Innovate UK

Results of Competition: Materials and Manufacturing Round 3 - Up to 12 Months

Competition Code: 1705_MM_R3_12M

Total available funding is £15m

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
FROGBIKES LIMITED	Advanced materials for children's bike componentry	£99,104	£69,373

Project description - provided by applicants

Frog Bikes is a British company dedicated to making cycling fun for children. We believe that the lighter the bike, the easier it is for children to learn to ride, and to enjoy it more as they progress. Many kids' bikes on the market weigh nearly as much as the child!

We have set about re-designing kids' bikes, creating a light but strong aluminium frame, and hand-picking components that offer great performance without compromising the weight of the bike.

As part of our ongoing commitment to be at the forefront of kids' bike design and manufacture, we are investigating new materials and processes that could be used to make our bikes even lighter and even more fun for kids to ride.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SKIPPING ROCKS LAB LIMITED	Development of a natural, waterproof, 60-day biodegradable, alginate material for lining paper-based cups and packaging	£92,251	£64,576

Project description - provided by applicants
* Over 5bn items of plastic-coated paper packaging, such as coffee cups, soup cartons and salad boxes are thrown away in the UK each year. Despite being composed of 95% paper and 5% waterproof polyethylene lining, the technical difficulty and high cost associated with separating the materials mean that only 1 in 400 recycled, resulting in 25k tonnes going to landfill every year. * Skipping Rocks Lab is an innovative sustainable packaging start-up focused on the development of natural, biodegradable alternatives to plastics. With over 30 years combined material, chemistry and design experience, we are pioneering the use of natural materials such as alginate, an extract from brown seaweed, to create plastic alternative materials and packaging with low environmental impact. * This has resulted in the development of a basic lab prototype alginate membrane that can used to encapsulate water. Spherical and transparent in colour, the membrane is edible, biodegradable and has a shelf life of 24 hours. * Building upon this success, we intend to research the possibility/assess the feasibility of creating a water-proof, fully biodegradable, alginate lining for cardboard cups and other paper based products -- as an alternative to low density polyethylene (LDPE) plastic, which is used on 90% of waterproofed paper products. * To address this we wish to develop of a proof-of-concept, natural, low cost (LDPE-comparable) waterproof, alginate lining material - stored at room temperature the lining has 0% degradation, enabling lined products to be kept for months and years, however when introduced to humidity AND microbial activity i.e. in a compost, the lining and product are fully biodegradable in 60 days (LDPE 30+years, PLA 120 days in industrial composter, 30 years in landfill). * The project focuses on the development of cross linking our proprietary alginate formula with different plant extracts to determine which offers the best water resistance and viscosity for the lining, identification of a natural binding agent and best way to manufacture the alginate-lined paper. * Alternative technologies do exist such as wax-coating, starch-coating and plant-based polylactic acid (PLA) cups however none of these are fully biodegradable in the natural environment within a short space of time. * The project represents our first step to developing products for the sustainable packaging market, expected to be worth $244bn by 2018 (8.3% CAGR - Smithers Pira Report). We conservatively estimate these to be worth £2.7m (138% ROI) by Y3, £13.1m (650% ROI) by Y5\.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
TISICS LIMITED	Development of SiC monofilament reactor for increased efficiency and capacity	£99,689	£69,782

Project description - provided by applicants

TISICS manufactures continuous silicon carbide monofilament (as oppose to tows) reinforced metal matrix composite; titanium or aluminium alloys. These materials have excellent specific strength and stiffness, therefore offer a light weight alternative to steel for space, aerospace and other mass sensitive applications. Additionally, its metal matrix means that it is a good alternative to polymer composite in compressive and high temperature applications. As part of a UK collaborative project supported by Innovate UK, TISICS have developed and now produce a higher performance silicon carbide monofilament for the reinforcement of metal matrix composites and one which has the potential to be manufactured at much lower cost than the only competitive (US) monofilament. However TISICS pilot facility is based on 25 year old designs and hardware originally established for R&D. This proposal aims to develop production process designs and procedures for monofilament that are production ready. It will build of recent developments in digital automation to address the inefficiencies resulting from the outdated hardware design to significantly improve the efficiency and productivity of the monofilament production. The benefits of the project outputs i.e. reduced build time and failures, extended batch duration and therefore increased cost effectiveness will be an enable for material qualification and uptake within the space and aerospace sectors. This will allow TISICS to compete on the world stage by becoming the only large-scale supplier of this class of material outside the US.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
FOAMTECH SYSTEMS LTD	A new, simple water foamed injection moulding process to allow class A polymer surface finish	£99,280	£67,510

Project description - provided by applicants

The global structural foam market is expected to reach $31.9 Billion by 2020, with annualized growth of ~6% between 2015 & 2020.
Structural foam is significantly lighter than solid plastics, with high strength-to-weight ratio and lower cost tooling. The automotive sector is the main driver to structural foam growth as lifetime energy & CO2 savings drive the need for light weight components.
Chemical blowing agents normally used in structural foam production cause ozone depletion & will be phased out under the Montreal Protocol. Gases such as butane & pentane are an inherent fire risk, while N2 & CO2 are relatively expensive to use, require storage alongside the mould m/c. Structural foam parts also using these processes all suffer from relatively poor surface finish especially when low injection pressure is used.
Foamtech is a new process to make structural foam moulded light-weight parts, with a Class A surface finish. The idea combines novel foaming technology - Super Heated Water Injection technology (SHWI) that uses tap water to foam polymer achieved using a novel injection technology derived from a common rail diesel injection system. This is combined with our novel melt stream splitting valve array that enables us to keep the 'foamed' fraction separate from the 'skin' fraction to achieve a class A surface finish.

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JOHNSON MATTHEY PLC PLASMA APP LTD.	Plasma deposition for thermoelectrics	£57,790 £41,841	£28,895 £29,289
Project description - provided by applicants			
The ability to produce coatings of a few nanometres where both the fine structure as well as composition determines the desired effect, has proved crucial for making modern devices like mobile phones and electronic tablets. However, there is presently no easily scalable method to produce relatively thick films e.g. of a couple of millimetres with structural and compositional control at the atomic level. The Virtual Cathode Deposition (VCD) approach pioneered by Plasma App has the potential to bridge this technology gap, and thus open-up new possibilities in device manufacture of the next generation of clever 'widgets'. Our vision here is to use VCD to provide thick-film manufacturing with an exciting new palette of graphene- type materials and layered structures. To test this, we will focus on the challenge of fabricating electrodes up to several mm thick for thermoelectric devices (they convert a heat-gradient directly into electrical power) where the preservation of nanostructuring in the active material is a major goal. This would provide the UK with an advanced technology to convert waste heat into useful power.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
OXFORD FIBER LTD	Sharp blades by thermal splitting	£81,811	£57,268
Project description - provided by applicants			
Oxford Fiber Ltd is a world-leading manufacture of tools used to install optical fibre networks for broadband internet use. We produce the wire cutters which are needed to install the optical fibre and this is carried out using an expensive polished diamond. We will develop a new technology which will replace the diamond and so make our installation tool cheaper and more reliable. This will make optical fibre networks cheaper to install and allow semi-skilled technicians and hobbyists to use optical fibre networks.			

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IRRESISTIBLE MATERIALS LTD University of Birmingham	Novel photo-resist material for next generation micro-chips	£452,853 £136,391	£316,997 £136,391

Project description - provided by applicants

Irresistible Materials (IM) is developing next generation photo-resist materials for the semiconductor industry. A photo-resist is used within the manufacturing process of microchips. It acts as a type of mask that enables patterns to be etched into silicon through a process known as lithography. It is these features etched into silicon that act as the 'wires' of the modern day microchip.
Resists are thus critical to the semiconductor industry, and the ever-decreasing size of microelectronics is possible only through continuous advancements in lithography and resist technologies.
However, current lithography technology, where the radiation used is 193nm wavelength light, is reaching its limit, and is unable to meet industry targets past 2018 (the wavelength is too large for the targeted microchip feature sizes). To address this, a new generation of lithography technology is planned for commercial introduction in 2019, called Extreme Ultraviolet Lithography (EUV).
In EUV lithography, the wavelength of the radiation is reduced to 13.5nm enabling higher resolution patterns, and thus smaller micro-chip features. However, there is presently no resist solution that meets industry targets for the planned introduction of EUV in 2019\. This creates a major need and opportunity within the semiconductor industry. Through this project, IM will develop a patented EUV resist material to directly addresses this need and opportunity.

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PLAQUETEC LIMITED LASER MICROMACHINING LIMITED	Precision forming and bonding of advanced medical components & sub-assemblies	£106,762 £76,043	£74,733 £53,230

Project description - provided by applicants

The lead applicant has developed a high performance catheter that a doctor can use to take blood samples from deep within the heart at the site of diseased heart tissue. Crucially, by collecting the blood at the site of the diseased tissue, the doctor can detect blood samples that are known to be exclusively associated with the disease. This close association with the disease has important implications for drug development and delivering the best course of treatment for patients with heart disease.

The production of this high performance catheter is very labour intensive and expensive. This cost is limiting the use of the catheter. The lead applicant needs to work with a specialist manufacturing company that is able to research and develop a new production process for critical components for the catheter that are not much thicker than a piece of sewing thread.

The enclosed project is focused on the collaboration of the lead applicant with the specialist manufacturing company to use laser beams and micro assembly techniques to shape, bond and assemble the critical components of this catheter. Via this project, the applicants hope to automate the production process and reduce the catheter price by approximately 90%.

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ADAPTIX LIMITED	Use of National Physical Laboratory facilities by SME to optimise Field Emitters for use in X-ray generation for higher energy applications	£94,500	£42,525

Project description - provided by applicants
Need: Computed Tomography (CT) capability in many hospitals worldwide is under-constraint, resulting in delays to planned procedures. CT scans are expensive per scan, and the increasing use (\>10% per year) is driving costs beyond inflation. Challenge: There is a need for a lower-cost, lower-dose 3D imaging capability in healthcare. The Adaptix Flat Panel Source facilitates a highly portable and low-cost, low-dose 3D 'Digital Tomosynthesis' solution with enhanced resolution. Variability in X-ray emission from different areas in the flat panel needs to be identified and mitigated. Significance: 3D imaging is a fundamental clinical tool as it provides exquisite detail in images thereby enhancing the sensitivity and specificity of diagnosis. Variability in source emission restricts the quality of 3D images. Limited lifetime of the emitters is a hurdle to their commercialisation. Innovation: Surface analytical methods with sub-micrometre spatial resolution will enable understanding of the reasons for emitter variability and failure, and thereby the identification of mitigation strategies. Outcome: This project is part of developing a reliable 3D imaging solution, small (circa 20kg) and cheap enough (<$100,000) to be deployed on a mobile basis within hospitals and polyclinics. The work done under this project will be performed in conjunction with the National Physical Laboratory (NPL) and will build upon an earlier 'Analysis for Innovator' project but ocussed on even higher power output that is suited for General Radiology. It will extend the understand the reason for variation in emitter tip performance and aid developments that enhance lifetime, reduce variation and reduce manufacturing costs. Further variation in emitter coatings and structure will be made and tested in a series of iterations.

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ACTIVE NEEDLE TECHNOLOGY LTD	R&D of RoHS compliant lead (Pb) free piezoelectric materials in active medical needle devices	£96,174	£63,475

Project description - provided by applicants
Active Needle Technology Limited "ANT" are the developers of a specialised high frequency vibrating needle that aims to reduce needle placement errors associated with ultrasound guided interventional procedures. This will save time, lower the cost burden on the NHS and other healthcare providers and reduce the need for the patient to return because their medical procedures (biopsy or epidural) failed. The ANT team has progressed to stage of having a pre-production prototype of this vibrating needle. ANT's development pathway is blocked by a near term environmental and regulatory roadblock. In order to work, the needle must vibrate rapidly, and these vibrations are provided by a special ceramic material (piezomaterials) that contains high quantities of lead. This large lead content creates hazards during processing, limits applications (e.g., _in vivo_), and is environmentally toxic during disposal. As response, regulatory agencies world-wide, including the EU (RoSH Directive), have begun restricting its use, which has triggered a strong desire to identify new lead-free alternatives with comparable properties to those currently used. While the medical device industry is currently exempt from such restrictions (until 2019), ANT aims to be ahead of the game by developing lead-free piezomaterials in its needle guidance technology. A particular market of focus for ANT is Germany, hence having a lead-free product is consider to be a major market advantage. The challenge for ANT, and project motivation, is to identify and characterise the most suitable lead-free piezomaterials for ANT's needle. In particular, a major aspect of ANT's in-house development is the use of computer modelling to ensure the needle actuator delivers the required performance. Current computer models can't deal with lead-free piezoceramic. The innovation takes a number of forms: 1 - ANT's active needle approach is innovative in terms of clinical practice; 2 - to date nobody has used lead free piezomaterials in a medical device and; 3 - The refinement of current computer models so that lead-free piezomaterials can be designed and manufactured.

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EIGHT19 LIMITED CENTRE FOR PROCESS INNOVATION	DIRECT - DIRect EnCapsulation Technology	£140,151 £59,994	£98,106 £59,994
Project description - provided by applicants			
The DIRECT project aims to bring together CPIs Atomic Layer Deposition (ALD) capabilities and Eight19's Organic Photovoltaic (OPV) platform to deliver an integrated process for barrier protection of OPV devices. The project is a 12 month feasibility study to establish the ground rules for roll to roll ALD barriers for solution processed OPV materials and resultant encapsulated photovoltaic modules. The project will initially be focussed on small area devices for testing ALD deposition on OPV materials, with a scale-up effort towards the end of the project. Test devices will be evaluated by for instance damp-heat testing to establish whether the ALD barrier has formed correctly. In addition a small wireless demonstrator will be produced to highlight the potential benefits of the technology pairing.			

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EM RESIST LIMITED	"n-CANTER": Non-Chemically Amplified Negative Tone Ebeam Resist	£92,678	£64,875

Project description - provided by applicants

Semiconductors are ubiquitous in many industrial and everyday consumer products e.g. smartphones and LED bulbs, along with solar panels, energy and space applications. Electron beam lithography, a key process in semiconductor manufacture, is used by universities and research centres and in high end industrial processes to create nanoscale patterns for use in nanoelectronic applications and microprocessor design and manufacture. Despite progress made over the last 50 years in electron beam optimisation, which facilitates the creation of two-dimensional nanoscale patterns at high resolution, density and reliability, resist materials are reaching their resolution limit.

New high performance resist material technology is needed to meet the requirements of new technology nodes and to support future technological progress. EM Resist Limited will undertake a Feasibility Study and Industrial Research Project for the development of a novel resist material that addresses the current limits to resolution and throughput presented by existing resist materials, and meets the urgent industry and research community need for a less expensive, more stable and easier-to-use technology that facilitates further R&D.

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OXFORD NANOSYSTEMS LTD	microFLUX - Microchannel Fabrication for Large Upgraded eXchangers	£93,400	£65,380

Project description - provided by applicants
Heat exchangers are used in a range of domestic and industrial applications from Air Conditioning, refrigeration and domestic heating, to chemical refinement and electricity production. Heat exchangers that boil a liquid are called two phase heat exchangers and are more commonly used in cooling applications. Currently, these heat exchangers are very inefficient at boiling fluids. To boil water at 100oC the heating surface of the exchanger has to reach 120oC and this inefficiency continues even when the liquid has started to boil. Microchannels are an interesting solution to these inefficiencies. Microchannels provide sites for bubbles to form on a surface and limit their size. This means that once the bubbles reach their maximum size they are forced off the surface and fresh, cool liquid fills the space. This increased rate of fluid replenishment allows the surface to be cooled more efficiently. Microchannels are not easily created as the techniques used to create them require open and flat surfaces and can be very time consuming. They can also be damaged in manufacturing which means they cannot be applied prefabrication. This makes them impractical for commercial use. microFLUX is a technology currently being investigated by Oxford nanoSystems as a method for improving the efficiency of these heat exchangers. microFLUX is a technique which allows channels, only a few hundred microns wide, to be cut into the internal surface of the heat exchanger. This overcomes the issues associated with microchannels and could allow them to be a real solution to the heat exchanger industry. The outcome of the microFLUX technology will be more efficient heat exchangers which are smaller, using less material in their construction, and consume less power to operate, reducing their carbon footprint. As global temperatures rise the amount of energy we use on cooling is expected to increase. microFLUX has the potential to minimise the impact this new demand will have.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
IMPACT LABORATORIES LIMITED	Development of Innovate Extrudable Poly-ceramic Composite	£99,300	£69,510

Project description - provided by applicants

Impact have developed a new lightweight, highly fire resistant composite material with appliactions from construction to transportation. This material will provide a step change in perfromance over plastics with regards to it's extreme fire resistance perfromance whilst also being lighter than metal or conrete. Due to how the material is formed through combining an organic polymer and an inorganic phase during the extrusion process, the material can be processed like a plastic and has the fire resistant properties of a ceramic.

To achieve production on a industrial scale and to maximise the variety of products and therefore applications for the material a continuous extrusion process needs to be developed. This will enable complex shapes such as solid and hollow profiles to be manufactured with ease allowing immediate market impact to meet current market demand. This material has applications over a huge number of industries from improving fire safty in construction through fire resistant cladding on buildings and fire critical utilties and transportation to reducing the use of high environmental impact products like hardwoods and concrete.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SWEETGEN LIMITED	Bifunctional catalytic composite material for oxidative wastewater treatment	£99,900	£69,930

Project description - provided by applicants

Many industries such as food production, breweries and agriculture produce large amount of effluents that contain organic contaminants which need to be removed before disposal. This requires lengthy and time intensive processes with a large cost (£12 billion worldwide for the relevant industries). Approximately 3 -- 5% of electricity produced is used to clean water. We have developed a catalytic composite material that can utilise air in order to clean industrial wastewater by consuming the organic material within this water. The principle is analogous to a catalyst for automotive exhaust cleaning. Compared to current technologies based on microbes, our material is insensitive to the external conditions, such as temperature, pH and composition, does not require any energy input or incubation times and can continuously be operated without any regeneration step. It is therefore an excellent solution to decrease the cost of water treatment for effluents not suited for other waste-to-energy technologies. Our composite materials and product design will simplify current wastewater processes making them more flexible, resilient, efficient and safe. The energy saved for wastewater cleaning has the potential to save millions of tons of CO2 from getting into the atmosphere, thus helping to mitigate climate change. During this project we will optimise the material and investigate its processing into innovative products.

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MICRO MATERIALS LIMITED	Durable Materials Bonding for High-Temperature Coating Indentation (DURABOND)	£124,252	£86,976
Cranfield University		£75,491	£75,491
THIN METAL FILMS LIMITED		£61,992	£43,394
WALLWORK HEAT TREATMENT LIMITED		£83,510	£41,755

Project description - provided by applicants

Nanomechanical testing is a revolutionary technique in improving our fundamental understanding of the basis of mechanical properties of materials and the importance of the nanoscale behaviour on their performance. It is important to measure nanomechanical properties at testing temperatures that are close to their operating conditions. The results are more relevant and the links between properties and performance and design of advanced materials systems for increasingly demanding applications are better understood.

Despite this, nanomechanical testing is usually carried out at room temperature since achieving reliable high temperature nanomechanical testing results requires a combination of very high level of thermal stability with test probe durability at high forces and temperatures making it extremely challenging experimentally. In this project we are investigating ways to improve the durability of the test probes by increasing their bonding strength and using prototype probes made by the newly developed processes to test coatings and thin films at higher temperatures than currently are possible. The results of the testing will be used to improve the performance of innovative erosion-resistant coatings operating in harsh environments in aerospace, automotive, coatings and nuclear industries.

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DESIGN LED PRODUCTS LIMITED	Uniform embedded lighting films based on inorganic LEDs	£96,961	£67,873
Project description - provided by applicants			
Design LED Products have developed an thin, efficient, mechanically flexible LED lighting technology which enables large area lighting. Driven by radical innovations, this project will deliver a postive leap performance, from which DLED will demonstrate large area, flexible LED lighting panels.			

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VIDERA SERVICES LTD	Natural Fatty Aldehydes for Flavours and Fragrances	£99,829	£69,880
Project description - provided by applicants			
A new manufacturing process will be evaluated for the sustainable production of natural aldehyde-based flavours and fragrances from renewable feedstocks (seed-oil processing by-product streams). These aldehdyes are among the most important ingredients used in perfumery and as aromas in hair care products, cleaning, laundry, and personal care products, and as ingredients in processed foods. Aldehydes also have applications as lubricants, insect traps, pharmaceuticals, plant growth regulators, antimicrobials and disinfectants. These compounds are currently produced at large scale from petrochemical raw materials. In addition to being derived from unsustainable resources, the chemical synthesis from petrochemicals result in the formation of by-products with unpleasant odours that are costly to remove and which limit their application. Biotechnological production of aldehydes has not been possible to date due to the inhibitory nature of the compounds to microbial cells. The proposed production technology will overcome these challenges by exploiting a novel yeast to convert plant fatty acids to useful aldehyde products.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
PRINTED ELECTRONICS LIMITED	3DP-Harness	£112,783	£78,948
AMPHENOL INVOTEC LIMITED		£39,134	£23,480
C ENTERPRISE (UK) LIMITED		£135,248	£94,674

Project description - provided by applicants

The 3DP-Harness project is industrial research to develop a demonstrator for an innovative technology for the robotic manufacture and installation of wiring harnesses through digital and additive manufacturing. This solution would revolutionise one of the last labour intensive elements of high value manufacturing. The SME partners, CEL and PEL, are UK SMEs in the high tech manufacturing sector. Amphenol Invotec are the UK's leading PCB manufacturer with an especially strong focus in defence, aero and space sectors. The initial customers for this technology are Tier 1 aerospace suppliers due to the specific advantages of the technology.

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Innovate UK

Results of Competition: **Materials and Manufacturing Round 3 - Up to 12 Months**

Competition Code: **1705_MM_R3_12M**

Total available funding is £15m

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
L & B CARE SERVICES LTD	RObotics & Additive Manufacturing in Built Environment for off-site Manufacturing of homes (ROAMBEM)	£64,070	£44,849
DG CITIES LIMITED		£5,380	£5,380
University of Greenwich		£15,685	£15,685

Project description - provided by applicants
The challenge of meeting house building targets in the UK presents major opportunities for new methods of construction such as off-site manufacturing for home construction. This will use smart robotics, additive manufacturing and sensor technologies that optimise the manufacturing process. Outside the UK off-site manufacturing of home building (or pre-fabrication) is a widely accepted method of house building with global sales expected to exceed 1.1 million units in the current year. Unfortunately, it is not a widely accepted method in the UK for historical reasons. Currently, the fashion-talk is to build low-cost 3D printed homes but to date no one has taken the jump from conceptual house printing to printing an attractive functional building that people want to live in. Additionally, it is not clear that 3D printing can make that move in an economical way. ROAMBEM has identified an approach which takes the best from traditional construction methods, robotics and additive manufacturing to develop an intelligent autonomous off-site manufacturing process for the construction of house building. The process will lead to a safer working environment, reduced labour costs and productivity gains ROAMBEM is a feasibility study with key innovations that seeks to a) identify new materials suitable for additive manufacturing, that will improve current U-values of thermal Insulation whilst improving noise suppression. 2) identify appropriate autonomous robotic systems to work alongside AM such as smart grasping 3) maximise the benefit of AM which needs the capability to be mobile so that it can be readily set up and used on a construction site (or in near-site factory). Combined, this will enable the optimisation of productivity while effectively reducing building costs. However, there are challenges that need to be overcome in terms of materials selection, removal of waste product and finishing after placement to provide a suitable surface and materials formulation.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MEDICAL DEVICE CONSULTANTS LIMITED CORMED LIMITED	Manufacturing Process for the Production of Sub-6mm Flow-Controlled Vascular Grafts	£97,131 £0	£67,992

Project description - provided by applicants
Blocked blood vessels are a primary factor in heart disease. We are planning to develop a new technique for manufacturing artificial blood vessels below 6mm in size. Smaller blood vessels are the ones most likely to become blocked so a solution for providing artificial grafts has the potential to save and extend the length of many lives. Making small artificial grafts has been problematic in the past because they tend to get clogged quite quickly, just like the ones they are replacing. However, we have found by computer-modelling of the blood flow, that changes to the internal profile of the blood vessel can encourage the blood to scour the surface and prevent any build up of material. We have managed successfully to make some small grafts with suitable internal profiles, but not reliably. Their shapes have not been consistent so we can not progress to the next stage of testing them in real blood flows. This project focuses on developing a semi-automatic means of making the artificial vessels consistently so that trials can take place. The challenges lie in the design and precision manufacture of the mandrel around which organic fibres are spun to create the structure of the graft. We intend to use a design company who has experience in precision metal 3D printing to create the mandrel so that we can set up a prototype batch production unit to develop the technique. We are also partnered by a medical device company who will help us get the innovation to market if it is successful.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
BIOCATALYSTS LIMITED	Modified recombinant yeast manufacturing process for efficient commercial large-scale production of enzymes.	£96,296	£57,778

Project description - provided by applicants
Biocatalysts Ltd are an SME located in Cardiff UK. Using microbial fermentation technology, we manufacture high-value enzymes that are sold into the following market applications: (i) used as processing aids in the manufacture of pharmaceutical intermediates (ii) used as processing aids in the manufacture of food ingredients (iii) used for DNA processing in Life Science applications. We have several microbial platforms that we use to manufacture recombinant enzymes incorporating both bacteria and yeasts. When we develop a strategic enzyme product for a new market or a novel enzyme product for a customer project we perform a diligent assessment of the enzyme with our Design for Manufacture process. This is aimed at maximising the probability that if we can make the enzyme at laboratory scale then we will be able to scale-up to large scale commercially viable fermentations and downstream processes to meet cost targets. Some enzymes are more suitable for expression in yeast than bacteria and our current default yeast manufacturing platform is in _Pichia pastoris_. The most widely used expression system in _Pichia_ at both the academic and commercial scale involves the use of Methanol as an inducer for the high-level expression of the enzyme (protein). Large-scale use of methanol in a manufacturing context is fraught with economic, health and safety and potential environmental constraints. Consequently Biocatalysts is currently limited to methanol-induced Pichia fermentations to a scale of 500 L. We are currently expanding our manufacturing capacity over a 2 year plan to 8,000 L. It is prohibitively expensive to equip such a facility with the capacity to work with methanol at this fermentation scale. Currently we have 3 enzyme products produced at large-scale in _Pichia_ with methanol induction, so consequently we are obliged to export this business to a partner company in Europe. Therefore, this project is aimed at developing a cost effective, high yielding methanol-free expression system for commercial manufacturing scale in the yeast _Pichia pastoris_ to allow our business to expand in this area in the UK.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SIGNAL BIOMETRICS LTD	Development of the first low-cost, fire/water resistant, clinical-grade biometric sensors and method to embed them into heat-resistant fabrics and protective clothing.	£93,424	£65,397

Project description - provided by applicants

* Signal Biometrics are an innovative sensor and vital signs monitoring company borne out of F1 motorsport where our Director's Dr Ian Roberts and Alan van der Merwe, currently work as the FIA F1 Rescue Coordinator, and FIA F1 Medical Car Driver.

* Despite 1000 in-car sensors, the challenges of heat, conductivity (on electronics) and integrating a biometric sensor into protective fabrics mean that there is no sensor/system on the market to monitor the vital signs of drivers or pit-crew - resulting in accidents being attended uninformed of the victim's status.

* To address this, we intend to develop the first reusable, low-cost, fire & water resistant, clinical-grade, biometric sensors and establish the optimum method for embedding them directly into fire resistant fabric & personal protective clothing to allow vital signs monitoring in the most extreme environments, where previously not possible (See App2).

* The project is being driven by demand from the motorsport, military & first responder industries to monitor in real-time the vital signs of employees in high-risk situations e.g. in a burning building - enabling quicker, safer, informed safety & healthcare interventions after an accident occurs. Although initially targeted at motorsport (Y1), the technology has much wider potential by enabling any item of protective clothing to be embedded with a biometric sensor - opening up applications including extreme sports, rescue and heavy manufacturing, where the ability to remotely, noninvasively monitor large group of people involved in hazardous environments is not possible at present.

* Working with the FIA, we have so far developed proof of concept hardware & software to allow continuous, remote monitoring of 100 user's vital signs concurrently in real-time. The project focuses on overcoming the technical challenges associated with developing new material properties - fire & water resistance - and the manufacturing method - reusable, low-cost, integration into fire-resistant, protective fabric/clothing - for clinical-grade biometric sensors without compromising performance and comfort.

* Our technology will be the first of its' kind and is an important step to us developing a full range of wearable sensors to measure body temperature, heart rate variability, galvanic skin response in environments of extreme heat and humidity. The market for enterprise biometric wearables will reach £9.6bn ($12.2bn) by 2018 (56.1% CAGR - Fung Global Retail and Technology, 2015) and believe the project will result in turnover of £25m by Y5, 50% related to exports, with 5 new jobs created.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
WEST OF ENGLAND TEXTILES COMPANY LIMITED	Developing a novel process to improve quality & competitiveness of British woollen cloth (S2S)	£96,079	£67,255

Project description - provided by applicants

The project aims to develop an innovative manufacturing system that produces a step change in the quality of woollen textile manufactured from British wool enabling it to be incorporated into a number of sectors (apparel, home and automotive furnishings) for export as high value products to Japan, US and China. The British luxury industries is a growing market with around 78% destined for overseas market. The project will diversify existing British wool cloth that are of coarser quality than cloth manufactured from state of the art imported higher cost Australian wool enabling it to be used for the new high end export market. Our principle innovation lies in the application of existing laser and vacuum steam technologies into the textile sector to improve the softness of the wool fibre and reduce its diameter to enable cloth which matches the quality of imported wool. The project will result in an increase in West of England's manufacturing productivity and a step change in our competiveness as we will manufacture higher value British textiles with increased export potential.. The project will also see financial benefits to the whole UK supply chain which are mainly SMEs from farmers, wool processors, weavers, cloth finishers and cloth converters who turn the cloths into a range of products.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
RAB MICROFLUIDICS RESEARCH AND DEVELOPMENT COMPANY LIMITED	Developing Microfluidic Lab-on-a-chip Technology Demonstrator for Onsite Lubricating Oil Analysis	£55,854	£39,098
WIDEBLUE LIMITED		£80,962	£56,673

Project description - provided by applicants
The automation of industrial practices to enable greater productivity on production floors is driving the need to replace conventional processes. One of such processes is the use of conventional laboratories to determine the rate of wear and degradation of lubricated production floor machinery. The inefficiency of this process results in reactive maintenance strategies where machinery is maintained only after it has broken-down thus reducing machine availability and productivity. Another is carrying out maintenance when there is no need for this as is the case with preventative maintenance strategies, making maintenance of machinery unnecessarily expensive. Diagnosing early, potential failure of heavy machinery is critical to operations across many industries. For this reason, industrial businesses in 2016 spent £2.01bn on state-of-the-art Oil Condition Monitoring (OCM) techniques. These techniques however, are inefficient, expensive and environmentally unfriendly, for example, costing additional £2.1bn in breakdowns, repairs and downtime losses. RAB-Microfluidics has developed cutting edge microfluidic lab-on-a-chip technology to deliver real-time continuous testing and analysis of lubricating oil. Our "Lab-on-a-Chip" technology delivers oil analysis 1000x faster and 10x cheaper than the current "send the sample to the Laboratory" approach. Analysis of contaminants in engine oil, drive trains etc. is a well-established method of detecting problems. This procedure is called Oil Condition Monitoring. We deliver this onsite, in real time, saving cost and improving equipment reliability. We combine our hardware technology with data computing by developing machine learning capabilities to utilise the data generated from our hardware. This offers customers real-time continuous monitoring, early problem diagnosis, rapid decision making, enhanced efficiency and cost savings. To date we have received various levels of funding to demonstrate the technology with laboratory based prototypes. Nonetheless, this project seeks to build on this and develop a field demonstrator to engage businesses in the manufacturing space in field trials and in the reality of the value our technology can provide. This technology will enable us to solve the hard-to-reach and hard-to-sense challenges of many business in the manufacturing space, using the data we generate intelligently and innovatively to forward model machinery behaviour and immerse businesses in industry 4.0\. We advance evolution of maintenance strategies to secure equipment reliability, increase Overall Equipment Effectiveness (OEE) and by extension productivity on production floors. We extend our capabilities to other industries such as transportation, power generation, maritime etc. helping to transition businesses in these industries to predictive maintenance strategies.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CONTINUUM TECHNOLOGIES LTD CENTRE FOR PROCESS INNOVATION	Graphene embedded in polymer textiles for smart clothing	£69,478 £26,837	£48,635 £26,837

Project description - provided by applicants

Technology continues to become increasingly personal and is now being worn on the body, such as on the wrist, helping to track and improve our health. Current wearable technology has three key limitations: the type of data it can gather on our health, lack of real-time collection of such data and these devices are often an extra bulky accessory that people eventually are unwilling to use.

This feasibility project led by Continuum Technologies and working with CPI, a HVM Catapult partner, will produce a highly sensitive fabric for smart clothing using graphene embedded into textile fibres to enable real-time performance and health monitoring.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DIAMOND PHOTOFOIL LTD	On-site direct to product print: Environment and user friendly full colour digital print for products and packaging	£99,454	£69,618
Project description - provided by applicants			
Environmentally friendly coating, labelling and application system for multiple applications. The system to be developed specifically to be easy to use on-site by packaging and consumer durable manufacturers for the direct digital print of their products without the use of wet or solvent based adhesives.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
GREEN RUNNING LIMITED	OPERating Analytics for elecTrical appliancEs (OPERATE)	£99,837	£69,886

Project description - provided by applicants

The "Internet of Things" offers appliance manufacturers a valuable opportunity to improve their understanding of post-production product performance and user interaction. Innovations such as smart sensors, cloud computing and data analytics can all support increased profitability by enabling new services, improving product design and potentially facilitating orchestration of new, circular business models. Yet at present only 35% of manufacturers globally are exploiting these technologies, and even those that do are limited to dispersed insights.

To address this market need, and exploit the opportunities of the IoT for UK manufacturers, UK SME Green Running propose their patent-pending OPERating Analytics for elecTrical appliancEs (OPERATE) solution. Leveraging strong in-house expertise of electrical monitoring-derived insights, machine learning algorithms and data analytics, Green Running's technology agnostic solution offers a comprehensive range of product/user insights with which manufacturers can improve their profitability.

This 9 month industrial research project, including a 3 month participant trial in partnership with one of the UK's leading consumer appliance brands will help validate OPERATE's full functionality, evidenced by a robust data set, and refine the customer proposition to ensure the optimal business model for exploitation.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CUTTING & WEAR RESISTANT DEVELOPMENTS LIMITED	Process development of Mud Motor Radial Bearing manufacturing using TSP (Thermally Stable Polycrystalline) Diamond Hardfacing	£84,004	£50,402
Project description - provided by applicants			
Development of Mud Motor Radial bearing manufacturing for the oil and gas industry using an innovative manufacturing technique for improved wear resistance, low coefficient of friction and high productivity.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
TRIBUS-D LTD	Application of Copper Sinter Technologies to Manufacture of Intelligent Power Modules (ACUSINT)	£45,885	£32,120
Loughborough University		£23,960	£23,960
ULTRAWISE INNOVATION LIMITED		£12,174	£8,522
Project description - provided by applicants			
There is a growing need to generate, convert and distribute electric power from the source to the load, which is fulfilled through the use of power electronics. This is of importance for electric and hybrid vehicles, industrial drives, smart appliances, the smart grid and all renewable energy sources. Packaging and assembly of the power electronics modules is important in determining the efficiency, size, weight and manufacturing costs which affect the uptake of new technologies in these applications. This project will seek to establish affordable manufacturing methods to utilise copper sinter technologies through advanced interconnection and device embedding techniques. This will create a UK controlled supply chain for the manufacture of customised smart power modules and supply of copper sinter materials.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
LOXHAM PRECISION LIMITED ULTRAPRECISION MOTION LIMITED	Automated micro-ECM for air bearing production	£185,783 £39,347	£130,048 £27,543
Project description - provided by applicants			
This project will investigate and test a new production method to fabricate fine features of advanced bearing slideway and spindle components. The developed production technology will enable the collaborating partners to produce leading performance precision motion slideways and spindles. These slideways and spindles will be high value and performance enhancing elements of the Lead Partners machine tool product range. The new systems will replace those presently imported by the Lead partner from the US and in themselves can represent future UK products. In the longer term, the developed production technology could represent the technology basis for a new range of micro-machine tool products. The partners will explore the broader commercial opportunities of the created process technology.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Q-BOT LIMITED	Sprayable, Vapour Permeable, Natural Insulation for Suspended Timber Floors	£97,366	£68,156

Project description - provided by applicants
One of the most pressing challenges when addressing Climate Change is the energy use of existing buildings. Effective insulation of the UK's hard to treat buildings is one of the great unresolved challenges. These properties tend to be the least frequently upgraded as current retrofit methods are often disruptive, labour intensive and cost prohibitive. In addition they can have significant technical limitations, or result in unintended consequences. Energy savings achieved by Q-Bot were modelled using SAP and used to compare floor insulation by Q-Bot to other measures such as Solid Wall Insulation, boiler replacement or double glazing. The payback period for Q-Bot insulation is much shorter than for Solid Wall Insulation or double glazing across all the properties monitored and often shorter than for the boiler replacement. Considering the life expectancy of 42 years for Solid Wall and Q-Bot Insulation, 12 years for the new boiler and 30 years for the double glazed windows, floor insulation by Q-Bot is the only measure guaranteed to pay back within its lifetime. Besides better U-Value and Airtightness (leading to improved EPC by 4 points) independent co-heating tests of Q-Bot floor insulation by Leeds Metropolitan University demonstrated higher overall energy savings (24%) than from a typical Solid Wall Insulation programmes of terraced properties (forming majority of homes in LB of Camden). In order to insulate homes more effectively and reduce the risk of unintended consequences Q-Bot will develop insulation materials with improved vapour handling qualities with the support of this project.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ZENTRAXA LIMITED	Dispondable Industrial Bio-Adhesives for Innovation in Manufacturing	£99,994	£69,996

Project description - provided by applicants

The global adhesives market is worth over £35 billion worldwide and although synthetic chemical adhesives are widely used in a large variety of manufacturing applications, there remains several challenges for the adhesives industry. These include reducing the environmental impact of the chemical production of adhesives and also the ability to disbond adhesives, allowing the previously bonded components to be recycled. Zentraxa Ltd is a new spin-out company from the University of Bristol that is using the power of synthetic biology to address these challenges. We have previously produced a variation of a peptide-based adhesives found in the natural world and are able to activate the adhesion on demand to bond two materials. In this project, we wish to further develop our range of naturally-based adhesives to make new adhesives that are tailored for the bonding of different materials, including the bonding of highly dissimilar materials, often necessary in the manufacturing of certain goods. Our adhesives also lend themselves being readily disbonded, a property that is highly desirable within many industries as it allows the disassembly of bonded components, either for maintenance or recycling. Since our adhesives are based upon those found in the natural world they are also biodegradable and therefore present no sustainability issues.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
NEDRA LIMITED	Reduced cost materials and process for lightweight automotive structures	£187,727	£131,409
GREAT BRITISH SPORTS CARS LIMITED		£161,383	£112,968

Project description - provided by applicants
This project aims to prove both the concept of a new material combination, flax based sandwich construction, and a new manufacturing process developed under a previous Innovate project, to produce strong, lightweight and low cost automotive body structures and exterior panels. Through the unique production method the project will investigate the limitations of the production process and the consequent impact on the design of structural components. At the same time the process will be tested to see how it can deliver acceptable A class surfaces that do not require further finishing processes. The process delivers low-capital investment production tooling and supports the production of low cost vehicles as well as any product using single side moulded panels. Once the process has been tuned, the project will look at flax reinforced resins in a sandwich construction with carbon fibre skins to provide resilience and impact resistance and also to encapsulate the flax to protect it from moisture. This will focus on achieving suitable strengths to carry loads, resilience to withstand repeated road load inputs and resistance to impacts. Following the experimentation, the project will create and automotive body structure to test the results as a complete assembly. This will lead to a new business with new business opportunities -- initially with Nedra on it's ultra-low weight electric vehicle family and subsequently in many automotive applications that seek reductions in cost and weight.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
LIGHTRICITY LIMITED	Manufacturing feasibility of miniaturised photovoltaic energy harvester for smart dust sensors	£99,643	£69,750
Project description - provided by applicants			
This project will address the needs of the fast growing Internet of Things (IoT) market by developing a manufacturing process to create the world's smallest and highest efficiency light energy harvesting (photovoltaic) module (mm^2 range) for smart dust sensors and motes. Smart dust sensors will require a mass-producible, low cost, highly efficient, ultra-small footprint and free shape power source that can operate in indoor and outdoor environments. Moreover, due to the large number of devices to be deployed in the field, a renewable power source will be essential to provide complete autonomy to these smart dust sensors. The power source should also provide sufficiently high voltage and power density to be combined with a rechargeable storage element (e.g. solid-state battery) and to supply energy to a smart dust sensor's low-power MCU (e.g. state-of-the-art sub-threshold ARM CPU implementations) and/or RF chipset. This project will build on Lightricity's Photovoltaic Energy Harvesting technology which has already exhibited superior low light level performance at the cm^2 level.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
NATURAL RESOURCES (2000) LIMITED	Surface Treatment Performance Evaluation and Optimisation of Specification for Pulp-Fibre Containers for Dry and Liquid Consumer Goods	£99,298	£69,509

Project description - provided by applicants

This project will assess and seek to optimise the performance of surface treatments for a biodegradable packaging solution to be used as an alternative to plastic packaging for fast moving consumer goods - including dry foods, bottled drinks and household products. Optimisation of the surface treatment will enable replacement of PET with moulded paper pulp containers.

The project builds on considerable work to date that has established a solution for the manufacture of the containers and the development of a closure solution from the same paper pulp material for whole product recyclability/compostability. This project focuses on developing and optimising the surface treatment to meet all regulatory, functional and economic performance criteria.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CYANETICS LTD.	Carbon Capture and Reusage-Conversion of CO2 from steelworks to coating products	£159,953	£111,967
TATA STEEL UK LIMITED		£39,641	£19,821
University of Nottingham		£85,540	£85,540

Project description - provided by applicants

We are working towards developing, in partnership with Tata Steel, smarter and cleaner manufacturing methods for taking waste CO2 emissions from Tata's existing steel production processes, to use as a raw material for a novel biologically-based manufacturing process. Thus valorising this by creating high-value chemical intermediates which will be used to manufacture steel coating products used in downstream processing, helping to ensure the ongoing profitability and sustainability of Tata's manufacturing operations as we move towards a low-carbon economy.

The process is based upon modified cyanobacterium which sequester CO2 and convert it to interesting product endpoints via cellular carbohydrate produced through photosynthesis, and does not rely upon non-sustainable sources of energy to operate. The current project focusses on process modelling and strain engineering to convert CO2 to our target products.

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Innovate UK

Results of Competition: Materials and Manufacturing Round 3 - Up to 12 Months

Competition Code: 1705_MM_R3_12M

Total available funding is £15m

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
THERMIC EDGE COATINGS LIMITED	High temperature corrosion protection of graphite parts for semiconductor industry	£83,954	£58,768
Project description - provided by applicants			
Next generation electronic devices, and especially power devices, are made on wafers a variety of materials. The semiconductor industry starts to process wafers at very high temperature (up to 1800 C). Materials to support the wafers (i.e. silicon carbide coated graphite) have reached their temperature limits at 1500 C. New materials need to be introduced which can fulfill the high temperature and other requirements used in those semiconductor processes. Thermic Edge Coatings aims to develop new technology for deposition of high temperature resistant materials on graphite in order to protect it against corrosion in semiconductor industry applications.			

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Total available funding is £15m

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
POLAR OLED LTD	Synthesis of liquid crystalline Thermally Activated Delayed Fluorescence (TADF) materials and utilisation in Organic Light-Emitting Diodes (OLEDs)	£97,024	£67,917

Project description - provided by applicants
Thermally Activated Delayed Fluorescence (TADF), is a highly efficient route to fluorescence that has just begun to be used in Organic Light-Emitting Diodes (OLEDs). TADF utilises a very small singlet and triplet energy difference in the excited state of an organic semiconductor material. This allows a higher degree of efficiency output from photoluminescence and electroluminescence, compared to fluorescence emitting materials. Liquid crystals have many beneficial properties that include, optical anisotropy, long-range order, fluidity and a key property of being able to be arranged on a substrate to generate polarised emission. Polar OLED proposes the design and synthesis of liquid crystal materials that exhibit TADF. This would be a new material class that has yet to be utilised in OLEDs. During this 12-month industrial research project, we will design novel materials that have a high possibility of forming calamitic liquid crystals. To achieve this we will design oligomer materials that have a high degree of aromatic conjugation, using this approach we can tailor the structure of the oligomers so we are able to manipulate the light output from the material under the forward bias present in an OLED, electroluminescence. A key target of the project will be to generate red, green and blue electroluminescent materials, that exhibit higher OLED performance metrics compared to none TADF liquid crystal materials. Polar OLED plans to use this industrial research project to develop working prototypes based on TADF liquid crystal emissive materials. The materials will be tested in flexible full-solution processed OLEDs. This is a new display technology that has the potential to revolutionise how we use OLEDs. Thin, light and fully printed using a digital process could allow the implementation of low-information content displays in many new markets. The successful design and synthesis of new TADF materials will improve the performance of our OLED products, increasing potential market access and the revenue streams available to Polar OLED.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SURFACE GENERATION LIMITED	High Rate Stabilisation of Preforms (Hi-RaSP)	£99,641	£69,749
Project description - provided by applicants			
The High Rate Stabilisation of Preforms or "Hi-RaSP" project seeks to develop and demonstrate accurate, rapid and affordable techniques for forming and stabilising aerostructure preforms prior to subsequent liquid moulding processes. Led and conducted by Surface Generation Ltd. (Oakham, Rutland) the project has oversight and support from a key aerospace Tier\#1 supplier and HVM Catapult centre.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DIGITAL APPLICATIONS INTERNATIONAL LIMITED	Digital Twin: Fast Track Industrial Prototyping Toolset and Methodology	£520,884	£312,530
DIAGEO SCOTLAND LIMITED		£14,189	£0
SIEMENS PUBLIC LIMITED COMPANY		£50,650	£25,325
University of Strathclyde		£211,579	£211,579

Project description - provided by applicants

An innovative digital solution will be developed for an improved cask filling system, using a digital twin to demonstrate and optimise the manufacturing process improvements achievable through the developed whisky cask filling system. The consortium, led by DAI, an IT solution delivery SME, will develop an improved cask filling system which will fill the casks to 100% in an equivalent cycle time to current filling solutions (which fill to below 95%) using a digital twin and data captured from the physical system to iteratively refine the solution. The project will fully validate the digital twin and demonstrate virtual commissioning and operational improvements. The technology developed and demonstrated within the project is applicable to a range of industry product and process improvement challenges, for example in the oil & gas, power production and pharmaceutical industries.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
RERUM CONSULTANCY LIMITED EFFICIENCY TECHNOLOGIES LIMITED	Use of Cavitation to extract high value chemicals from waste streams	£10,166 £78,249	£7,116 £54,774

Project description - provided by applicants

The project is based on the use of cavitation to extract more vanilla from spent pods and coffee from spent beans than in currently accessible. Cavitation allows matricies such as food waste or in this project spent vanilla pods and coffee beans to be broken down further to release any residual material which conventional methods can not release. This project will demonstrate the potential of the technology for other applications at a scale which is representative to industry. This technology has the potential to be a disruptive technology to food industry and redefine how it handles its waste products and the value it can glean from this stream

This project will address proof of concept for the cavitation technology. This technology creates a constant cavitation zone which can breakdown material structures and release high value compounds from their natural matrix. It is a physical process which involves not chemicals enabling the end food product to be labelled as natural (not modified).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
HARDIDE PLC	Low temperature chemical vapour deposition coating of duplex and super duplex alloys	£97,088	£67,962

Project description - provided by applicants
The proposed Industrial Research project will develop a process for manufacturing hard Chemical Vapour Deposition (CVD) coating at a lower temperature than currently possible, and also optimising the coating process to make it more efficient and economical to enable coating a wider range of materials and applications. The patented CVD Hardide Tungsten Carbide coatings are currently used on some valve, pump, oil tool and aircraft components and are proven to protect them from wear, erosion and corrosion, typically tripling live of critical parts in demanding environments. Meanwhile the current CVD process temperature of 500Â°C may affect some grades of steel, limiting the range of the coating applications. The project will start with the lower temperature coating process development. This will involve a significant materials manufacturing technology innovation as reducing temperature has a strong exponential effect on the rate of chemical reactions. This stage will involve a series of experimental coating cycles designed using the Taguchi technique. Once the process development is completed the low-temperature coating key properties will be tested by certified UK laboratories, to enable engineers design the coated parts and to predict their performance. Main areas of focus are developing coating process for the oil and gas, petrochemical and chemical engineering equipment. The new low-temperature coating can also be useful for some aerospace industry materials, tool and bearing steels. Conformal low temperature CVD coating can be best suitable for complex shape parts made by Additive Manufacturing (3D printing). Achieving the project objectives will create new business for Hardide, expand the range of our coatings and applications. It will also have a wider impact on the UK producers of pumps, valves, oil tools, enabling a step change in durability of their equipment, making them more competitive internationally. The project will take 12 months, will be performed by Hardide Plc, an SME as a sole applicant involving several leading UK laboratories as subcontractors to conduct testing.

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