Results of Competition: Robotics For a Resilient Future R&D

Competition Code: 2010_ISCF_CRD_AIDE_ROBOTICS_RESILIENT_FUTURE

Total available funding is £7,100,000 over 2 streams

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

Participant organisation names	Project title	Proposed project costs	Proposed project grant
EUROVIA INFRASTRUCTURE LIMITED	The Distributed Automated Cutting System project (DACS)	£99,504	£49,752
LOOP TECHNOLOGY LIMITED		£248,970	£174,279
University of Sheffield		£149,000	£149,000

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Paving works in developments and town-centres typically last from several months to a few years and are disruptive to local businesses and the general public. Cutting slabs with circular saws is noisy and dangerous, as blades can shatter and impinge on the public environment. It also produces a significant amount of waste-water/slurry. Operators can suffer manual handling injuries and injuries linked to continuous use of vibrating equipment. Local businesses see a reduction in footfall during paving projects and can lose business, whilst councils are often forced to reduce rates and pay compensation. Moving the cutting operations off-site would be of significant benefit to all stakeholders. The distributed, automated cutting system (DACS) will deliver a dedicated paving slab robotic cutting cell within a factory environment and will produce bespoke slabs within a 24/36-hour turnaround time, minimising on-site disruption. Key objectives are: * Improving paving productivity by 40-50% which will reduce the overall infrastructure project time by 7%; * Improving safety of the site and surrounding areas; * Reducing cutting noise near operators from 105db (typical saw) to 85 dB (safe limit) and removing such noise from the public sphere entirely; * Preventing operator exposure to hand-arm vibration syndrome and carpal tunnel syndrome caused by use of vibrating machinery; * Reducing waste from 10% of stone ordered to 3%, equivalent to 700 sqm, 280 pallets or 16 articulated lorry-loads for a typical retail contract; * Delivering cut-to-shape stone within 24-36 hours.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CREATE TECHNOLOGIES LIMITED	AutoInspect	£318,896	£223,227
University of Oxford		£133,477	£133,477

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Project description - provided by applicants
Createc and the Oxford Robotics Institute are collaborating to develop an autonomous industrial inspection solution. This will combine a sensor payload that allows accurate visual, auditory and thermal measurements and a navigation framework that allows repeatable accuracy for data with high precision. This comes in a package that can be easily used with any mobile robot system, while the current configuration is tailored for the needs of the Energy/Oil&Gas industrial facilities.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
OFFSHORE SURVIVAL SYSTEMS LIMITED	SAR Box: Developing AI to enable unmanned search and rescue	£405,440	£283,808
DU PRE MARINE LTD		£5,102	£3,571
EVEROZE PARTNERS LIMITED		£2,674	£0
OFFSHORE RENEWABLE ENERGY CATAPULT		£73,368	£73,368
ORSTED POWER (UK) LIMITED		£5,172	£0
SAVIOUR MEDICAL LTD		£3,600	£2,520

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Project description - provided by applicants
Saving lives at sea is time critical, North Sea temperatures average 10.5°C where unprotected casualties have less than 30 minutes before swim failure and death. More people than ever are working offshore due to the continued development of offshore wind (OW), oil and gas (O&G) decommissioning and commercial shipping. OW projects are moving further from shore where wind speeds and wave heights increase. Average distance to shore of farms under construction in 2019 was 59km, up from 35km in 2018\. This will increase over the next decade, forcing operators to rethink onsite SAR provision OSS are developing the world's first remotely operated Search and Rescue (SAR) service to keep offshore workers safe, keep rescuers out of harm's way and support the ever-growing blue economy. The service requires a network of semi-autonomous Unmanned Rescue Vessels (URV's), ready to rapidly deploy in case of an emergency. Reducing emergency response times to save lives at sea whilst reducing the requirement put people at unnecessary risk. The system will use SARbox (sensors and machine learning / AI developed in this project) to identify and actively track casualties drifting in the water enabling the URV to navigate to them and position for recovery. Thereby taking the search out of search and rescue. The overall objective is to enable unmanned SAR. This requires the development of a sensor array combined with AI/Machine learning to identify and track casualties in the water, supporting the navigation of the URV to perform casualty recovery. This will form the SARbox system and this project will take SARbox from TRL2-5\.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
WESTFIELD SPORTS CARS LIMITED	RICHE - Robots In Controlled Healthcare Environments	£349,631	£244,742
Cranfield University		£53,697	£53,697
University Hospitals Birmingham NHS Foundation Trust		£90,672	£90,672

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Westfield Technology Group will be leading an innovative project in collaboration with University Hospitals Birmingham NHS Foundation Trust and Cranfield University to demonstrate the application of cutting-edge driverless electric mini pod logistics, with temperature controlled lockers, linking into an existing robotic pharmacy. The project will be testing a prototype interchangeable ("hot swap") temperature controlled locker system for fast deployment, within which medication will be securely transported. A "one-to-many" delivery concept will be trialed, whereby multiple orders will be delivered to a single location, eradicating the need for additional delivery and / or collection related journeys, providing an innovative way for members of the public/departments to receive goods, and in doing so conglomerating orders, targeting the reduction of vehicle miles between sites, related carbon emissions, allowing staff to be better deployed for direct care and reducing lead-time for patients. The lockers will be loaded onto the mini pod by the pharmacy robot, with the mini pod then completing the defined routes. The mini pod will remain on site for an extended period of time so as to allow maximum flexibility for staff/public to collect at their convenience within a pre-booked window, to coincide with their departure from site or visits to the wards. A complete chilled locker system will be manufactured for the mini pod integrating both facial recognition and QR code technology to provide locker access. To complement this, a supporting app will be created to provide information on locker location, delivery time, shopping top-ups and interactive messaging, to provide maximum flexibility to the consumer and staff. In addition, a supporting operator app will be created to provide information on locker location, delivery time, state of charge, on-board temperatures, remote locker override, mini pod and system errors. Finally, through working alongside Cranfield University, the project will be fully integrated with their existing mechanical and software engineering faculties to provide hands-on experience in product development, as well as creation of new courses for IOT technology.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CLOGWORKS TECHNOLOGIES LIMITED	Holistic Principal Tunnel-Sewer Survey System (HS3) using Unmanned Aerial vehicle and Artificial Intelligence+Big Data	£164,959	£115,471
INTENTTECH LIMITED		£142,850	£99,995
SEWER SURVEYS UK LIMITED		£71,974	£50,382
UNIVERSITY OF HERTFORDSHIRE HIGHER EDUCATION CORPORATION		£120,000	£120,000

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The survey process of deep principal tunnel-sewers is very tedious, needing sewerage regulation entity be disconnected for 2-months for crucial airing and intercommunication network setup, and survey done by 3-squads for 0.5months (assuming a 4-mile long tunnel), expending 2.5 months in total and over half a million pounds in costs. The environment is also particularly unsafe; it has rodents and other disease-carrying animals and carries harmful solids and chemicals even after airing. More recently, they have been found to contain traces of Corona virus (BBC 2020). All these make it difficult to conduct the required multiple survey annually of each, causing intermittent collapse, blockages, and particularly incessant leaks and associated pollution episodes. Pollution episodes from leaks are big and frequent because there are over 3,500 deep principal tunnel-sewers, to which the over 400,000 miles of sewers are connected to, and from which sewage is transported to treatment stations. The leaks have led to pollution of more than 50% of UK rivers and rising (Environment Agency, 2018). The penalty fee for such leaks are usually huge and hard hitting on revenue, causing tunnel owners to be desperate for alternative survey methods. A popular case is that of Thames Water that was given a £20 million penalty significant and avoidable pollution episodes on the River Thames in 2017 (Environment Agency, 2017). Avoidance comes mainly through frequent surveys that begets quick intervention. Thus, an unmet market need exists for a highly productive (quicker, cheaper and safer) survey system that will engender frequent tunnel-sewers surveys. This project will thus develop a holistic Tunnel-sewer survey system (HS3) that includes a tunnel survey-specific unmanned aerial vehicle (T-suv) and artificial intelligence classification models (AI-CM) that will analyse T-suv's videos for fault-classification and survey reports production. At 2-miles per hour T-suv will produce survey videos of a typical Tunnel-sewer system of circa 4-miles length in 2 hours. HS3's AI-CM will analyse the generated survey videos and produce fault reports in circa 30 minutes.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DIGITAL & FUTURE TECHNOLOGIES LIMITED	APLAUSE - Automated Precision Loading And Unloading System Environment	£299,201	£209,441
MIRALIS DATA LIMITED		£79,200	£55,440

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The APLAUSE project focuses on the emerging UAV drone delivery market. The project looks to build on our engineering works to support Unmanned Air Vehicles during the COVID-19 pandemic for the NHS. We have been working with the NHS, flying UAV's carrying COVID-19 samples, PPE and other biological agents between pathology labs and hospitals. APLAUSE takes these works and looks to build automated loading and unloading systems for UAV's, providing a new man to machine interface. UAV's are inherently dangerous. At the moment they are manually flown by pilots at each end of the flight. Landing is a manual operation and the loading/unloading phase only happens when pilot calls out that all is clear. This is a commitment the pilot has to do as detailed in their operations manual as approved by the CAA. Our vision for the project it to take the learnings from our previous endeavours working with our partners within the NHS and create and automated loading and unloading system for UAV's that will stand the test of time and allow us to work with the CAA as they move from manual control of UAV's through to automatic, where one pilot flies the UAV remotely all the way and then on to autonomous mode where one pilot is overseeing 15 UAV's in flight at any one time. Our key objectives are to build a working demonstrator system, funded with help from the public purse, that enables us to demonstrate how a UAV may unload and load new cargo, whilst operating within a closed aviation environment. By doing this we will be propelling the UK forward as a country with innovative solutions for the UAV industry with a focus on parcel delivery solutions. Our main area of focus is on the loading and unloading of goods and power sources on to UAV's to enable remote operated parcel delivery flights to be fully automated. We need to create a safe environment to automate the loading and unloading of UAV's that complies to aviation and commercial needs and regulations. APLAUSE is innovative as it builds on our initial UAV flights, made under COVID-19, utilises the opportunity that the CAA has afforded us,with regards flying in a pandemic, and takes a significant step forward for the UK UAV and robotics industries alike, building a solution that can be adapted to changes in UAV airframe and commercial context alike.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MOBOTICS LIMITED	Robust Automated Discovery (RAD)	£319,085	£223,360
CENTRE FOR PROCESS INNOVATION LIMITED		£74,721	£74,721
JOHNSON MATTHEY PLC		£59,795	£29,898

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Project description - provided by applicants
In some respects, laboratory work has changed little from the lab benches of the 1800s; certainly, the image of laboratories packed with scientists in white coats still holds today. As for many industries, the emergence of COVID-19 has had a major effect on research-intensive industries, and we need to mitigate for this in the future. In 2020, researchers at the University of Liverpool developed a new technology: a mobile robotic chemist that is able to work by itself, 24 hours a day, making decisions about which experiments to do next using artificial intelligence (see BBC News feature, June 2020). Based on this technology, a new spin-out company, Mobotics, was formed. In this project, Mobotics will partner with Johnson Matthey, a UK science and chemicals company, and global leader in sustainability, along with ABB Robotics and the Centre for Process Innovation. By combining their skills in chemistry, robotics, software, and artificial intelligence, this multidisciplinary team will create a resilient solution that will allow companies in the future to operate their research remotely, even in periods of lockdown or social distancing. We will also demonstrate the concept of a "backup lab" -- that is, a mirrored robotic facility in another site that can be controlled securely over the internet. This will allow companies to be more resilient to disruption in the future, not only related to COVID-19 or other diseases, but also in terms of problems with supply chain, infrastructure, or 'spikes' in demand. This programme builds on areas of core UK strength where we hold an international lead and will catapult this new technology into a range of sectors, including pharmaceuticals, home and personal care products, and clean energy (e.g., new battery materials). Societal benefits will include greater flexibility for staff and the ability of researchers to work from home where needed. Longer term, this technology also has the potential to make research more inclusive -- for example, for people with disabilities who might not be able to work within a more conventional laboratory environment.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MOTION ROBOTICS LIMITED	OSPREH: Optimising Speed, Productivity, Resilience and Efficiency in Healthcare	£157,970	£110,579
APIAN LIMITED		£122,102	£85,471

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
OSPREH stands for **O**ptimising **S**peed, **P**roductivity, **R**esilience and **E**fficiency in **H**ealthcare The NHS is a non homogenous organisation that must interface with external pharmaceutical, supplies and testing laboratories. The sharing of resources between hospitals and optimised, rapid, reliable and prioritised interfacing with external suppliers and service providers could increase the resilience of the system when faced with the sudden impact of a dramatic event. Typical cases include the sharing of PPE stocks, the laboratory testing of blood pathology and the urgent supply of cancer treatments to hospitals unable to make the cytotoxic drugs locally. In each of these cases we can show that the NHS is not resilient, lacking speed of service, reliability and efficient productivity. OSPREH's vision is to apply state of the art aerial drones in combination with robotics and AI methods to speed up the interconnect between different hospitals and external bodies. Key to this vision is the development and evaluation of ergonomic SMART drone pad control centres, highly automated to deal with drone transport; specifically addressing in bound outbound flight safety and security, drone maintenance, drone garaging, as well as origin and endpoint parcel/item handling. In addition to this, OSPREH will perform SMART tracking of items (assigning priority and deadlines), the AI providing recommendations coordinating both drone logistics and hospital work flow.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
HAUSBOTS LIMITED	HausBots - Wall Climbing, Damp Proofing and Paint Applicator Robot	£282,650	£197,855
SAFEGUARD EUROPE LIMITED		£30,311	£21,218

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
HausBots Limited, a Birmingham based SME is focused on developing transformative wall-climbing, paint applicator technology, that disrupts project delivery within the painting, decorating and damp proofing industries. Painting is the 5th most dangerous job in the UK, with Painters at risk of falling from height and experiencing health conditions, including repetitive strain injury and contact dermatitis as well as long term exposure to hazardous materials. With application methods barely changed since paint was invented, painting is time consuming, labour intensive and dependant on height access equipment. HausBots will change this, with their robots significantly de-risking paint and damp proofing application, disrupting the industry through safer, cost effective methods. This project accelerates the development of their world-first solution, exploring hardware and software enhancements covering precision painting to deliver safety, productivity and financial advantages to Painters, Contractors and Clients.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
GRIMME (U.K.) LIMITED	Automation harvesting of whole-head iceberg lettuce.	£207,968	£124,781
AGRI-EPI CENTRE LIMITED		£27,140	£27,140
IDS IMAGING DEVELOPMENT SYSTEMS LIMITED		£6,237	£4,366
P D M PRODUCE (U.K.) LIMITED		£24,943	£12,472
SALADS HARVESTING SERVICES LIMITED		£22,167	£13,300
University of the West of England		£66,159	£66,159

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Project description - provided by applicants
The horticulture sector is heavily reliant on access to seasonal labour for many field operations, including harvest. Movement restrictions because of Covid-19, post-Brexit uncertainty, competition from other sectors, and the lack of suitable UK-based labour have driven growers to seek investments in labour-replacing technologies. 99,000 tonnes of lettuce were harvested by seasonal workers in the UK in 2019 with a farm gate value of £178 million (Defra BHS, 2020), UK's highest value field vegetable crop. This project has identified an opportunity to automate the process, and reduce the reliance on seasonal labour, by developing an innovative robotic solution. * We intend to adapt existing mechanical capability and lift the lettuce clear of the ground by discs and then gripping the stem with pinch belts. * The lettuce will then be presented to camera sensors that will direct an air blast which will blow the outer wrapper leaves of the lettuce head clear to expose the stem. * Machine vision via deep segmentation will then be deployed using a second camera sensor to train a deep learning model to identify the precise location to be cut. The three separate developments will be combined to form a prototype for field trials towards the end of the 2021 UK season. Engagement with end-users has confirmed their need and willingness to be part of the development of such a machine. Early indications are that harvesting costs could be reduced by around £5,000 per hectare per annum. 123,000ha of lettuce and chicory was grown in the EU in 2018 (FaoStat, 2020) with similar areas in the USA. These areas have similar issues to the UK with access to seasonal labour, therefore the potential market for such an innovative machine is extensive.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Q-BOT LIMITED	GrowBot - Eversion robot for the construction sector	£349,147	£244,403
Queen Mary University of London		£149,549	£149,549

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Q-Bot is replacing centuries-old construction techniques with smart processes that make it easier for contractors to inspect, maintain and upgrade buildings. Q-Bot's solutions combine robotics, 3D scanning, digital tools and AI, enabling contractors to: * identify the needs of each property; * automate repetitive tasks; * reach inaccessible areas; * track the work done; and, * seamlessly share information. These state-of-the-art tools allow fuel poverty and carbon emissions to be reduced simultaneously and cost effectively. In Northern Europe there are 20m homes with uninsulated suspended floors and Q-Bot has already successfully commercialised a solution that uses a robotic vehicle to apply insulation without needing to take the house apart to access the floor void. Q-Bot's solution is quicker, cheaper, performs better and is hassle free when compared to traditional approaches. Q-bot's current retrofit insulation service is already fully accredited and is used by Q-Bot's network of installation partners across the UK to deliver insulation services to their clients, including homeowners, Local Authorities and Housing Associations. So far, Q-Bot's robots have insulated over 1,000 sites successfully, with over 1,500 more sites committedl. The outcomes of this project will support the company to increase the proportion of properties that can be insulated and therefore help the UK achieve its climate targets. This project builds on ground-breaking robotics innovation in the area of soft and flexible robotic manipulators by the Centre for Advanced Robotics @ Queen Mary (ARQ), Queen Mary University of London (QMUL), initially developed for surgical applications, and a previous project funded by InnovateUK (104059). This project will develop the technology further, with a view to utilisation not just in under floor voids and inaccessible areas of buildings, but also in other extreme and challenging environments. The project will deliver an industrial demonstration prototype that will be validated in demanding environments as well as further developing the robots as a service business model (with validation in a range of industrial segments using 'Lean Start-up' principles). This business model has the potential to fast-forward the adoption of robotic services in the sector as the capital cost is removed de-risking adoption, whilst enabling immediate performance feedback and continuous improvement (leading to faster technology improvements and further development of applications of the technology).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
BLADEBUG LIMITED	BladeBUG Leading Edge Repair Tool	£362,352	£253,646
OFFSHORE RENEWABLE ENERGY CATAPULT		£29,583	£29,583

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
In the last decade, the number of offshore wind turbines in the UK has doubled to over 2,000 active turbines, saving 29 megatonnes of CO? every year, and producing 10.4GW of power combined. The UK is aiming to raise this to 40GW by 2030\. As power requirements increase, so does the size of turbines and their distance from shore resulting in higher risk and cost of maintenance. Current wind turbines may have blades over 80 m long, and even larger wind turbines are in development. One of the primary issues that wind turbines face is erosion of the leading edge of the blade, due to high speeds at the tip of the blade. As wind turbines get larger, the blade tip speed increases, escalating erosion. Technicians using rope-access equipment are sent out to repair the damaged edges caused by this, by sanding and applying leading edge protection materials. However, more hazardous environments further from shore and on larger turbines will lead to greater risks to these technicians. This will also result in longer turbine downtime, and more costly repairs, reducing green energy production. Robotic repair solutions such as BladeBUG can improve safety by removing humans from this hazardous environment. In addition, use of robots and automation can reduce the cost of earlier stage repairs and productivity can be increased via preemptive maintenance before damage impacts performance. This also reduces turbine downtime, as fewer large scale repairs are needed. Repeatable, precise robotic actions will also improve repair efficiency. This project aims to develop a modular tool carrier and tool for sanding the leading edge of turbine blades, enabling the previously developed BladeBUG robot to carry out leading edge repair procedures. As a result of productivity and efficiency improvements, individual turbines will produce more energy throughout their lifetime, reducing the UK's reliance on fossil fuels as a source of energy. With the planned growth of the UK's wind sector, this will have an even greater effect in the future.

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MUDDY MACHINES LTD	Building Resilient Robotic Harvesters for High Value Field Vegetables	£417,380	£292,166
JGHC LIMITED		£29,638	£20,747
University of Warwick		£50,461	£50,461

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
This industrial research project will further develop the capabilities of an existing robotic vegetable harvesting concept in order to develop a prototype that can be used for commercial trials during the 2022 harvest season in the UK. There will be a special focus on the resilience of the machine in an in-field environment as well as cyber threats from external agents. This project addresses both labour shortages in agriculture and the UK's move towards net-zero greenhouse emissions. This project is led by Muddy Machines Ltd, an agricultural robotics start-up and supported by leading UK asparagus experts at JGHC Limited and cybersecurity experts Warwick Manufacturing Group, University of Warwick.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ABOVE SURVEYING LTD	FollowPV - Developing autonomous unmanned aerial vehicles with spatial awareness for improved image quality from solar farm inspections	£248,519	£173,963
Loughborough University		£60,160	£60,160
University of Essex		£46,131	£46,131

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Project description - provided by applicants
The FollowPV project plans to develop a 'self-driving' (semi-automated) drone system for inspecting solar farms. Our device will allow a drone to follow rows of solar panels in the same way that a 'self-driving' car is able to keep in lane. However, unlike a car, a drone is not connected to the road by wheels. Therefore, our device must also enable the drone to follow the rise and fall of solar panels over uneven terrain. Solar farms are critical to the UK's energy supply and to reducing emissions, so they need to be inspected regularly for defective components. We use drones with specialist cameras to inspect entire solar farms in a single visit, which is more efficient than inspecting panels on-foot. This reduces maintenance costs of solar farms allowing operation at optimum condition, which helps keep down the cost of electricity to the consumer. However, some defects are only visible very close-up, yet reveal early systemic degenerative problems for the future. Current drones are not accurate enough to fly very close to solar panels, and therefore manual inspections are sometimes still needed. These are very time-consuming, expensive, and involve health and safety risk. To use a drone to capture this ultra-high detail imagery, we want to fly much closer to the panels (within 5m). However, in the same way that 'sat nav' is not accurate enough to control the steering wheel of a self-driving car, then GPS is not accurate enough to control a drone so near to the solar panels. To do this accurately, the drone (like the car) needs to be able to 'see' its environment, and to understand and use this information to make tiny control adjustments. This requires special sensors on the drone, and onboard artificial intelligence (AI), which can rapidly process and make in-flight corrections. Loughborough University (LU) and the University of Essex (UoE) already have expertise in utilising drone technology with this capability for use in 'smart agriculture' (e.g. crop disease monitoring), but similar technology can be applied to solar farms. In our proposed partnership, the expertise of LU and UoE in drone automation will be combined with _Above_'s expertise in solar farm inspection and worldwide network of international customers and commercial partners. Ultimately, our desire with this project is to ensure that the UK and the world's solar plants are working as efficiently as possible, thus reducing our reliance on fossil fuels.

Results of Competition: Robotics For a Resilient Future R&D

Competition Code: 2010_ISCF_CRD_AIDE_ROBOTICS_RESILIENT_FUTURE

Total available funding is £7,100,000 over 2 streams

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

Participant organisation names	Project title	Proposed project costs	Proposed project grant
ARCTORIS LTD	ARC - Autonomous Research Continuity - A national resource to protect UK life sciences R&D against disruption	£380,464	£266,325
PEAK ANALYSIS AND AUTOMATION LIMITED		£77,976	£54,583

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
2020 has witnessed business disruption like no-other in living memory. In the life sciences sector, laboratories were abruptly closed, immediately bringing R&D to a standstill. Pharmaceutical companies in the UK, with tens of thousands of staff each; over 40 top tier universities each with active research programmes; numerous biotechnology companies across the country; even Public Health England and its national biobank resource - all were shut down from March 23rd to May 10th with far-reaching repercussions. Life sciences laboratories operate complex, multi-stage processes such as the growth of human cells and tissues in vitro for research purposes. Termination of these processes is destructive, irretrievable and costly. Not to mention the delays to life-saving new treatments. Until now, life science laboratories were operated by, and dependent on, humans. The laboratories of tomorrow, however, will be autonomous, robotically operated, and therefore resilient to disruption, and compatible with the evolving nature of work. ARC will exploit existing proprietary robotic laboratory infrastructure within Arctoris, the leading outsourced autonomous laboratory, and innovate to establish new competencies that will underpin a national laboratory continuity resource, the 'Arc'. The Arc will operate fully autonomously to salvage disrupted processes and provide continuity to research activity for life science laboratories in pharmaceutical, academic and biotech research centres nation-wide. The Arc will become the UK's trusted and resilient resource for the provision of cellular, biochemical and biophysical experimental processes along the entire pre-clinical drug discovery and development pipeline - from target and hit identification all the way until in vivo studies. Arctoris, with its robotic facilities in Oxford, UK, is the global leader in fully automated experimentation but does not yet have the technology required to fully support sufficient scale and diversity of automated processes to secure national R&D efforts. ARC will expand on proprietary robotic and computational technologies that are currently used for delivering fully automated drug discovery experiments and enable the Arc to support nation-wide life sciences research activities. Through ARC Arctoris will complete a plan of experimental development to expand the breadth of robotic cell handling competency and the computational orchestration of processes to sustain hundreds of activities in parallel. ARC, and its experimental development plans, represent the greatest chance for UK life sciences R&D to step forward into a stable and resilient future and to maintain our position of global competitiveness in the face of a rapidly evolving and demanding work environment.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ENERGY INTEGRITY SERVICES LTD	EchoBoltBUG	£102,294	£71,606
BLADEBUG LIMITED		£215,907	£151,135
GE ENERGY (UK) LIMITED		£38,352	£19,176
OFFSHORE RENEWABLE ENERGY CATAPULT		£49,172	£49,172

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Project description - provided by applicants
Offshore wind is one of the UK's biggest industrial successes of recent years. In the last decade, the number of offshore wind turbines in the UK has doubled to over 2,000 active turbines, saving 29 megatonnes of CO? every year, with 10.4GW of installed capacity. The UK is aiming to raise this capacity to 40GW by 2030 and 75GW by 2050\. As power requirements increase, so does the size of turbines and their distance from shore, resulting in more challenging and costly maintenance. The UK has a compelling Green Recovery opportunity; the Government's Offshore Wind Sector Deal targets a 60% increase in UK content at our offshore wind farms and a five-fold increase in exports. One of the primary issues that wind turbines face is the testing and re-torquing of offshore wind turbine bolts. Current practice requires technicians to scale wind turbines in hazardous conditions, manually re-tightening as many as 1,000 bolts per turbine. There are 10,429 wind turbines (offshore and onshore) in the UK, equating to an estimated 10.5 million bolts that are critical to the integrity of wind turbine structures. Having to use heavy duty hydraulic wrenches makes this mammoth task time-consuming and high-risk. The proposed EchoBoltBUG will combine two UK success stories, BladeBUG's robotic walking platform with the EchoBolt ultrasonic inspection device. Unmanned robotic solutions have the potential to make offshore work safer, more resilient and cost effective compared to traditional methods. This project aims to develop an unmanned walking platform that records the sound echoes within bolts, demonstrating exactly when a bolt needs re-tightening, with the potential to reduce the frequency of bolt maintenance significantly. The UK Government is targeting a five-fold increase in exports from UK offshore wind suppliers (to £2.6 billion per year) by 2030\. Tackling climate change over the coming decades is one of the greatest challenges of our time and offerings such as EchoBoltBUG will be decisive in meeting net-zero targets across the world.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
PLATFORM KINETICS LIMITED	Detection of fungal plant pathogen spores using Advanced AI and Imaging (AAII)	£97,828	£68,480
Rothamsted Research		£41,494	£41,494

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Project description - provided by applicants
The project aims to develop an image-based identification system for air-borne fungal spores of important UK crop pathogens, using image analysis and artificial intelligence approaches in an automated, robotic sampling device. This method will provide real-time, continuous results of monitoring air samples, providing data on inoculum levels for multiple pathogens and allergens. The key objective is to automate the impaction of airborne spores onto an adhesive transparent film, which will be moved past a microscope camera, focusing on three separate planes and with innovative lighting, spectroscopy, image recognition and AI used to classify spores to indicate abundance of selected pathogens. Test samples produced by Rothamsted Research in lab conditions and real farm-based air samples will be used for training and validation of the system. The method will provide rapid identification and quantification of air-borne spores, aiming initially at three key diseases of concern in the UK. Image analysis and artificial intelligence methods will be developed to 'learn' to identify the pathogen species from known spore samples, and the algorithms developed will enable rapid identification of these pathogen spores in field samples. The main benefits will be an accurate and fast indication of infection risk to crops for a range of diseases, which will help with disease management, especially decisions on fungicide applications. Many crops are treated more often than is necessary so as part of integrated pest(and disease) (IPM) and to reduce agricultural emissions, the project will potentially reduce fungicide applications while improving disease control. Added benefits could be reduced spray costs for farmers and a reduced rate of development of resistance by pathogens. In addition, there will be beneficial effects on biodiversity and the environment from limiting fungicide use. The project is led by Platform Kinetics Limited, an innovative SME specialising in deployable, automated scientific instrumentation using imaging, robotics, and artificial intelligence. The project will produce a lab-prototype system and will be tested by Rothamsted using a realistic experimental set-up. Rothamsted Research will use existing air samplers to take samples for image analysis and design of the system and will validate results by lab-testing duplicate air samples. Private investment will be used to follow on fund this technology to commercially exploitation and integration with crop management software.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SAGA ROBOTICS LIMITED	FASTPICK: Novel active vision and picking head to robotically harvest soft fruit	£350,000	£245,000
University of Lincoln		£149,894	£149,894

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Uncertainty over access to seasonal migrant labour is placing the otherwise vibrant UK fresh produce and soft fruit sector under unprecedented pressure. The immediate impacts of Brexit and COVID-19 have and are restricting availability to the 69,000 seasonal migrant workers who travel to the UK each year to harvest over £1bn of fresh fruit and vegetables. Robotics and automation technology offers a permanent solution that can disconnect the sector from it's labour dependency, whilst also creating high skilled jobs and growth for the UK robotics sector. However, critical challenges remain to develop robotic technology that can pick fruit within dense, occluded and biologically variable clusters. Leading robotic fruit picking technology can pick 80% of strawberries at 4 seconds per berry. FASTPICK will develop active vision systems integrated to a novel robotic picking head and private 5G network that aims to pick 95% of fruit at c. 2 seconds per berry, the same performance of human harvesters. This performance removes the final technical barrier to large scale adoption of agri-robotic systems for the soft fruit sector. FASTPICK will develop a state of the art active and dynamic vision system that uses multiple cameras, including visual servoing in the picking head to create a 3D scene of complex clusters and identify critical picking points for the gripper. FASTPICK will be implemented in a Gazebo digital twin environment that can be used to optimise picking control and as a key tool for future robotic development. High speed image processing will be optimised by integrating the system into cloud and mobile edge compute via a private 5G network. An optimised picking head and active vision system will be integrated onto the fully autonomous Thorvald robotic platform developed by Saga in collaboration with the University of Lincoln. It will be tested and demonstrated on semi-commercial crops of strawberries. The collaboration is led by Saga Robotics Ltd in collaboration with the University of LIncoln (UoL) and leading robotic system developers Cambridge Consultants. The picking solution will be co-created with Berry Garden Growers whose cooperative members produce over 45% of the UK's soft fruit. Co-creation enables effective and responsible innovation whilst also underpinning significant, rapid and scaled routes to market for Saga. The technology will be marketed to the UK and global fresh produce sectors but secondary markets exist across multiple robotic application domains.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SEYO LIMITED	Distributed Middleware and Semantic Hardware Description for Heterogeneous Mobile Robotic Fleets in Logistics Warehousing	£360,579	£252,405
TU PACK LIMITED		£88,097	£61,668

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Project description - provided by applicants
E-commerce growth has supported the proliferation of third party logistics warehouses (3PL), however, it is difficult for these companies to stay competitive without embracing robotic automation. This problem has been exacerbated by the ongoing pandemic and the related social distancing measures, which necessarily reduce the ability to process parcels quickly and efficiently. Nonetheless, 3PL are struggling to migrate to robotic automation: this is not due to hardware availability or costs, given that solutions are available and can be affordably leased; the issue lies in fragmentation (i.e. robots from different manufacturers that do not talk to each other), which imposes expensive integrations (three to five times the cost of hardware) to those brave 3PL that take the leap. Ultimately, these solutions only address functional interoperability and do not provide warehouse-wide process optimisations, which makes them unsuitable for most 3PL scenarios. Seyo Ltd and Tu Pack Ltd aim to build and trial innovative technology for the creation of a platform enabling interoperability across different types of robots in a 3PL environment. The main vision consists of enabling gradual and risk free transition of small/medium 3PL to robotic automation, which allows them to: * grow their profits by increasing the amount of processed orders within the time unit, * improve the quality of life for their employees, by allowing them to focus on value added tasks, whilst letting robots take care of the menial ones and * become more resilient to market fluctuations. To achieve this, Seyo will build a software layer that hides the hardware details of a robotic device and represents such a device in terms of what tasks it can perform. This software can run on a designated board or on the robot itself and it allows each robot to safely communicate and move together with other robots as part of a well defined choreography. Moreover, the project aims to build a system that keeps track of the available robots, along with their capabilities, and optimises the aforementioned choreographies by analysing the warehouse processes in a holistic fashion. Finally, a warehouse simulation system will be prototyped with the aim to analyse several warehouse configurations, and select the best one in terms of throughput, ahead of the live trial, which will take place at one of the Tu Pack warehouses.