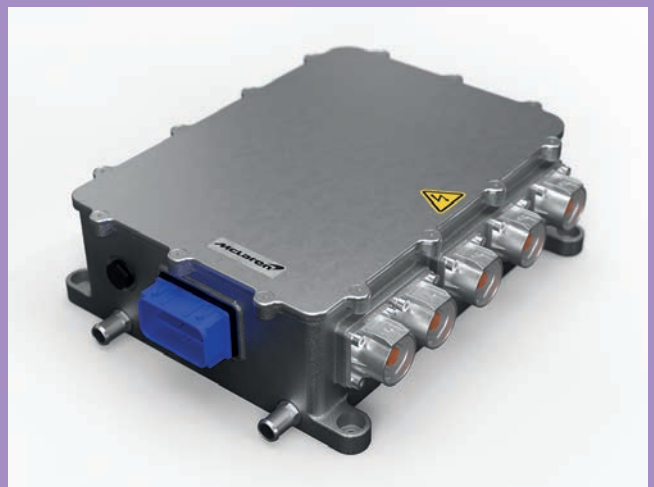


Photo used with permission from McLaren Applied Technologies

McLaren Applied are leading project ESCAPE to develop an end-to-end supply chain for automotive power electronics. The automotive sector is moving to electric cars, introducing new materials into its systems for improved performance. Silicon carbide is one such material, offering significant benefits compared to existing silicon components.

There is an opportunity to develop a UK supply chain in a globally growing market, and provide UK companies with easier access to material to their requirements. Project ESCAPE brings together organisations from semiconductor manufacturing, electronic production and packaging and McLaren as the end user to build a UK supply chain able to supply to McLaren's needs and compete globally.

McLaren has two future products based on this project, providing certainty to future resourcing. The project brings together £25 million investment, including £9.8 million in grants from the Advanced Propulsion Centre.

## CASE STUDY

### UNIPART MANUFACTURING INVEST IN LATE-STAGE R&D THROUGH JOINT VENTURE WITH COVENTRY UNIVERSITY TO ACCELERATE GROWTH



Photo used with permission from Unipart Manufacturing

Unipart Manufacturing recognises the importance of investing in new skills and capabilities at the same time as investing in existing business as crucial for future growth and success. Doubling up on investment, in times of financial crisis, is an almost impossible task.

Drawing on technology roadmaps, company strengths and industry knowledge, Unipart Manufacturing approached Coventry University

with a clear vision for collaboration with industry and academia, opening up funding avenues and attracting customer interest in the latest technological innovations to strengthen its approach to late-stage R&D.

Out of this collaborative relationship, a pioneering joint venture was born: the [Institute for Advanced Manufacturing and Engineering \(AME\)](#).

Co-located on one of Unipart Manufacturing's sites, AME creates a talent pipeline of graduate engineers, provides a facility for developing new manufacturing processes and products to support the customer base. It is where new customers start their journey with Unipart Manufacturing. To make the collaboration financially viable, research projects with a customer pull or contract are prioritised and where grant funding can be secured. This funding boost leads to jobs created and further benefits the UK economy by demonstrating the UK as serious leaders in R&D technologies. The approach has driven a culture of collaboration with not just Coventry University, but with suppliers, customers, technology partners and funding bodies.

AME provides a unique blend of business and academia ensuring Unipart Manufacturing's late-stage R&D is financially viable and has resulted in £250 million in new business, including the launch of Hyperbat, a significant new entrant into the manufacture and assembly of high-voltage battery systems.

## CASE STUDY

### QINETIQ: TESTING AN AUTONOMOUS LAND VEHICLE IN LIVE EXERCISES WITH THE BRITISH ARMY



Photo © Ministry of Defence

QinetiQ is developing an autonomous uncrewed ground vehicle (UGV). Through a Defence and Security Accelerator programme launched in 2017, it was able to take its prototype into a live experiment with the British Army. The development team was on-hand to implement changes based on feedback coming in during the live exercises. This iterative feedback loop was described as invaluable to product development and an important part of co-creation between the users and engineers. The UGV is designed to deliver supplies across challenging terrain, working in concert with an uncrewed air system (UAS) and the controlling software, with applications in several different situations, including civil applications such as disaster relief. The Defence Science and Technology Laboratory awarded a contract to QinetiQ for its first fleet of autonomous UGVs in March 2020.



## Market environment case study

### CASE STUDY

#### **BAE SYSTEMS: COMMERCIALISING A DISRUPTIVE INNOVATIVE PRODUCT WITH OPPORTUNITIES ACROSS DIFFERENT MARKETS**

BAE Systems operates in a highly competitive sector: defence. As such they drive forward R&D, for example an optical technology that enables a viewer to see an image projected into their eyes whilst still being able to see the actual backdrop meaning a pilot can see critical information while flying, a driver can be shown data while driving or a soldier can see vital stats on the battlefield.

In 2005, BAE Systems licenced on an early-stage technology from a University of Cambridge University spin-out before developing its own technology in this field. It then took 10 years to develop the technology to a prototype stage where it could be

shown to customers to bring them on board. The first commercial product, for the defence market, was a head-up display, 50% lighter, brighter and more capable of handling information than existing technology. It was then developed further into augmented reality glasses to be used across a range of military and commercial markets and generate new demand back into the defence sector. As a result of BAE Systems continuous incremental investment of over £15 million over 15 years there is now significant potential for the technology in multiple markets. However, the late-stage investment to adapt and tailor the core technology to each new market can be significant. This naturally restricts BAE Systems' ability to maximise the full market potential when balancing overlapping investment requirements against shareholder expectations of business returns in the near term.



Photos used with permission from BAE Systems