

Results of competition:

Technology-inspired innovation - January 2014 - Advanced materials - Feasibility study -

Total available funding for this competition was £2m from the Technology Strategy Board.

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
Cella Energy Limited	Filtration System for High Performance Hydrogen Power Systems	£33,000	£24,750
Project description - provided by applicants			
<p>This project will deliver an advanced filtration system to provide ultra-pure hydrogen gas for a fuel cell, to power an electrical device. Cella has developed an advanced, innovative chemical hydrogen storage medium with high capacity and turn-key accessibility. However, the ultra-low (ppm) levels of impurities required by fuel cells require the hydrogen to be filtered completely prior to entry to the fuel cell.</p> <p>Using a novel class of smart filtration materials called metal-organic frameworks (MOFs), Cella will be able to purify the hydrogen to acceptable levels using a compact, lightweight and cost-effective system. This will allow Cella's hydrogen cartridge technology to out-compete Li-ion batteries in key applications, and will enable the company to succeed and grow in the near-to-medium term according to its current Technology Strategy Board-supported business strategy.</p>			

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Cheyney Research Limited (Cambridge X Ray Systems)	Development of a Prototype Carbon Nanomaterial Advanced Xray Source	£33,000	£24,750
Project description - provided by applicants			
<p>Xray sources are ubiquitous. Conceived more than a century ago, they are found in airport luggage scanners and hospital wards; they are common place in electronics validation equipment, and are essential to foreign body detection systems in the food and pharmaceuticals industries.</p> <p>Most systems, however, employ thermionic sources that operate at high temperatures, are inefficient, cannot be pulsed rapidly. In contrast, field emission sources are efficient, operate at room temperature and respond almost instantaneously in time. Nevertheless, despite many technological advantages, field emission sources have yet to be widely adopted due to inherent fundamental material limitations.</p> <p>Nanomaterials, an emerging class of materials measuring less than one thousandth the width of a human hair, are capable of resisting such aggressive conditions. In the Cambridge Xray Systems feasibility study a nanoengineered prototype Xray source, grown atom-by-atom, will be developed.</p>			

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Composites Evolution Limited	Fire-retardant bioresins for sustainable aircraft interiors (BioAir)	£29,729	£22,297
Project description - provided by applicants			
<p>The objective of the BioAir project is to develop bioresin based composites for application in aircraft interior components. Currently, these industries use phenolic resin that is known to be toxic and have severe health hazards to operators. The new composites with bioresin will provide social and environmental benefits.</p>			

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DZP Technologies Limited	Laser assisted graphene patterning	£32,850	£24,638
Project description - provided by applicants			
<p>The emerging graphene industry is now producing its first generation of products and prototypes. However, many of the potentially outstanding applications of graphene remain unexploited because of the lack of reliable, industrial processing methods for the integration of graphene into functional electronic, optical, and sensing devices.</p> <p>This project aims to develop a new graphene deposition method, using our laser transfer technology to produce graphene patterns of high resolution and high purity. Such patterns may find applications in miniaturised electronics, ultra-sensitive sensors, RF transistors, ultra-high frequency computing, integrated circuits, logic, and memory.</p> <p>Our technology offers a unique solution which may help develop the graphene supply chain by providing a critical link for graphene processing, bridging the gap between graphene manufacture and end users.</p>			

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E4 Structures Limited	Development of low embodied energy, lightweight, 3D honeycomb structures from hybrid Composite Materials as a direct replacement for oil based polymers in product manufacture.	£32,900	£24,675
Project description - provided by applicants			
<p>This project will develop innovative composite materials formed from sustainably derived materials. There is significant innovation in the use of novel binders (inorganic silicates and geo polymer binder technology), fillers (straw or recycled glass fibre). Products will have reduced materials costs, higher technical performance and a low embedded CO₂ as compared to current materials. E4 Structures is an established manufacturer of structural composite components with expertise in materials development. They have identified both a clear market need and potential customers for this new technology.</p>			

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Glass Technology Services Ltd (GTS)	ACCES-LS	£33,000	£24,750
Project description - provided by applicants			
<p>GTS will develop an advanced glass-based laser rod design, offering significant reductions in size, weight & power requirements compared to current sensor technology at <50% the cost. The thermal conductivity of laser glass is ~7% of a YAG crystal rod, as such conventional glass laser rods experience excessive heating during continuous use, leading to thermal lensing effects & damage to coatings, restricting glass to lower power outputs for given repetition rates/laser designs.</p> <p>The 'Advanced Composite Core-clad Eye-Safe Laser System', ACCES-LS improves the thermal conductivity of the laser rod, offering a step change in performance, with potential to revolutionise the eye-safe imaging market.</p>			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Highland Biosciences	Flexible Piezoelectric materials for diagnostic devices	£32,529	£24,397
Project description - provided by applicants			
<p>This project will examine the use of novel flexible piezoelectric materials in the fabrication of the next generation of low energy devices for diagnosing and managing diseases such as type 2 diabetes.</p> <p>The approach will study the process of manufacturing state of the art flexible piezoelectric devices and develop a feasible manufacturing route to market. New devices based on novel materials that go beyond simple assessment of blood glucose are being innovated. The performance of existing devices will be assessed against the needs of the growing number of diabetic patients looking to manage their disease at home, giving them a new level of convenience and quality of care. The output of this project will be a clear and investable opportunity.</p>			

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Ilika Technologies Limited	Synthesis Optimisation of Lithium Phosphorus Oxinitride (LiPON) from the Elements	£33,000	£24,750
Project description - provided by applicants			
<p>The development of solid state lithium ion batteries is predicted to provide a step change in performance compared to state of the art lithium ion batteries. The benefits of solid state batteries include increased thermal stability, simple construction and increased energy densities. The reduced footprint and increased energy densities of solid state batteries are ideal for powering remote wireless sensors such as those proposed for the ever expanding Internet of Things.</p> <p>State-of-the-art solid state lithium micro-batteries use LiPON as the solid electrolyte. The synthesis of LiPON is only possible via the sputtering of lithium ortho-phosphate targets in nitrogen plasma but this method has serious limitations. This study will deposit thin films of LiPON with demonstrable control over the ratio of nitrogen to oxygen incorporated into the films and ion conductivities comparable, or superior to those of materials prepared using state-of-the-art deposition methods.</p>			

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In-Cycle Ltd (lead) CCm Research Limited	Advanced Leather Polymer Composites	£33,221	£24,916
Project description - provided by applicants			
<p>The project will aim to create new Leather Polymer Composite (LPC) materials through the utilisation of two green chemistry technologies; Supercritical (SC) CO₂ and Biopolymers.</p> <p>The main objectives are to explore the potential of SC CO₂ assisted polymer extrusion to: i) create a light weight and breathable composite by utilising SC CO₂ as a foaming agent; ii) generate enhanced mechanical properties via improved fibre to polymer bonding; iii) improve the compatibility of bio-derived polymers and leather fibres.</p> <p>These innovations will attempt to create a low cost and environmentally friendly alternative to bonded and artificial leather. Providing the possibility to utilise the majority of leather waste generated in the UK into a material that will be fully recyclable.</p>			

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Integrated Materials Technology Limited	Second Generation Structural Composites (SGSC)	£33,000	£24,750
Project description - provided by applicants			
<p>The mechanical and deformation properties of any material are determined by its microstructure. Traditional structural fibre composites, which have aligned continuous fibres, are very difficult to form because their relatively inextensible fibres dominate the properties of the materials. This creates serious processing problems and safety and maintenance issues in use.</p> <p>This project will explore the feasibility of producing thermoplastic composites composed of discrete fibre domains, which may be dimensioned to provide a wide range of mechanical and deformation properties. If successful, the resulting Second Generation Structural Composite (SGSC) materials will enable easier, more rapid forming of complex shaped parts, which will reduce composite manufacturing costs, extend the use of composite materials in a wider range of applications, and bring safety and maintenance advantages to the end user.</p>			

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Keronite International Limited	White Inorganic Coatings for Satellites (WICoSat)	£31,950	£23,950
Project description - provided by applicants			
<p>A white coating with low and stable solar absorptance is required for thermal shield applications on the satellite exterior surfaces. White paint has been used with limited performance in extreme space environments such as UV, radiation, adhesion, outgassing, contamination, extreme thermal and operational loads over a 15 yr mission lifetime. Transparent anodising of aluminium alloys is used also with limited performance.</p> <p>Recent trials by Keronite shows, the use of high voltage plasma discharges and unique electrolyte formulations in the Keronite process also allows the formation of optically white coatings on Al-alloys. The proposed study will investigate the feasibility of developing the existing knowledge to create white ceramic coatings with low and stable absorptance value on aluminium alloys and CFRP.</p>			

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Kwikbolt Limited (lead) Beckett MIM Limited	The development of managing steel components within the aerospace industry using an adapted metal injection molding process	£24,250	£18,187
Project description - provided by applicants			
This technology inspired innovation competition is for a feasibility study into the possibility of producing an advanced material by the process of additive manufacture. Resulting in a production process that is able to provide a more competitive product that maintains exceptional properties more efficiently with less wastage and reduced energy consumption and emissions.			

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Medibord	Feasibility study into the experimental application of advanced materials to reduce radiation backscatter in the high value radiotherapy planning and treatment market.	£33,000	£24,750
Project description - provided by applicants			
<p>Cancer Research UK has revealed that in the UK alone in 2013 there were in excess of 330,000 cancer diagnoses. X-ray CT, MRI and Linac systems are widely used in cancer radiotherapy planning and treatment.</p> <p>Medibord Ltd produces patented radiotherapy positioning products which are used by healthcare professionals worldwide to accurately and reproducibly locate and treat a patient's cancerous cells which is critical for effective treatment. Based on technical and market research Medibord has identified a potentially significant product enhancement which could further enhance the long term outcomes for patients by ensuring that additional radiation exposure does not occur as a result of imaging and treatment. This additional radiation is responsible for secondary cancers in a number of cases.</p>			

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MICROPPLY LIMITED	Outdoor surface marking 3D thermoplastic printer - for printing 'invisible' electronics and surface coding 'tags' for machine reading (by cars, and smartphones used by partially blind/sighted)	£33,000	£24,750
Project description - provided by applicants			
<p>Surface Markings applied to asphalt give facilities owners ability to construct safety, education, and advertising in prime locations, leading to global opportunities in playgrounds, car parks, road safety markings. A \$50bn industry, employing 250,000 people.</p> <p>Current systems typically apply as thermoplastic bonded to surface using a naked flame. This gives variable results, is unsafe, and banned in underground applications /confined spaces. This project develops the world's 1st outdoor ground marking 3D printer system capable of printing ultrathin markings; which can be 3D print-coated/embedded with machine readable electronics (tags).</p> <p>Tags will be readable by 1bn cars and 0.28bn partially sighted pedestrians, enabling them to 'see' curb edges, road markings, etc. Key challenges are, speed of heating, material choice, effectiveness of 3D printed electronics. A demonstrator system will be built to show the system in operation.</p>			

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NDT Consultants Limited	Weld Assessment using Infrared Thermography (WAIT)	£32,294	£24,220
Project description - provided by applicants			
<p>Because of the lack of an efficient NDT technique that is able to evaluate high volume of welds in a production line, the welding and assembly industries still rely on the old destructive ways to inspect welds. These methods inspect only a very small fraction of welded parts and the latter are usually discarded along with a whole batch of parts where a faulty weld has been identified, making the method very costly to the industry.</p> <p>This project investigates application of Infrared Thermography to inspect resistance welds. Given the advantages of Infrared Thermography that are contactlessness and high speed, the project output will enable faster and automated weld inspection, leading to higher volume of inspected welds. It has therefore the potential of making significant cost savings to the industry and improving safety. NDTC will conduct investigations to find the best ways to apply thermography in order to identify critical weld defects.</p>			

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Oxford Advanced Surfaces Limited	Adhesion Promotion for Semicrystalline Thermoplastics	£33,000	£24,997
Project description - provided by applicants			
The project will develop novel spray applied adhesion promoters for use on high end thermoplastic materials such as PEEK and PPS for use with commercial epoxy or polyurethane based coatings, paints or adhesives.			

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Picofluidics Limited	High deposition rate superfill copper	£27,674	£20,756
Project description - provided by applicants			
<p>3-D Integrated circuits, utilizing vertical metal inter die connections, will ultimately provide improved system performance, smaller form factor and reduced cost when compared to current largely 2-D device formats. They enable the stacking of homogeneous or heterogeneous devices in a small package which in turn will open up many new applications.</p> <p>Currently the cost associated with the fabrication of the vertical Cu connections called Through Silicon Vias (TSVs) is limiting the adoption of this technology. Approximately 50% of the cost of the formation of an advanced TSV is associated with the Electrochemical Deposition (ECD) of Cu and the field Cu removal step. We aim to substantially increase (>2x) the deposition rate of the ECD Cu by improving the transport kinetics within the high aspect ratio vias. Cost reductions achieved by this advance will help make TSV accessible for more applications.</p>			

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Seacoustics Limited	The Feasibility of Constructing COSHH Compliant Sensors from Eco-Friendly Materials	£33,249	£24,937
Project description - provided by applicants			
<p>Today, sensors are still being designed using hazardous, lead zirconate titanate piezoelectric ceramic (PZT).</p> <p>This project is to examine the feasibility of replacing PZT with eco-friendly materials. The study will evaluate the performance which can be obtained from a number of alternative materials. It will then proceed to prototype and evaluate several sensor designs, initially aimed at the civil engineering application to monitor and control excavation and tunnelling operations in confined sites.</p> <p>The objective is to encourage UK Industry to prepare for the certainty that PZT, which is exempted from current legislation, will become prohibited in the foreseeable future. The innovation in this project is the concept that eco-friendly materials can be used to replace lead-containing materials, whilst still providing a satisfactory performance for the many different markets required.</p>			

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Sedgetech	Graphite for High Tech Industries	£19,460	£14,565
Project description - provided by applicants			
<p>Sedgetech's funding from the Technology Strategy Board allows a feasibility study to examine extraction and purification of graphite from waste materials. High purity and large crystal size graphite underpins a number of important development areas (Li ion batteries, super capacitors, exfoliated graphene) and hence demand is driving price as natural resources are scarce. Other countries are investing in graphite extraction from minerals sources (Norway, Finland, Canada) but UK lacks a natural supply, hence investment in recovery from waste makes sense to satisfy this increased demand.</p> <p>Building on current technical knowledge, Sedgetech will provide samples of refined graphite to end-users for assessment and for the development of specifications. The information provided from this feasibility study will allow investors to make an informed decision when funding exploitation of this opportunity, providing new jobs and growth for the UK.</p>			

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Things3D Limited	Anti-counterfeiting 3D Printed Products using Quad-Band Covert and Overt 3D Printed Authenticating 'Tags'	£32,805	£24,604
Project description - provided by applicants			
<p>Traditional anti-counterfeiting measures usually involve hard to copy labels (hologram or DNA). This is simple when products are made in factories under common control. But, with advances in 3D printing - the future may see IP owners license a large distributed network the 'right to create' one, or a number, of a particular product from a media file adapted to control 3D printer. The challenge for IP rights owners is how to integrate tagging to aid anti-counterfeiting and enable supply chain participants to authenticate/ verify provenance of 3D printed products.</p> <p>We investigate feasibility of using advanced materials to 3D print a tri-band tag system which will do exactly that, embedding tags that can be read/written to. Key challenges are, validating materials of tri-band tag options, methods for read/write to 3D printed materials, and performance of tri-band tags. Demonstrators will be built. Counterfeiting is estimated as a USD\$1.7trillion threat by 2015 - amplified by 3D printing.</p>			

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Zagres Limited	Feasibility Assessment of a New High-Efficiency Flexible Perovskite Solar Cell Technology for Use in High-Volume Consumer Electronics Applications	£32,863	£24,647
Project description - provided by applicants			
<p>The project aims to study, assess and quantify the technical and commercial feasibility of a newly developed Solution-Processed Sintered Nanocrystal (SPSN) perovskite technology demonstrated on 0.3 cm² cells with record efficiency of 15.1%. The technology promises applications in high-volume consumer electronics and electricity generation from glass windows.</p> <p>The SPSN technology reduces Titanium material use by x100 and enables the fabrication of perovskite solar cells on flexible substrates such as polymers. This can potentially reduce the cost of solar cells to 30% of today's commercially available Silicon-based products, enabling far greater applications to benefit from the solar energy.</p>			