

Digital roads among eight new Prosperity Partnerships

Digital roads that can report when they need to be repaired and Artificial Intelligence (AI) air traffic control systems are among the revolutionary new technologies being developed through eight new projects announced today.

The business-led Prosperity Partnerships are announced today in support of the government's ambitious new Innovation Strategy.

They are supported with an investment of almost £60 million by the Engineering and Physical Sciences Research Council (EPSRC), part of UK Research and Innovation (UKRI), businesses and universities.

They include a partnership between construction and engineering company Costain, Highways England and the University of Cambridge to develop 'digital roads' which can report when repair work is needed.

Using a digital twinning system which visualizes the road and its condition, it would allow highways agencies and councils to identify when repair work is needed with roads able to repair themselves using self-healing materials.

This would negate the need for laborious and costly on-site inspections, prevent unnecessary delays to motorists as a result of road works, and reduce the emissions generated by roadworks.

P&G, Durham University and Imperial College London aim to develop the tools needed to accelerate sustainable alternatives to everyday household products, such as laundry detergents and household cleaners, needed to help the UK achieve Net Zero by 2050.

And NATS and The Alan Turing Institute also aim to use digital twinning to create the world's first AI system to control airspace in live trials, working with human air traffic controllers to help manage the complexities of their role.

UKRI's Engineering and Physical Sciences Research Council (EPSRC) is investing £19 million in the projects through its long-running Prosperity Partnerships initiative.

Industry and university partners are investing a further £40 million.

Prosperity Partnerships build on existing UK strengths in industry and academia to develop new technologies, processes, and skills that will deliver economic growth and create jobs across the UK.

EPSRC Executive Chair Professor Dame Lynn Gladden said:

“Artificial intelligence, digital chemistry and digital twins are some of the new and transformative technologies that will help to drive the Net Zero revolution, address major societal challenges, and deliver prosperity to the UK.

“By bringing together UK businesses and universities, these new Prosperity Partnerships will generate the knowledge and innovations that will enable these cutting-edge technologies to realise their transformative potential across a diverse range of sectors.”

The new Prosperity Partnerships announced today bring the total number of partnerships launched by EPSRC to 47 with a total investment of £335 million.

That includes £125.2 million from EPSRC and £3.6 million from the Biotechnology and Biological Science Research Council, also part of UKRI, £167 million from industry partners and £39.2 million from universities.

Project summaries

Costain, Highways England, and the University of Cambridge

The partnership aims to develop “digital roads” utilising digital twins, smart materials, data science, and robotic monitoring to create connected physical and digital products and associated processes that can improve the cost, time, quality, safety, sustainability, and resilience performance of expressways. The resulting system will use self-sensing and self-healing materials on and off the road surface to inform the road’s digital twin through robotic monitoring. These in turn, along with other data, will inform the data-science enabled digital processes in making better design, construction, maintenance and operation predictions, and back. This will allow proactive, robotic interventions and road maintenance schemes that are more sustainable through the smarter use of resources.

NATS and The Alan Turing Institute

The partnership aims to develop the science needed to deliver the world’s first AI system to control airspace in live trials. These new tools would utilise digital twinning and machine learning to work in harmony with human air traffic controllers and help them to manage the complexities of air traffic control. Such tools will become more important with growing use of uncrewed aircraft and airspace playing a crucial role in delivering aviation’s commitment to net zero emissions by 2050.

bp, Cardiff University, Johnson Matthey and The University of Manchester

Catalysis is the process of speeding up a chemical reaction by use of a substance known as catalyst, and it is vital to a wide range of technologies and processes. It underpins the production of advanced fuels, the removal of local pollutants in car

exhausts, and the manufacture of materials vital to modern life, among other applications. Catalysts are estimated to be used in the manufacture of more than 80% of the materials around us, accounting for more than 20% of UK GDP, and have been honed over decades to work with fossil fuel resources. This partnership will develop new catalysts to help the UK move to a sustainable, low carbon, net zero future. These new catalysts will be inspired by nature and will convert sustainable biomass, waste, and carbon dioxide into valuable products such as fuels and lubricants, delivering major economic benefits as well as reducing carbon emissions.

SeeByte and Heriot-Watt University

Many potentially dangerous jobs in harsh and extreme environments, such as inspection, repair and maintenance offshore, are still carried out by human workers. The partnership aims to help a variety of sectors to transition to the use of teams of smart robots to carry out these roles instead, working closely with human operators and experts on-shore. Using cutting edge robotics and AI technologies, researchers aim to develop the robust methods (such as manned-unmanned teaming, explainable AI, robot scene understanding and joint decision-making) needed for humans to collaborate with autonomous systems, so as to have them operate effectively and safely in hazardous and unpredictable environments.

Element Six and University of Warwick

Diamond is the epitome of a multi-functional material with applications in thermal management, optical transmission, electrochemistry, and quantum technologies. Engineered synthetic diamonds offer an extraordinary combination of extreme properties and are capable of meeting the needs of the most demanding of applications in these diverse fields. The partnership aims to build on the UK's world-leading role in diamond growth and exploitation to develop diamond solutions in areas where conventional materials are increasingly unable to meet the performance levels required by new technologies. We will establish a UK diamond technology supply chain which will help researchers and businesses to capitalise on the potential of high quality, tailor-made synthetic diamonds to develop next-generation solutions to real-world challenges.

P&G, Durham University and Imperial College London

Consumers recognise that everyday responsible consumption is essential to solve some of the most complex global challenges across water scarcity, energy consumption & decarbonisation – but are not willing to compromise the performance of their household products for living sustainably. P&G, Durham and Imperial College will take on the challenge to develop new, breakthrough scientific tools revealing how to re-

invent the performance of everyday products such as laundry detergents and household cleaners to address these complex challenges. This suite of experimental and theoretical tools, spanning component mechanisms, kinetics and surface interactions, will accelerate development of sustainable alternatives to current products and household tasks, helping the UK to achieve Net Zero by 2050.

HSBC and The Alan Turing Institute

AI technologies have the potential to unlock significant growth for the UK financial services sector through novel personalised products and services, improved cost-efficiency, increased consumer confidence, and more effective management of financial, systemic, and security risks. The partnership aims to develop the trustworthy, data-driven AI decision-making approaches that are needed for the wider adoption of these technologies. It aims to address challenges such as how to increase the accuracy of predictive models without threatening fair treatment of all customers or improving transparency without leaving systems open to external threats. It aims to outline how the finance sector can make the transformational shift to the greater use of AI technologies and ensure that these technologies have fairness, security and accountability at their heart, while being robust and aware of privacy.

Mitsubishi Chemical UK, the University of Nottingham and the University of St Andrews

Acrylic polymers are durable and versatile synthetic materials with a wide range of uses, from vehicle components and substitutes for glass, to paints, coatings and medical products. The partnership will harness the UK's technical and manufacturing leadership to decarbonise this industry by increasing sustainability and reducing waste. This will allow the UK to seize the growing opportunity presented by the global acrylics market, with the market provided by PMMA, one form of acrylic, estimated to exceed \$8 billion by 2025.