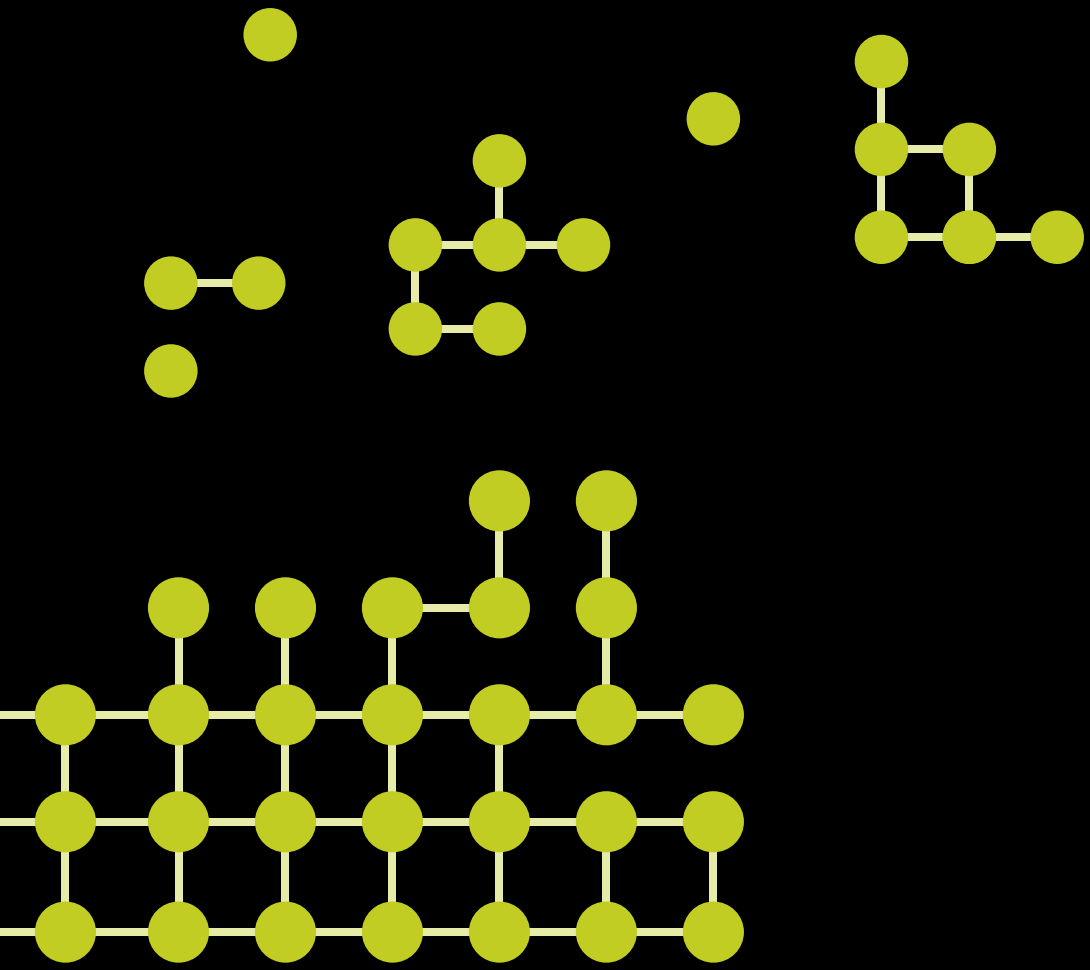
Technology Strategy Board
Driving Innovation

Collaboration Nation

Technology-inspired feasibility projects



Disclaimer

The entries in this directory were provided by the individual companies. The Technology Strategy Board cannot guarantee the accuracy or completeness of any of the information about the winning projects.

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Introduction

This directory of feasibility projects we helped to fund provides an overview of the opportunities highly innovative small companies can offer across the UK through their developing technologies. It can also be used to help link those companies to the wider funding community to develop their ideas into new products, processes and services.

Technology-inspired feasibility studies

Nearly two-thirds of commercial innovation stems from small companies and they are a vital source of wealth-generating new products. In January 2011, we launched a competition for technology-inspired feasibility studies. We wanted to stimulate innovation across our core technology areas and help to ensure that small and micro businesses across the UK are well-equipped to respond to society's current and future challenges.

We invested £2m in 91 projects across six areas: advanced materials; biosciences; electronics, photonics and electrical systems; high-value manufacturing; information and communication technology, and nanotechnology.

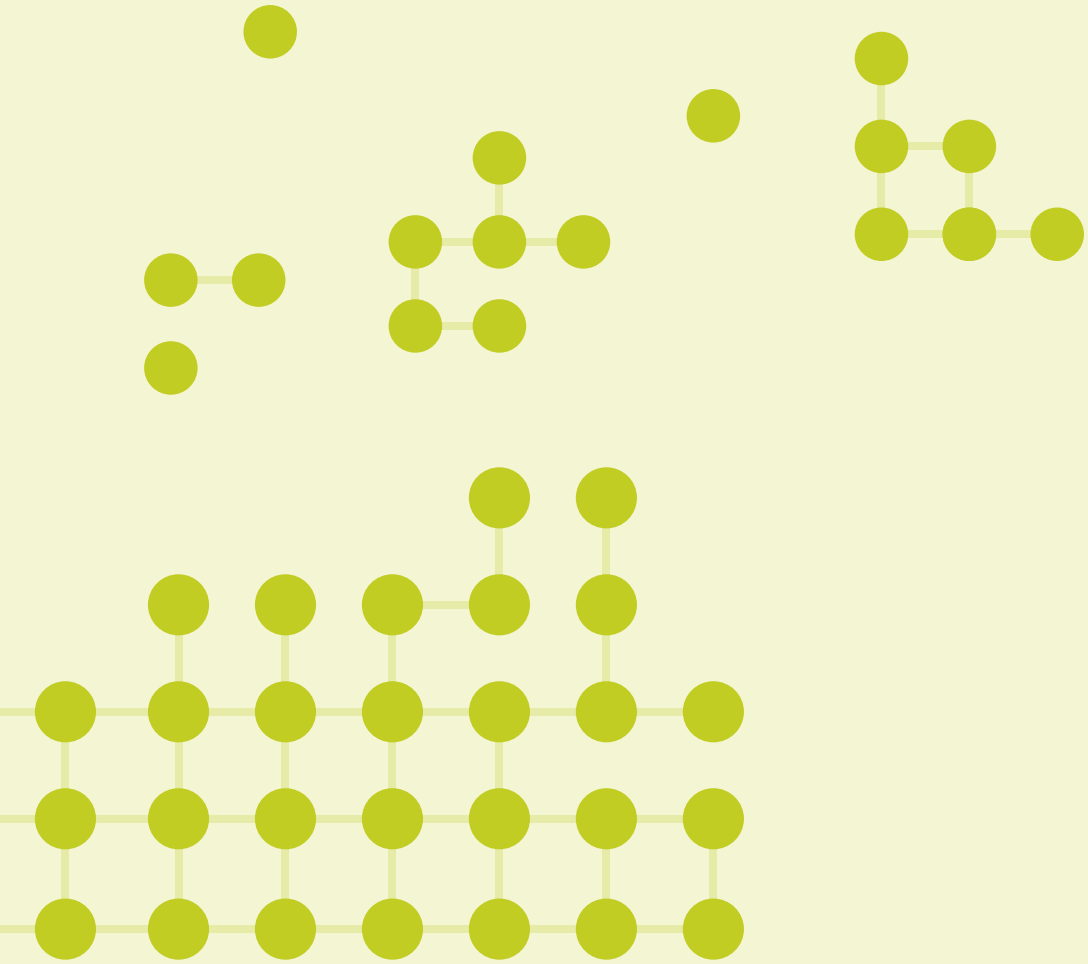
Studies lasted up to three months and we invested up to £25k in each project. Some projects were conducted by single companies, while others were carried out by collaborative consortia.

Footnote

This directory provides a snapshot of the winning projects and companies so that potential future collaborators, investors and companies interested in open innovation can get to know the companies involved.

Index of companies

Advanced Materials



Altrika Ltd

Advanced surfaces for improved therapeutic research and manufacture

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Altrika is a regenerative medicine company providing advanced therapies utilising human cells and next generation materials. As well as manufacturing cell products (Myskin and Cryoskin) for skin regeneration, we specialise in novel material discovery and development of life science tools.

What was the business need that motivated the project?

The culture and harvest of stem cells for R&D and therapeutics is a rapidly expanding area. While there has been much attention on understanding the biological systems and growth media, there has been less focus on optimising materials for particular applications. The £300m consumables market for stem cell research is under-served by reproducible, effective products which optimise cell-material interactions.

What approach did you take to address the challenge?

Cultivating and harvesting cells in laboratories invariably requires use of plasticware. To harvest cells, they must be removed from the surface by enzymatic or physical means, neither of which is desirable. In addition, cells may be adversely influenced by a non-defined culture surface. We can improve cell yields by using novel materials, rather than damaging enzymes, to aid the release process. Knowing the surface composition allows improved control over cell-material interactions.

What are the potential benefits?

Most cell culture consumables are not optimised for a particular application and are provided by non-UK companies. There are areas in which the UK can now take a lead in advanced materials fabrication, specifically: improved cell yield to reduce time and cost associated with culture; control of cell differentiation and potency; passive cell harvesting to maintain a healthy population; and a chemically defined material suitable for regulatory approval.

What are the next steps?

We have achieved successful surface development and characterisation for a particular cell population. We will now evaluate prototype materials in academic and commercial R&D environments to generate a data set of application notes. Further funding and recruitment of key development partners will accelerate manufacturing scale-up and revenue generation.

Bluefrog Design Ltd

Ultra-flat substrates for high-performance rotating dynamic seals for high-value markets

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Bluefrog Design is a product design business with particular expertise in developing innovative water control products. We hold more than 17 patents. Our partner in this project, Diamond Hard Coatings holds patents for applying ultra-hard thin layers to substrates.

What was the business need that motivated the project?

A Technology Strategy Board 2010 feasibility study established proof of principle for construction/design of novel tap header cartridges (domestic rotating seal) incorporating aeration but the alternative (low embodied energy) material for disc construction did not offer sufficient lifetime. Current technology ceramic discs are relatively costly owing to high embodied energy and are bulky, with excess materials in cartridge and tap body.

What approach did you take to address the challenge?

We addressed the lifetime issue by investigating materials which: were capable of forming sealing surfaces in rotating seals; suitable for application of ultra hard coating to offer the required wear characteristics; required less energy and material input; and were cheaper to manufacture. All this involved researching potential materials and surface preparation techniques as well as surface conditioning and measurement, deposition, bench trials and technical evaluation against sector performance criteria.

What are the potential benefits?

Our technology will not only enable manufacture of recyclable long-life domestic rotary seals without need for high-energy embodied ceramics, but also reduced material use in cartridge and tap manufacture with thin seals. The annual UK domestic and industrial new tap market is 11.25 million units; 10 million use header cartridges. The unit price is around £1.50, making the UK market £15m annually, while in Europe it is £100m and globally £0.5bn.

What are the next steps?

Further work is needed on optimising patterning to minimise friction, defining the level of surface finish required to maintain lifetime seal integrity and also the thickness of coating to maintain seal integrity over a commercially acceptable lifetime. We are looking at a commercialisation agreement with a manufacturer of cartridges or domestic/commercial taps.

Curar Animal Therapeutics Ltd

How can we attach devices to hairy surfaces?

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Curar Animal Therapeutics was formed in November 2010. We focus on the development, manufacture or assembly, and sale of products in the veterinary sector.

What was the business need that motivated the project?

Animal healthcare is a high-value growth market. While medicines and foods remain the dominant proportion of revenues, there is growing use of medical devices. However, to be effective these devices must remain attached to animal hair and skin. We wanted to understand how we could improve current methods and ultimately produce a range of animal-specific products.

What approach did you take to address the challenge?

Our aim was to test different ways of safely and effectively securing a device to an animal. There is little information available on this topic in current literature so we used modified industry standard methods to test the performance of various adhesives on animal hair/hide. This allowed us to identify different features that influence adhesion and that could potentially enhance performance.

What are the potential benefits?

The output from this study has increased our knowledge of how adhesives perform on animal hair and this has greatly assisted in formulating an 'animal adhesive' specification. This information has led us to novel designs that we believe could potentially generate a competitive advantage through an animal-specific range of products that have superior performance compared with competitors.

What are the next steps?

In order to progress this further, we intend to continue our investigation to establish how different adhesives and designs perform on different types of animal hair/fur/hide. Once these are completed, we will generate working prototypes to combine the design and adhesives features that we believe will enhance performance.

EPL Composite Solutions Ltd

The conversion of waste construction bags and recycled polymers into oil spill remediation materials

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EPL Composite Solutions specialises in the application of advanced polymer composite materials. Our business covers research, design, development and prototyping of novel products and processes across a wide range of industries including transport, utilities, energy and infrastructure.

What was the business need that motivated the project?

Some 230,000 litres of oil are spilt accidentally in the UK (8 million gallons in the US) and the market for remediation materials is worth £1.4bn and growing at 25%. The partners previously developed 100% recycled fibre materials that could be re-formatted for this industry. We since identified an opportunity to re-process the materials into secondary fuel sources after deployment.

What approach did you take to address the challenge?

Our challenges were to devise optimum material formats for oil adsorption and a re-processing method to convert spent materials into industrial fuel sources. We manufactured several prototypes from various waste streams for sorbency tests and devised a consolidation method based on vacuum moulding. We ignition-tested reprocessed materials which exhibited calorific values comparable to coal (20-30MJ/kg). A techno-economic evaluation confirmed three material formats to be viable compared to commercial counterparts.

What are the potential benefits?

They are that 100% UK recycled materials could be used to remediate accidental oil spills instead of hydrocarbon-based virgin materials, reducing virgin production and associated environmental burden. A 5% market uptake would be worth £70m and commercialisation would create jobs and wealth in the UK. Re-use of deployed materials as fuel sources would also save virgin energy use. Commercialisation is now possible within the next year.

What are the next steps?

The partners are seeking further funding of up to £250k to scale up the technology, where we anticipate technical and economic viability. Our aim will be to commercialise a range of 100% recycled oil spill remediation materials within a year and to attract major clients with the enhanced environmental credentials.

Fibre Extrusion Technology Ltd

Enabling technology to make enhanced performance absorbable yarns with potential uses in surgical sutures, other medical devices and industrial uses

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FET supplies unique know-how and process solutions for making filament yarns and fabrics from synthetic absorbable materials, used in the manufacture of surgical sutures and other medical devices. Our customers include four of the world's five largest suture manufacturers.

What was the business need that motivated the project?

Our international healthcare customers tell us of a clear business opportunity. The market wants products that increase quality of life for an ageing population. These customers are asking for performance leaps to enable them to differentiate their surgical and medical product ranges. Specifically, some seek to make absorbable suture materials with physical properties 30%-50% superior to present levels.

What approach did you take to address the challenge?

We aimed to prove the feasibility of satisfying these customer requirements for enhanced suture yarns, by using our own advanced polymer mixing, extrusion and spinning technologies. This is in conjunction with a novel drawing process which minimises damage from excessive heating. During the study, tenacity results were achieved some 40%-80% higher than the normal achievable range using absorbable PGA polymers.

What are the potential benefits?

We estimate that the study outcome, followed by two to four years' further work to commercialise for suture applications, could realise some £7m-£10m of income to us in the period 2016 to 2018 in the form of sales of know-how and equipment. The enabling technology also has potential for use in a number of medical device healthcare applications where very high strength and bio-absorbability is required.

What are the next steps?

We have data for a further programme of work to define, specify and build a pre-production prototype of our technologically innovative process. With additional funding of £200k we can complete this within two years, avoiding cash flow limitations. We will seek a grant for R&D from the Technology Strategy Board.

M Wright and Sons

Feasibility of using 3-D woven engineering-fibre sections for concrete reinforcement

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M Wright and Sons is a technical-textile company employing 49 people in the manufacture of high-performance woven narrow fabrics. We use specialist fibres – carbon, aramid, glass, polyamide and polyester – to supply the safety, medical, aerospace, military and composite reinforcement industries.

What was the business need that motivated the project?

The opportunity exists to establish the feasibility of using a fibre and textile-based technology for woven 3D structural engineering fibre reinforcement pre-forms in concrete and composite beams and structures. This would improve long-term structural integrity and reduce material degradation in the construction and nuclear industries. Relevant fibres for this process are, for example, basalt, carbon, Kevlar® and glass.

What approach did you take to address the challenge?

We created the pre-forms using a unique 3D computer numerical control (CNC) loom capable of weaving 'T', 'I', 'U', 'Top hat' or circular cross-sections which can be tapered and bent. The loom has a novel computer-aided design and manufacturing (CAD-CAM) front end to ensure that sections reflect performance criteria and can be designed to customer-specific criteria. We have successfully produced and tested concrete and composite beams with woven glass fibre I-sections.

What are the potential benefits?

This innovation has the potential to replace steel as reinforcing for concrete in a market where global demand exceeds £100bn. Existing pultruded glass-reinforced composite concrete-reinforcing bar is 33% more expensive and has a density of 25% of the steel equivalent, so this technology offers a 67% cost reduction. Allowing for additional processing and strength-to-weight ratio adjustment, this leaves a high value-added gap to assist its adoption and use in construction.

What are the next steps?

We will undertake further trials with different fibres and sections to reinforce concrete and composite beams and other products, together with extensive independent testing to produce a demonstrator as a precursor to commercialisation. We have proposed this as part of a full Technology Strategy Board ICT manufacturing and construction application.

M Wright and Sons

Step change in the flame-retardant properties of polyester textile webbing

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M Wright and Sons is a technical-textile company employing 49 people in the manufacture of high-performance woven narrow fabrics. We use specialist fibres – carbon, aramid, glass, polyamide and polyester – to supply the safety, medical, aerospace, military and composite reinforcement industries.

What was the business need that motivated the project?

Spray-on flame retardant on polyester webbing for fire-fighting breathing apparatus degrades with use and washing but professional equipment of this type uses webbing costing an order of magnitude higher than conventional products. What is required is a low-cost, non-halogen fire retardant, capable of mixing with polyester. Other halogen-based fire retardants do not perform adequately in harsh fire environments.

What approach did you take to address the challenge?

In proving the feasibility of creating comparable fire-retardant polyester yarn and textiles, our innovation was the use of a patented non-halogen fire-retardant powder. We undertook mixing and extrusion trials and harsh fire tests in order to identify a suitable polyester that would mix at an appropriate temperature with the fire retardant chemical. The fire tests were successful and we have identified suitable polyesters to produce weavable yarn.

What are the potential benefits?

Process cost savings would increase our net margin from 10% to 31% in the UK market for fire fighting breathing apparatus webbing. That market is worth around £1m, of which we enjoy a 30% share. The global market is valued in excess of £12m. We would have access to wider markets worth £100m for aerospace, automotive and other transport systems and £300m-plus in domestic and industrial seating and soft furnishings.

What are the next steps?

We will undertake further trials with different grades and blends of polyester to take this proof of concept to the laboratory-tested prototype stage. We need to produce a demonstrator, with independent testing and trials, and we have already identified an EU polyester yarn bulk producer for a commercialisation project.

Master Technologies Ltd

Incorporating novel semi-conducting nano particles into anti-counterfeit and security textile fibres and yarns

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Master Technologies Ltd is a small private business based within the Polymer Centre for Industrial Collaboration at the University of Bradford. We are a research and development company specialising in novel textile fibres for high value end uses.

What was the business need that motivated the project?

We identified recent advances in the development of novel semi-conducting nano particles which could produce unique properties if incorporated within textile fibres. These properties could offer very high levels of anti-counterfeit protection and also have potential use in security/military textiles.

What approach did you take to address the challenge?

Utilising currently available, analytical grade, semi-conducting nano particles and using the knowledge and experience of our team, we investigated ways of incorporating these particles within a range of different textile polymer types. Following this feasibility study, we aimed to move on to production of sample textile fibres and the testing of these fibres for end use suitability.

What are the potential benefits?

Textile fibres and yarns incorporating the novel properties of these nano particles will have huge potential for use in brand protection and anti-counterfeit operations for a wide range of textile and textile-related products. With estimated losses from counterfeit textile products currently in excess of £300m annually, this technology could at least halve supply chain counterfeits.

What are the next steps?

Following successful completion of the feasibility study we will prepare a development plan for commercial production of a range of unique multi-filament textile yarns. We will focus initially on the anti-counterfeit market, approaching major global brands.

Nonwovens Innovation & Research Institute Ltd

Advanced fibrous composite material for the selective binding of antibodies (SelBindA)

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NIRI Ltd is a University of Leeds spin-out company formed in 2005 and employing 20 people. We specialise in development of commercially viable nonwoven products and offer technical support to businesses across many sectors, including medical, filtration, construction and automotive.

What was the business need that motivated the project?

Current blood filtration devices are not designed to remove harmful antibodies from donated blood products. A filter that could selectively remove antibodies would reduce the risk of serious adverse reactions to transfusions. After initial development of new generation blood filters using NIRI's patented Hydrospace technology, we identified further market potential for this technology in the blood filter market.

What approach did you take to address the challenge?

Our project team have delivered a step change in the development of a new generation of blood filtering products. Employing NIRI's Hydrospace technology within the fibrous filter structure provided a medium in which to house the antibody binder and also enabled the binder to be evenly distributed across the fibrous structure. That maximised its ability to capture antibodies from blood components.

What are the potential benefits?

We have proven the feasibility for a filter that reduces the level of specific antibodies in blood components. In addition to clinical benefits this would also reduce logistic expenses incurred by global transfusion organisations. The blood pack filter market in the UK is worth £18m; globally it is more than £500m. A viable filter in the market would generate licence income for NIRI, creating employment opportunities.

What are the next steps?

To develop these positive results into a commercially viable product, we will seek funding to address four key areas. These will be to optimise effective antibody removal and retained blood component quality, to optimise filter component costs, to scale up manufacture and to ensure the filter obtains Marketing Authorisation Approval.

OJ-Bio Ltd

Biosensors for the detection of matrix metalloproteinases to monitor wound healing in clinical settings

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OJ-Bio Ltd is a joint venture between UK nanobiotechnology specialists Orla Protein Technologies Ltd (www.orlaproteins.com) and Japanese electronics and communications company Japan Radio Company (www.jrc.co.jp). We make diagnostic devices and sensors allowing the rapid measurement of disease markers.

What was the business need that motivated the project?

Impaired wound healing is a serious medical problem. A key contributor is an overabundance of matrix metalloproteinases (MMPs) in the wound. Monitoring the level of MMPs provides a clear predictor of how wound healing will progress and allows the clinician to begin a course of treatment. This in turn reduces hospital stays and treatment times, with clear economic benefits.

What approach did you take to address the challenge?

We designed a 'reporter' protein with the following characteristics: oriented, covalent attachment to biosensor surface; accessible cut sites specific for MMPs; and large mass released upon cleavage by MMPs. We assembled this on our sensor device, and demonstrated that loss of mass from the surface could be easily monitored. Both MMP2 and MMP9 showed specific release of protein from the SAW surface, with concentration-dependent signal.

What are the potential benefits?

Current tests cannot always determine the reason for non-healing in an optimally managed wound. Our development of specific diagnostic tests for use in wounds has the potential to revolutionise their treatment. For maximum benefit, these tests need to provide objective support for treatment decisions. This will help to improve standards of wound care and aid the cost-effective use of limited resources.

What are the next steps?

We have already begun to approach potential partners and customers and hope that this small R&D study, which we could not otherwise have funded, could lead to significant commercial developments in the near future. We welcome approaches from any interested partners.

PJH Partnership Ltd

New materials for power storage

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The PJH Partnership specialises in process and materials development based on the application of supercritical CO2 and superheated water. We have worked across a range of industries as a contract R&D business since 1998, with four staff and annual turnover of £350k.

What was the business need that motivated the project?

The ability to store power created by intermittent generators, such as solar and wind, will considerably improve their all round efficiency and costs, widening their market and rate of uptake. Any storage unit needs to be easily deployed yet retain flexibility and rapid delivery of stored energy. We believe that our novel approach will result in such a unit.

What approach did you take to address the challenge?

Our approach has been to utilise the thermodynamic characteristics of supercritical CO2. Spare energy from an intermittent power source has been used to transform CO2, initially held on a stable substrate, into its supercritical state. The supercritical CO2 acts as an energy reservoir released via a turbine. Keeping the CO2 above its critical point minimises energy loss, and recycling via the CO2 sequestering substrate develops an efficient closed loop system.

What are the potential benefits?

Our system can be used to store non-peak power produced from a wide range of intermittent generating systems, so improving their efficiency. This method of power storage is flexible and potentially applicable to a wide range of intermittent generators ranging from domestic to medium-scale industrial uses, increasing their range of application.

What are the next steps?

We need to further develop the intermediate CO2 storage material to optimise its high-pressure performance and build a pilot unit capable of demonstrating the practical application of the basic system, its cost and flexibility

RepRegen Ltd

Hypoxia mimicking bioactive glass for hard-tissue regeneration

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RepRegen is a medical device company. We develop products to repair and regenerate tissue in the body.

What was the business need that motivated the project?

Development of a cobalt-containing synthetic bone void filler (BVF) hypothesised to stimulate the hypoxia pathway and thus angiogenesis, can aid more rapid formation of higher quality bone. The unique selling points are that it acts via a mechanism not currently exploited by other BVFs and it can help repair large bone defects, an indication for which no BVFs are currently licensed.

What approach did you take to address the challenge?

We conducted a feasibility study to investigate the properties of cobalt-doped bioactive glasses (ion release, dissolution and in vitro toxicity). On the basis that cobalt is known to stimulate wound healing via cellular processes influenced by the hypoxia pathway, we investigated a range of glass compositions and particle sizes to identify a glass that delivers the required amount of cobalt for it to be therapeutic and non-toxic.

What are the potential benefits?

The bone void should heal more rapidly as the newly formed blood vessels will transport essential nutrients for bone regeneration. The unique mechanism of action should enhance the performance of this product over synthetic BVFs and they will be cheaper and less risky to use than biological growth factors. The overall benefit to patients will be faster bone regeneration, reduced recovery and hospital time and less pain.

What are the next steps?

Now that the viability of the formulation has been determined, we will need to determine the impact of cobalt concentration on cellular effects, gene regulation, bone formation and bone metabolism. Once the physicochemical properties are well understood, we will be able to test the candidate glass compositions in vivo.

TISICS Limited

Manufacture of a prototype titanium metal matrix composite steam turbine final stage blade

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TISICS was spun out of QinetiQ in 2005 and employs 11 staff. We manufacture lightweight silicon-carbide-fibre-reinforced titanium composites (TMCs) for high-performance applications in aerospace. We are targeting expansion into other markets such as energy, oil and gas and space.

What was the business need that motivated the project?

Power plant final stage steam turbine blades are long, with high tip speeds to maximise residual energy extraction. They are typically manufactured from steel. We aimed to demonstrate that such a blade can be made using TMC, a lighter, stiffer material of comparable strength. Improved stiffness and reduced mass will increase steam turbine efficiency and reduce CO2 emissions.

What approach did you take to address the challenge?

Our task was to fabricate a representative TMC blade that could be tested by a power plant industry partner for comparison with existing R&D data. Our project focused on the challenge of incorporating stiff fibre and titanium foils into a curved, twisted blade. We adopted a novel tooling route to enable this and 'near net shape' production. This was necessary because significant material removal after processing could distort the blade.

What are the potential benefits?

Small increases in blade efficiency result in tonnage reductions in CO2 emissions from fossil fuel power plants. Other benefits for the power plant industry will result from mass reduction, increased stiffness and corrosion resistance of TMC and from improved designs not possible with conventional materials. As the only non-US producer of TMC, we will be able to develop TMC blade manufacturing technology for the UK power generation industry.

What are the next steps?

Our blade will be tested by a UK steam turbine manufacturer to evaluate the technology and its potential. If favourable, we will follow with a larger R&D project to characterise the material for steam turbine use, assess the benefits and the technical and commercial feasibility of TMC blades in steam turbines.

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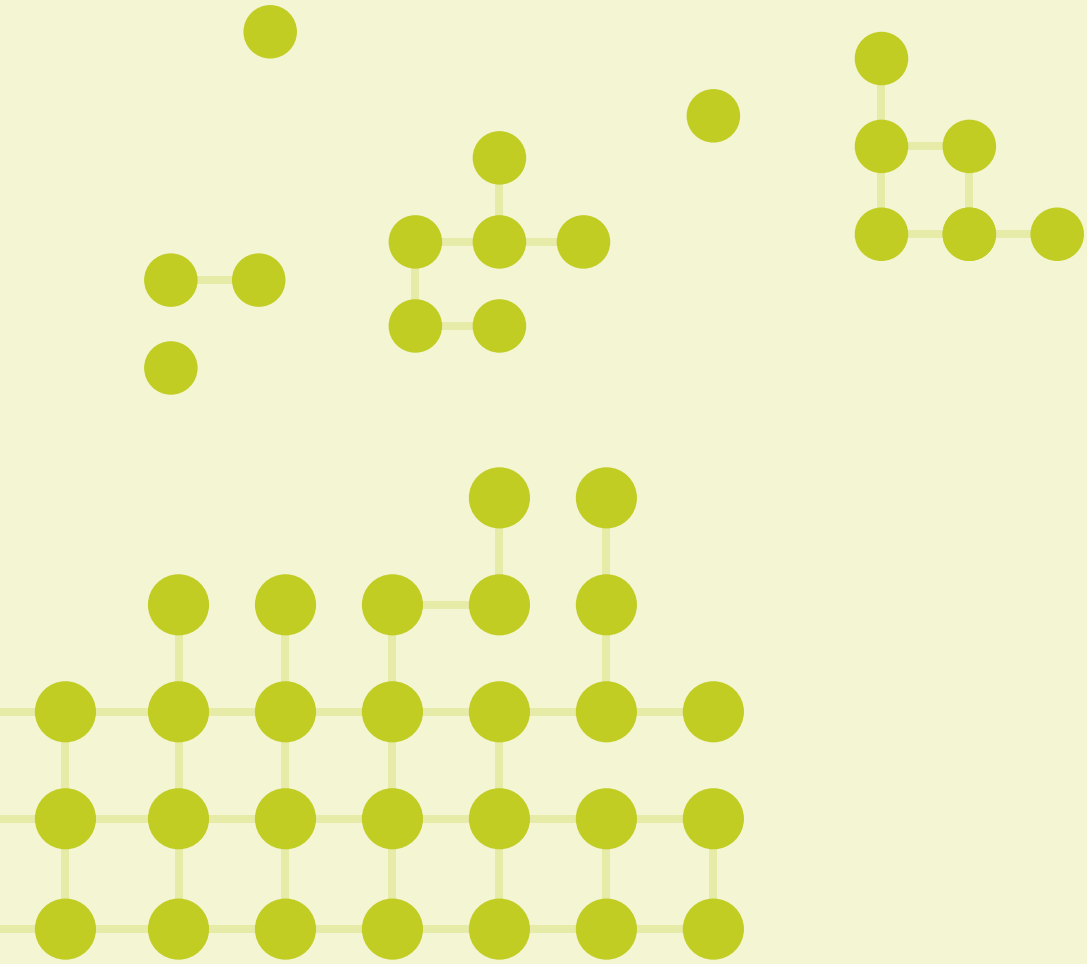
Bioscience



Biopolymer Solutions Limited

Probes for sodium content and mobility

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Biopolymer Solutions provides scientific services, consultancy and training to the food, pharmaceutical, biomaterials and ingredients sectors. We assist with development, through understanding, measurement and manufacture, of innovative biopolymer based materials and processes related to these products.

What was the business need that motivated the project?

There are significant drivers for salt reduction in foods but the first step is an accurate assessment of current sodium levels. Assessment should be quick and suitable for a range of foods. We considered that there was a method available that potentially could do this job and might be exploited commercially.

What approach did you take to address the challenge?

To achieve a commercial test regime required significant collaboration, covering such areas as understanding of food systems, knowledge of the hardware to build nuclear magnetic resonance equipment and programming for Na-23 detection. Joining with Advanced Magnetic Resonances has allowed bespoke construction of equipment that has then been tested and validated within an academic department of food sciences. We have tried our method on products where salt levels are of most concern.

What are the potential benefits?

The equipment works and has benefit at many levels. Compared with other salt detection methods the nuclear magnetic resonance allows simpler and more rapid preparation of samples. Also, the running costs for the measurements are low and do not use environmentally harmful solvents and compounds. So more samples can be measured and this should facilitate good production control. Consumers can use accurate data to make decisions about salt in their diet.

What are the next steps?

We will now undertake validation in the public domain. Food companies will supply samples and values from traditional tests so that we can make correlations and publicise them. Improved software is another focus along with work to improve low-level detection of salt. We need to find a partner for commercialisation.

Cambivac Ltd

Feasibility of applying advanced genomics in a novel approach to vaccine virus attenuation

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Cambivac researches, develops and supplies, under licence, veterinary vaccine know-how or technology to pharmaceutical vaccine manufacturing companies. We use state-of-the-art genomic and traditional virological techniques to provide novel solutions to current global disease challenges.

What was the business need that motivated the project?

We aimed to address the lack of effective vaccination approaches to rapidly evolving viruses such as porcine reproductive and respiratory syndrome virus (PRRSV). We have chosen to evaluate our approach to vaccine virus attenuation in the context of PRRSV as it is one of the most rapidly evolving viruses identified to date.

What approach did you take to address the challenge?

Our study investigated the feasibility of applying state-of-the-art genomic analysis and DNA synthesis techniques to the development and deployment of improved attenuated vaccines for PRRS in the first instance. We would achieve this by identifying a set of 'universal' attenuating mutations. These can be rapidly introduced into emerging virulent strains, using novel techniques with predictable outcomes in terms of their attenuation, vaccine potential and safety.

What are the potential benefits?

PRRSV is arguably the most economically important pig pathogen, estimated to cost global swine producers in excess of $1.5bn annually. These losses are largely the result of a failure to develop and deploy effective vaccines. Our study is a critical step towards Cambivac developing and deploying the approach towards improved attenuated virus vaccines aimed at the control of rapidly evolving viral diseases such as PRRS.

What are the next steps?

Further study is needed if we are to build on the achievements obtained plus knowledge gained and to resolve remaining technical challenges and test improvements to the concept. We would look to combine our in-house expertise with that of a knowledge base provider in a proof of concept study.

DestiNA Genomics Ltd

Novel companion biomarker assay for glioma cancer drug development

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DestiNA Genomics Ltd is developing rapid, high specificity, enzyme-free assays for the direct detection of nucleic acids and their mutations, including micro-ribonucleic acids (microRNAs). Established in 2011 as a spin-out from the University of Edinburgh, we now have eight employees.

What was the business need that motivated the project?

Detection of nucleic acids and their mutations is a rapidly growing market research segment for drug profiling and toxicity. Improved quantitative in-vitro cell based assays are needed by the pharma industry as early routine tests. Developing new in-vitro assays for investigation of anti-cancer compounds through multiplexed microRNA and messenger RNA (mRNA) in faster, better and cheaper formats represents a significant business opportunity.

What approach did you take to address the challenge?

Our approach was to focus on glioma cell lines, to develop a set of specific, high-affinity probes to detect specific micro-RNAs and mRNAs. We then quantified them using our DestiNA Genomics chemical technology against current reverse transcription and polymerase chain reaction (PCR) techniques. Drug response was then profiled using image-based high content analysis of cell viability, apoptosis and cell-cycle phenotypes.

What are the potential benefits?

The development of our prototype cell-based assay is valuable for cancer drug profiling and development, enabling more rapid decision making of drug efficacy across the heterogeneous nature of glioma cancer cells.

What are the next steps?

We are continuing our association with academia to further develop the assay. A full-time PhD studentship is being sought for this. We have also started discussions with a number of pharmaceutical companies to evaluate our chemically-based detection technology.

Enlightened Designs Ltd

Novel flat panel photobioreactor for algae cultivation with enhanced yields

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Enlightened Designs is a technology-led micro-business developing algae culturing systems. These feature novel photo-bioreactors which provide improved parameter control in outdoor systems to increase yields and reduce deployment costs in order to make advanced biofuels a reality.

What was the business need that motivated the project?

Algae has the potential to be a feedstock for large-scale, sustainable biofuel production, though it is difficult to replicate the high yields achieved in the lab in outdoor sytems where it is hard to control parameters at realistic deployment costs. We set out to develop a test-bed for trialling low-cost algae culturing systems and for use as a technology demonstrator.

What approach did you take to address the challenge?

We set out to test low-cost materials and configurations to optimise the design of upscaled panels in a rugged, reliable outdoor system. We constructed a test-bed featuring industrial-spec automation and control to allow outdoor trials of the novel panels in a mobile demonstration unit. This resulted in a 5m^2 flat panel unit, which is the largest and most advanced in the UK and represents an 80-fold upscaling.

What are the potential benefits?

The project represents a significant advancement of our company's capabilities and has brought the technology closer to the requirements of the market, enhancing the prospect of commercialisation. We received a good response from academic partners, exposure in the media and have attracted interest from venture capitalists – vital to rapidly developing the technology, rolling out commercial systems and recruiting staff.

What are the next steps?

To achieve another ten-fold increase in deployed area, vital for commercialisation, we require significant advances in panel production processes and system integration. These are in development, with the goal of creating a pilot plant measuring 100m^2. This requires partnerships with academia, industry plus a suitable venue and funding.

GlycoMar Ltd

Novel nucleic acid detection for determining norovirus levels in food

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GlycoMar is an early stage discovery company, supplying marine-derived glycobiology compounds to the biopharmaceutical industry and developing novel cosmeceutical and nutraceutical ingredients.

What was the business need that motivated the project?

GlycoMar's subsidiary, VeroMara, provides a norovirus testing service to the shellfish industry. There are major shortcomings with the current reverse transcription polymerase chain reaction (RT-PCR) methodology used for this test. We sought to address these through a novel probe-based technology. The project would provide a superior test that would differentiate VeroMara from competitors and open up global market opportunities.

What approach did you take to address the challenge?

Our study examined the potential of a nucleic acid detection method, developed by DestiNA Genomics Ltd. This produced a simplified, accurate and reliable method for norovirus detection in foodstuffs, unaffected by the issues of extraction efficiency and inhibition. The suitability of this technology was evaluated in comparison with the European Committee for Standardisation (CEN) method.

What are the potential benefits?

Our new method has potential to address the two major shortcomings of current methodology: very low extraction efficiency of viral material from food and high levels of inhibition of the detection method (RT-PCR) by the food matrix. The nucleic acid detection method being tested may also be suitable for incorporation in point-of-use rapid testing technologies. If successful, it will be broadly applicable in food, clinical and environmental settings.

What are the next steps?

The project successfully developed highly selective probes for norovirus. The next steps are to develop probe-tagging and signal amplification technology to allow determination of low genome copy numbers in food samples. They will also involve our engagement with possible technology partners for rapid test platform selection and test development.

Ingenza Ltd

Accelerated development of industrial microbes using genome segment assembly (GSA)

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Ingenza is an Edinburgh-based synthetic biology company, a world leader in the adaptation of microbes for industrial use. We develop scaleable industrial bioprocesses, applying engineered microbes for the manufacture of pharmaceuticals, biologics, biofuels, food and agrochemicals.

What was the business need that motivated the project?

Synthetic biology has applications in many products, from high-value biopharmaceuticals to commodity chemicals. Yet optimising expression of a gene remains empirical. Typically, many systems are tested to produce a biocatalyst or biologic efficiently, often taking one to two years. Combining genes amplifies this time frame and cost, with many opportunities lost to competing technologies or not undertaken at all.

What approach did you take to address the challenge?

We evaluated a novel combinatorial gene cloning method, greatly augmenting synthetic biology methods, to produce high-value chemicals and proteins. The study required us to integrate bioinformatics with innovative DNA ligation strategies and high throughput screening. This demonstrated our technology as a predictable tool to achieve efficient gene expression in engineered microbes. The study achieved a high degree of success, exceeding our expectations in this initial application.

What are the potential benefits?

This technology is applicable to all areas of our business, accelerating development of microbes to produce high-value products and oil replacement technologies, which could provide significant returns within three years. The success of our study demonstrates synergy with Ingenza's other enabling technologies in synthetic biology. Shortening the timeline to deliver cost-effective bioprocesses will encourage adoption of industrial biotechnology by UK manufacturers, with recognisable benefits to society.

What are the next steps?

A follow-on program will test the robustness and scope of our technology, enabling broad implementation within current operations. Dissemination of results will illustrate our leading capabilities in synthetic biology. This technology will be factored into current and future partnerships to deliver the highest value to support our future growth.

Longma Clean Energy Ltd

Continuous flow microwave reactor for fast recovery of fuel from biodiesel waste

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Longma conducts research into biomass renewable power generation, fuel processing and emissions control and generation of electricity as well as providing engineering consulting services in chemical engineering and controls. We are developing a continuous flow microwave reactor for fast recovery of fuel from biodiesel waste.

What was the business need that motivated the project?

First generation biodiesel manufacture produces a waste stream, of which 20-40% is potentially recoverable as biodiesel. The underlying reason for this inefficiency is that the esterification reaction of free fatty acids is much slower than the transesterification of tryglycerides targeted in the biodiesel plant. Speeding up the reaction can ensure economic viability in recovering this component.

What approach did you take to address the challenge?

We used our innovative reactor to speed up the esterification reaction. Our technology is ideally suited to continuous flow reactions and we tested this approach with a small demonstrator. We studied the reaction envelope by varying the system and reagent properties and used it to prove that the reaction could be achieved more than 20 times faster than with conventional technology.

What are the potential benefits?

Our technology allows us to use a continuous flow reactor instead of the traditional large-scale batch reactors. It cuts total processing time from a multi-day operation to single shift. Capital costs will also be significantly lower than for a batch reactor. Our new reactor is also less sensitive to contaminants, ensuring a more complete and lower cost reaction.

What are the next steps?

We have identified a partner who will pilot the technology in a new recovery facility. If the pilot is successful a full-scale system will be built in 2012. At the same time we will investigate other reactions that should benefit from our novel reactor.

New Generation Biogas Ltd

Accelerated methanogenesis – optimising biogas production

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New Generation Biogas, established in 2010 by Stirling Paatz and Howard Sutton, designs, manufactures and supplies compact, high-efficiency anaerobic digestion (AD) systems based on technology developed at North Wyke Research. Together we have a combined 40 years of advanced manufacturing experience.

What was the business need that motivated the project?

There is a mismatch in the UK between the currently available large-scale 'conventional' AD systems and the very large number of potential agribusiness customers who require small-scale on-farm systems. Conventional technology is not economically viable at small sizes so a new approach is required. Advanced manufacturing techniques and control methods are required to exploit this opportunity.

What approach did you take to address the challenge?

Our principal technical challenges were in the selection of suitable commercially available materials and components that could be used in a production process. No market currently exists at this scale so we made selections from a range of non-AD industries and used them to produce a reactor system for the evaluation and development of the main operating processes. The result was a unique, functional system. Biological trials are ongoing.

What are the potential benefits?

The benefits of a commercially viable compact AD system are significant, with thousands of potential customers in the farming industry alone. With high transport costs, this market cannot be addressed by centralised AD plants so we see a major opportunity for a robust network of distributed micro-generation systems, producing significant manufacturing employment opportunities in the South West and beyond. Our project has set the baselines for these production systems.

What are the next steps?

To move forward to commercialisation we are engaged in discussions with two major potential customers. Each would purchase medium-scale pre-production systems for installation on trial sites. This would provide us with the necessary funding to scale up the experimental system and cover the design and manufacturing costs.

Prozomix Ltd

Rational development of a novel ketoreductase biocatalysis enzyme panel

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Prozomix Ltd, a private biotechnology company, was founded in 1998. We develop, produce and supply a large, diverse and rapidly expanding range of novel enzymes and related advanced products and services for biocatalysis and other focus areas, including for biofuel/biorefinery applications.

What was the business need that motivated the project?

Biocatalysis enzyme technology is in demand to produce cost-effective and/or environmentally friendly active pharmaceutical Ingredients (APIs). But it has two significant problems: firstly, panels of enzymes from which biocatalysts can be screened are not large enough or do not evenly sample natural diversity, making them speculative; secondly, existing biocatalysis products are very expensive to employ when screening and scaling up.

What approach did you take to address the challenge?

The major challenge was to differentiate us from competitors by developing sufficient enzymes to sample the huge natural diversity currently known from the genomics (DNA) databases. To accomplish this we developed new high-throughput cloning technology (GRASP). This enabled us to clone a very large number (150) of enzyme encoding genes within the three months of the project and to develop fully and commercialise 53 new biocatalysis enzymes.

What are the potential benefits?

This project has led not only to the development of a state-of-the-art commercial Ketoreductase Enzyme Panel, but also endows us with enabling technology (GRASP) for rapid development of other panels of advanced enzymes. Panel sales will increase revenues and, in conjunction with added-value related products and services,such as contract manufacture, will lead to further job creation at Prozomix. Biocatalysis is a recognised green-chemistry alternative to traditional chemical synthesis.

What are the next steps?

We will complete the Ketoreductase Panel (300 enzymes) using existing resources. However, maximum advantage could be achieved by developing other related panels, so offering a truly comprehensive biocatalysis enzyme toolkit. To this end, we are seeking future investment opportunities.

Quality Milk Management Services Ltd

Use of matrix-assisted laser desorption/ionisation-time of flight (MALDI-TOF) analysis for species and strain typing of organisms from bovine milk

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Quality Milk Management is a veterinary-led, laboratory-based consultancy, servicing the dairy industry. We provide laboratory, recording and data analysis services to farmers and vets and conduct both applied and more fundamental research.

What was the business need that motivated the project?

Mastitis is the most costly disease affecting UK dairy cows. The timely and accurate identification of organisms causing intra-mammary infection is a key component of mastitis control. Moreover, research has demonstrated that there is significant variation within species in the behaviour of mastitis-causing organisms. Cost-effective approaches to strain typing are likely to be crucial in refining mastitis control.

What approach did you take to address the challenge?

Our study investigated the utility of MALDI-TOF mass spectrometry analysis, both for species-level identification and sub-species typing of the most common bovine mastitis pathogens. We compared MALDI-TOF-MS analysis and conventional biochemical techniques in the identification of the key mastitis pathogens and both techniques with sequence typing of Staphylococcal isolates. In addition, we assessed the ability of MALDI-TOF-MS analysis to identify less common causes of bovine mastitis.

What are the potential benefits?

Our study clearly demonstrated the utility of MALDI-TOF-MS analysis in the identification of organisms from bovine milk. In addition it demonstrated its potential for sub-species typing of some of the key bovine mastitis pathogens such, as E. coli and S. uberis. Our approach offers an opportunity to increase both speed and accuracy of routine bovine mastitis diagnostics, as well as the potential for cost-effective sub-species strain typing.

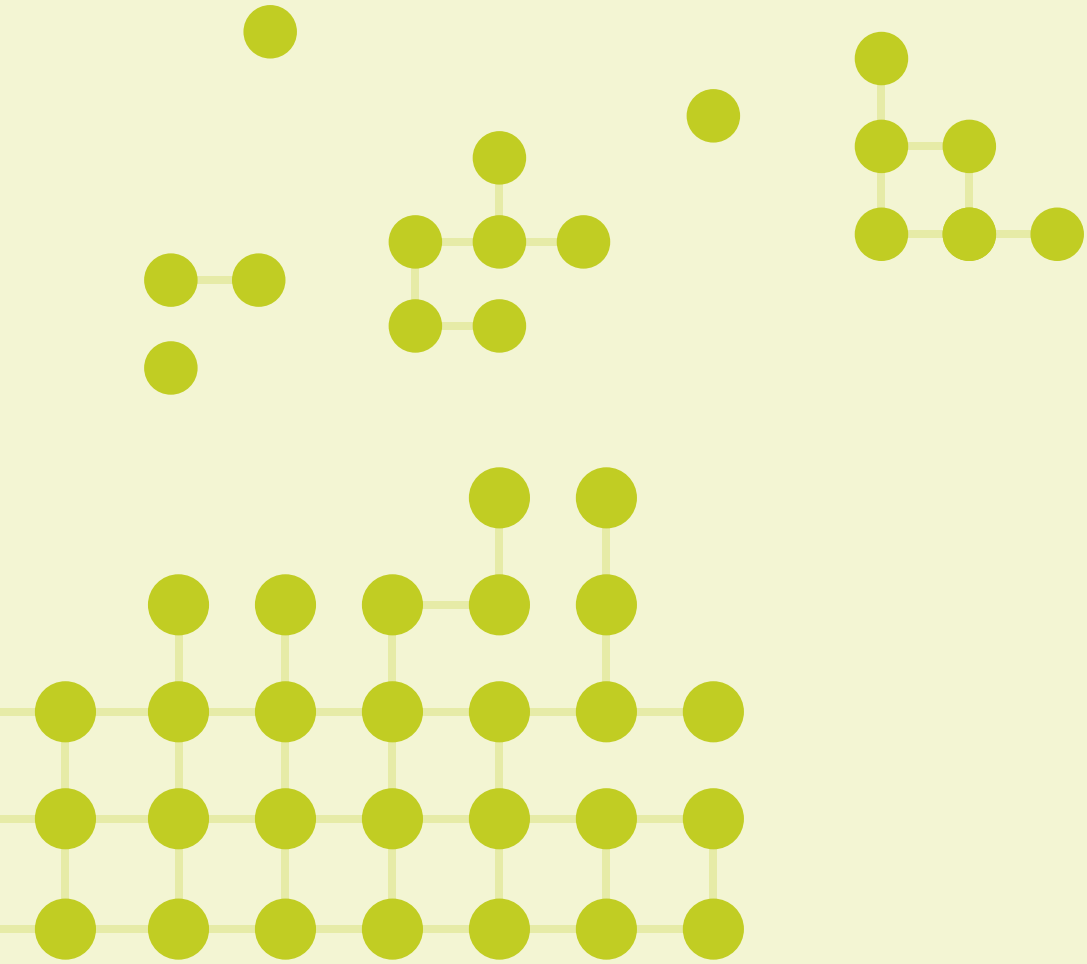
What are the next steps?

We are already implementing MALDI-TOF-MS analysis for the identification of organisms from bovine milk in our routine diagnostics. As well as working to refine this approach in terms of species level typing, we intend to utilise existing resources to develop sub-species level typing using this technique.

Collaboration Nation

Technology-inspired feasibility projects

Electronics, Photonics & Electrical Systems



4D Optics Ltd

A novel wavefront sensing and correction method for use in the human eye

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4D Optics was founded in 2008 to develop novel high-resolution ophthalmic imaging for diagnosis of age-related macular degeneration (AMD). We have a highly experienced R&D team with expertise in advanced ophthalmic optics and we collaborate with a leading ophthalmic centre.

What was the business need that motivated the project?

We had identified a specific market need for technology for AMD diagnostics. We had developed a new low-cost solution using novel adaptive optics to meet this need and implemented a prototype system to test these concepts. Our challenge in this project was to demonstrate that these concepts and technology could be successfully applied in the living human eye.

What approach did you take to address the challenge?

We designed and implemented a prototype instrument for use with human subjects. The system was successfully tested and high-resolution images achieved. We have overcome major obstacles in taking the project from technology concept to viable early prototype and demonstrated imaging of the human retina. Although our general approach is not unique, our underlying technology is, delivering higher resolution sensing and imaging at a substantial cost advantage over other approaches.

What are the potential benefits?

Successful completion of this project is a major milestone in the development of a new tool for AMD treatment and the company's future success. The technology has the potential to become an important part of a revolution in the treatment of a common blinding disease, with clear individual and societal benefits. This will establish 4D Optics as an innovator in the ophthalmic sector and assure our future growth

What are the next steps?

The instrument we have developed will allow us to conduct early-stage experimental imaging to further validate the technology. We anticipate that this will be developed into a pre-clinical prototype design for testing with our clinical partners. We will seek appropriate engineering and commercial partners to exploit the discoveries.

Bath Labs Ltd

A novel high-speed wireless solution for transport broadband access

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Bath Labs is a small electronics R&D company, with a special interest in communications.

What was the business need that motivated the project?

It is often difficult to communicate while on the move in the UK. Mobile voice and data networks are located in populated areas and coverage is intermittent on trunk transport routes. There is a need to improve working efficiency for business people on the move and there are opportunities for entertainment sales to cater for those travelling for leisure.

What approach did you take to address the challenge?

Our approach has been to explore the technical performance and to model the deployment and support costs for leaky feeder-based transport communications, based on the use of low-cost cable types not traditionally used as leaky feeders.

What are the potential benefits?

The impact to the UK economy could be significant. The Department for Transport's economic case for the High Speed Rail Network 2 (HS2) claims the reduction in journey time would generate overall benefits of between £40bn and £47bn, largely from the time savings. How great would be the potential economic benefit to the UK if every hour travelled by a business rail passenger could be productive?

What are the next steps?

Our study has confirmed the technical feasibility of the concept, and has revealed which applications are likely to be economic and which not. Further work is being done to scope a prototype trial for the most promising application, and to validate real-world technical performance deployment costs and support costs.

BioKinetics Ltd

Surface imaging and assessment system

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Biokinetics has wide experience designing custom vision systems for clients in an eclectic range of industries, from automotive to pharmaceutical. We help them to address production obstacles for which an off-the-shelf solution is not readily available.

What was the business need that motivated the project?

We approach potential clients periodically, offering our experience in resolving a persistent measurement problem. In one case, the issue was the assessment of the clean state of generic 'slurry type' mixing plant. Among the industries that use such a process are pharmaceutical, confectionery, personal care products and brewing.

What approach did you take to address the challenge?

We applied our experience in custom imaging system design and integrated a range of novel inspection test paradigms to evaluate the usefulness of the approach. Our system has evolved so that it can be retrofitted to commonly used components of typical mixing plant designs and to act as a 'smart' sensor array. It can communicate with pre-existing supervisory control and data acquisition monitoring (SCADA) and control systems.

What are the potential benefits?

As the respective industries have an ongoing requirement to clean their plant equipment on a frequent basis, the consumption of valuable resources such as water, energy and chemicals form part of the overhead of manufacture. An effective, objective system to indicate cleaning end points and rate of cleaning of the internal surfaces, would yield not only financial savings but also enhance the green credentials of global corporations.

What are the next steps?

We will further develop the base design to allow the addition of conventional and innovative supplementary sensors. With the processed image data, these will collectively provide objective process control points. We intend to engage with one of the interested industrial parties to continue development and validate the technology.

Covesion Ltd

Tuning out the MATRIX – high-energy lasers for biomedical imaging

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Covesion is Europe's leading manufacturer of periodically-poled nonlinear optical crystals. Our products are used for frequency conversion of lasers, enabling new wavelengths (colours) to be generated for applications in green lasers for picoprojectors and cinema displays, spectroscopy, and aeronautical countermeasures.

What was the business need that motivated the project?

Mass spectrometry employs Matrix Assisted Laser Desorption Ionisation (MALDI) for analysis of biomolecules and large organic compounds. MALDI systems use UV lasers at 337nm and trial-and-error crystal matrix compounds for analytes to absorb laser energy for measurement. Tunable mid infra-red lasers will enable new applications in drug discovery, metabolism analysis, cancer diagnosis, and proteomics, requiring no crystal matrix.

What approach did you take to address the challenge?

For MALDI, a wider range of wavelengths means a wider range of biological measurements and applications. MgO:PPLN (magnesium-oxide-doped periodically poled lithium niobate) offers market-leading conversion efficiency and wavelength tuning range, but achievable pulse energies are limited by damage threshold and size of the crystal aperture (intensity). Pulse energies for LDI spectroscopy are 0.5 to 1mJ, prompting a feasibility study to fabricate MgO:PPLN with apertures five times larger than currently available.

What are the potential benefits?

An August 2010 report from Global Industry Analysts Inc. predicts global spectrometer sales to exceed $10.3bn by 2015. Molecular spectroscopy is the largest segment, predicted to reach $3.3bn by 2012. Over 500 MALDI systems are sold per year at $0.5m per system. IR laser sources for LDI sell for around $50k each, with a strong retro-fit market for upgrading exisiting systems.

What are the next steps?

We can now develop new fabrication techniques and work with Elforlight to feasibility test our MgO:PPLN crystals in high-power OPO (optical parametric oscillator) systems. These suggest LDI applications in healthcare; drug discovery, metabolism analysis, and cancer diagnosis. We will continue development with current partnerships as well as end-user MALDI companies.

Disect Systems Ltd

IMPACT – Imaging by microwave phase and amplitude contrast

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Disect Systems is a UK-based developer of scanner imaging software designed to run on standard computing platforms rather than expensive bespoke systems. Our products allow clinicians and other professionals to study scans at any location on PC or laptop.

What was the business need that motivated the project?

Medical X-ray CT (computed tomography) scanners are expensive and available only in key locations. They are heavily used, with consequent delays in the patient pathway, and they also present a degree of risk to patients and operators. Increasing patient safety and reducing delay are key objectives across the health sector and we propose a new way of achieving those objectives.

What approach did you take to address the challenge?

Radio waves can be used to scan an object just as X-rays do. The challenge in using radio is achieving adequate image resolution from the scanner. The wavelength of radio frequencies is orders of magnitude longer than for X-rays, which affects resolution. We explored techniques to achieve the best possible resolution and succeeded in demonstrating that 'mm' resolution can be achieved from a radio frequency CT scanner.

What are the potential benefits?

Radio frequency CT scanning offers a fundamentally safe alternative to X-ray CT and has the potential to be significantly less costly by exploiting off-the-shelf devices. Since they are smaller and of simpler construction with very low running costs, radio frequency CT scanners can be widely deployed as desktop and/or portable machines. They are perfectly suited for use in front line community care centres as well as centralised acute care facilities.

What are the next steps?

We are seeking funding to develop in partnership with Essex University a fully operational experimental scanner using radio frequencies to underpin an in-depth test and measurement programme, leading to trials. The funding will also support a market study in this new field as well as enabling patent protection.

easel technologies limited

Solid state power matching for gas plasmas used in the manufacture of semiconductors

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easel technologies is a micro-company formed in 2005 and supplying radio frequency (RF) power products specifically designed to cope with difficult and demanding electrical conditions. Applications for our products include plasma processing, laser excitation and semiconductor manufacture.

What was the business need that motivated the project?

Modern plasma processing requires exact and precise control of the ionised gas to achieve the best results. The coupling of RF power into the plasma is a critical factor and, for some time, there has been a need to increase the speed of response and the reliability of the coupling network. Our project investigated the feasibility of a digital solution.

What approach did you take to address the challenge?

The essence of the project was the design of a high-power digital switch and assessing its use in a power coupling, or matching, application. The most important tasks were the identification of suitable components and a search of the IP. Fortunately, advances in an unrelated area of technology have produced devices with the appropriate characteristics and the IP search prompted additional design work which we hope will be unique.

What are the potential benefits?

We have determined that it is both feasible and practical to design and manufacture an improved RF power matching network. It has given us confidence to continue development, with the aim of producing a device with considerable export potential. The UK has a strong position in advanced manufacturing and instrumentation and the funding of projects such as this helps maintain our position and leads to growth.

What are the next steps?

The next stage is the design of the complete matching network. Hopefully, this will be followed by collaboration with potential customers to test its suitability in a variety of applications. The most appropriate method to organise later stages of development may be through the formal structures of a funded programme.

Farm Energy & Control Services Ltd

Wireless mesh networks for photovoltaic (PV) installation communications

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Farm Energy & Control Services Ltd is a low-volume manufacturer of electronics and electrical equipment, specialising in temperature regulation in agriculture and remote data capture systems for process monitoring and alarm. We are market leaders in the UK pig sector.

What was the business need that motivated the project?

We were seeking diversification opportunities, particularly from the growth in small-scale PV installations in UK. These will benefit from remote monitoring but conventional technology is too expensive in residential or small commercial installations and suppliers lack in-house expertise in data capture. There is a need therefore for low-cost, robust monitoring – especially where third parties are involved with system supply.

What approach did you take to address the challenge?

We investigated the application of low power 802.15.4 wireless mesh network nodes to collect pulse output data and allow remote collection through concentrators, with upload to central database and web-based viewing software shared to reduce operating costs. The practicality of the approach has been demonstrated on the bench and in simulation. The innovation is in concentrated local wireless data collection rather than more expensive smart meters.

What are the potential benefits?

Our target sector is only a subset of a wider potential market for low-overhead, small-footprint diffuse data gathering. We expect monitor systems sales of £250k within three years and significantly reduced energy and water waste. Longer battery life also improves sustainability. The project advanced the company's techniques and capabilities and resulted in an immediate system sale in another application, based on work done. Customer feedback is very positive.

What are the next steps?

We need to turn prototypes into marketable products so extensive software testing is required and we will investigate other communications routes, such as 3G and ADSL. We are seeking a medium-scale PV supplier to collaborate in taking products to market and will undertake wider market research into other application opportunities.

Gold Standard Simulations Ltd

An electronic design automation (EDA) tool for statistical static random-access memory (SRAM) analysis and validation

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Gold Standard Simulations is the leader in the simulation of statistical variability in nano-CMOS (Complementary Metal-Oxide Semiconductor) devices. Services we offer include physical simulation of statistical variability, statistical compact model extraction and statistical circuit simulation.

What was the business need that motivated the project?

In modern chips up to 80% of the silicon can be consumed by SRAM. Owing to the small size of the transistors used to make it, SRAM is one of the components most sensitive to variability. Future SRAM design in advanced technologies requires accurate EDA tools, which are based on physical simulation. Such tools do not currently exist.

What approach did you take to address the challenge?

We performed a comprehensive investigation into the application of our own simulation technologies to the modelling of SRAM designed with a 25nm bulk metal-oxide semiconductor field-effect transistor (MOSFET) device. Through large-scale Monte Carlo simulation we have demonstrated that extremely accurate statistical circuit simulations, provided by the RandomSPICE (Simulation Program with Integrated Circuit Emphasis), are needed to assess the impact of device variability on SRAM performance and yield.

What are the potential benefits?

Given that a huge proportion of modern chips contain SRAM, the optimisation of its design for future technologies is fundamentally important to the global electronics industry. Through better design, electronics companies can reduce the power consumption of their devices and, by improving production yield, reduce waste and costs. This project has allowed us to assess the feasibility of producing an EDA tool which can help deliver these benefits.

What are the next steps?

As part of this project we have produced a development plan for an advanced EDA tool specifically geared toward the simulation and optimisation of SRAM designs. We intend to prepare a follow-up bid for Technology Strategy Board funding to help deliver this tool to industry within the next 18-24 months.

High Voltage Partial Discharge Ltd

A central monitoring system for offshore and shipping high-voltage networks

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HVPD offers a complete range of on-line partial discharge (PD) high voltage (HV) insulation diagnostic test and monitoring technologies and PD test services. We serve both utility and industrial clients across the worldwide electricity supply industry.

What was the business need that motivated the project?

Failures of switchgear, cables, transformers and motors or generators can cost millions of pounds daily in lost oil and gas production or interrupted sailing schedules. We identified a need for remote-access HV insulation condition monitoring technology for offshore oil and gas platforms and shipping power networks to reduce such failures.

What approach did you take to address the challenge?

The technical risk involves processing efficiently designed algorithms regarding time and memory usage to process large amounts of data. Our system will be installed at central switchboards and be capable of monitoring the insulation condition of complete networks (switchgear, cables, transformers, motors and generators) on the platform or vessel. This will be engineered through a combination of advanced capacitive and inductive wideband PD sensors and an intelligent PD monitor system.

What are the potential benefits?

Operators adopting our technology will be able to drill and process resources more reliably and cost effectively while guarding against potential failures and explosions. Further benefits are seen in improved asset availability, increased production and reduction of energy consumption. Plant failure leads to serious consequences, measured in costs, safety and socio-economic implications; our solution enables asset managers to improve reliability of HV networks while maximising plant service life.

What are the next steps?

We intend to use the results of our feasibility study as the basis for a proposal of a Technology Strategy Board development project. We want to develop BETA Monitoring systems for field trials with a number of large oil and gas companies.

OptoSci Ltd

Compact, laser-based gas analyser for remote, long-term process control of solid oxide fuel cells

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OptoSci Ltd, founded in 1994, is a leading producer of photonics instrumentation systems for the international academic and research markets. We have extensive expertise in the development and manufacture of optoelectronic and fibre optic instrumentation.

What was the business need that motivated the project?

Solid oxide fuel cells (SOFCs) are being developed as a high efficiency, low pollutant alternative to large-scale power plants. The global SOFC market is estimated at more than $1bn, providing $400m-plus annual revenue to US and UK manufacturers. They have a need for a gas analyser that can be embedded as part of an SOFC diagnostics system.

What approach did you take to address the challenge?

In a previous research programme involving Strathclyde University and Rolls-Royce Fuel Cell Systems, we supplied rudimentary, laboratory-type instrumentation for methane gas measurements in an SOFC. The system demonstrated improved response and accuracy compared with current technology (gas chromatograph). We devised a plan to develop the instrumentation to a fully operational, compact prototype, expanding the system capabilities to remote operation, dual gas-species and multi-point detection.

What are the potential benefits?

A gas chromatograph requires sample conditioning, making real-time monitoring of an SOFC impossible. This new system permits remote, real-time, in-situ monitoring of gases, pertinent to the safe and efficient running of an SOFC system. The market in SOFC process monitoring is strong and partnerships with SOFC manufacturers to produce an embedded system for diagnostics could be worth £15m annually to OptoScii Ltd.

What are the next steps?

A collaborative study involving a fuel cell systems company, academia and ourselves for a minimum six months' on-site trial could provide a direct route to sales. It would also provide a solid reference site for future market development. Publications in academic and industrial media would further increase our exposure.

Oxsensis Ltd

Low cost-per-channel sensor

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Oxsensis designs and manufactures optical sensors for harsh environments, particularly in applications serving gas turbines, aviation and oil and gas markets. Our products include dynamic pressure sensors and extreme temperature sensors, with further developments planned to include optical accelerometers.

What was the business need that motivated the project?

We saw an opportunity to reduce the cost of our sensor systems by investigating multichannel interrogation systems.

What approach did you take to address the challenge?

We carried out an assessment of available multiplexing approaches, including wavelength and time-division multiplexing. Our next step was to build a proof-of-concept interrogator for simultaneous interrogation of two sensors in the laboratory.

What are the potential benefits?

Reducing the system cost for each sensing channel could allow us access to lower cost applications, thereby increasing the overall market for our sensor systems.

What are the next steps?

We are already developing a more complete prototype system which can be demonstrated to potential customers. Discussions are under way on establishing customer specifications.

PolyPhotonix

Development of novel solutions for healthcare applications

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Polyphotonix is a company specialising in the design and development of organic light emitting diodes (OLEDs) for novel applications. Our strong scientific team are developing innovative processes (with IP) to permit high-volume low-cost production of OLED devices.

Please contact PolyPhotonix direct for further details of this project.

PragmatIC Printing Ltd

FlexLOGO

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PragmatIC Printing enables printed logic circuits that introduce intelligence and interactivity into a wide range of products and applications, in form-factors that are not possible using silicon chips – ultra-thin, flexible, robust, transparent and disposable, for example.

What was the business need that motivated the project?

Although many technology companies have demonstrated individual components capable of integration into future products, it is widely acknowledged that the supply-chain for plastic electronics is very immature, with little activity on systems integration. FlexLOGO's focus is a commercial application prototype based on flexible, organic light-emitting devices (OLEDs) and can help to stimulate the interest of the creative industries, a major UK strength.

What approach did you take to address the challenge?

Our FlexLOGO demonstrator is a brand enhancement label for the consumer goods sector, bringing together multiple plastic electronics components and demonstrating systems integration. The form-factor is suitable for integration with consumer product packaging, using paper or plastic substrate. Our demonstrator has a generic flashing logo based on OLEDs-on-flex, which is activated by a printed touch-switch in a thin, flexible form-factor not able to be used with conventional technologies.

What are the potential benefits?

FlexLOGO has advanced know-how for systems integration of printed electronics, with components (OLEDs-on-flex, printed batteries and printed circuitry) integrated with PragmatIC's thin-film logic. We are using FlexLOGO to market the possibilities of plastic electronics in the consumer goods sector and to support our licensing discussions. This is a substantial global opportunity since demand for electronics in smart packaging is projected to exceed £1bn by 2022 (IDTechEx).

What are the next steps?

We will continue to work with scale-up and supply-chain partners to produce end-user-specified integrated product demonstrators capable of commercial production within the next 12 to 24 months.

Print Yorkshire

Interactive posters – commercialising the production process

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Print Yorkshire is a regional network for the printing and packaging industry in Yorkshire and the Humber. We promote innovation through projects and also bring the industry together to debate popular topics.

What was the business need that motivated the project?

This project looked to build on a previous demonstrator project to ensure that the manufacturing processes are sufficiently robust for commercial production and sale at a profit. It focused, for example, on cost-effective ink usage and assembly techniques and on developing business costing models and manufacturing protocols.

What approach did you take to address the challenge?

We carried out print trials in both screen and litho to ascertain appropriate ink coverage for optimum conductivity at a commercially acceptable cost. We produced a device to enable print operatives to measure conductivity 'at press' and to develop operating guidelines. We also developed ways in which printed posters and other electronic components could be assembled cost effectively We wrote manufacturing protocols and costs models to aid manufacturing consistency.

What are the potential benefits?

The essence of the project was to progress the work of the demonstrator project to 'close to commercial production' status. Our partners, all commercial businesses, agree that through this project they are now closer to offering with confidence an interactive poster to their customers and to maximising the benefits of the lead that they have gained.

What are the next steps?

Given the capabilities of our partners and the market potential open to them it is essential that the initial markets are the right ones, with the right market applications. With this in mind they have identified an opportunity outside of this project to engage a graduate to develop a marketing strategy.

Sapere Systems Limited

Autonomous robotic drill for hypophysectomy

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Sapere Systems is a medical device company founded in 2010 to develop autonomous interactive robotic devices for use in surgery. Our core invention is automatic sensing and feedback from tissue environments, discriminating events which allow the device to take certain action.

What was the business need that motivated the project?

We developed and successfully demonstrated a robotic drill for use in cochleostomy. We want to demonstrate the broader commercial potential of the technology. The objective of the study was to design and make an autonomous interactive robotic drill with potential to remove the pituitary gland (transnasal hypophysectomy or THP).

What approach did you take to address the challenge?

A problem in drilling during surgery is that the material being drilled flexes and this movement can result in damage to nearby tissues. In THP, drilling poses risks to adjoining soft-tissues such as the optic nerves and major blood vessels, which may have catastrophic consequences if damaged. We successfully demonstrated a drilling system and phantom unit, illustrating feasibility in accessing the pituitary gland, potentially without causing soft-tissue damage.

What are the potential benefits?

The impact of our study is to show the potential of robotic tools to facilitate safer surgery in this technically very challenging area of the human skull base. The market potential is large since surgeons in several disciplines, such as ENT and neurology, work in this anatomical area, which is difficult and dangerous to access.

What are the next steps?

We want to engage a group of experienced surgeons whose opinions will shape the design of the equipment for use in a clinical trial. Further laboratory and clinical studies will lead to our commercial objective of securing a corporate partner to take the product through to patient benefit.

Solus Technologies

Electronic pulse synchronisation for non-linear microscopy

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Solus Technologies develops and manufactures semiconductor disk lasers (SDLs) which provide exceptional performance, reliability and value. Our SDLs are tailored to meet application requirements and deliver customised yet cost-effective novel products for customers to advance their applications.

What was the business need that motivated the project?

Coherent anti-Stokes Raman Scattering microscopy (CARS) is a powerful technique that provides significant advantages. However, current schemes used for CARS microscopes are large, expensive and complex. If synchronised SDLs can be used instead, the system cost will be significantly reduced, as well as being an order of magnitude smaller, and will provide the basis of a robust turnkey system.

What approach did you take to address the challenge?

We investigated the feasibility of electronically phase-locking two independent ultra-fast lasers with a novel master-slave digital technique in order to provide the required laser synchronisation. Significantly, the technique would correct for any time delay, operate in real-time, avoid large and unwieldy optical delay lines and also maintain the spatial relationship between the two laser beams.

What are the potential benefits?

The global microscope market is worth billions of dollars and CARS microscopy represents the cutting edge of the high-value systems that will help drive future growth. CARS microscopes deliver distinct advantages, including sample archiving and molecule selectivity that are currently high on the list of end user demands. The demand for these unique characteristics will drive high growth in the sector, providing benefits in employment, exports and health.

What are the next steps?

We will now target a wavelength-tunable dual SDL system using the knowledge gained from the feasibility study. We will design new electronics to synchronously lock the lasers together to provide the required functionality. We will forge closer relationships with existing collaborators and seek new application developers.

SVT Licensing Ltd

Autonomous heat transfer for electronic components

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SVT Licensing Ltd is a start-up that is commercialising innovations in energy sub-systems. We specialise primarily in gas compression, heat transfer, and power generation from waste heat.

What was the business need that motivated the project?

Electric vehicles' range is reduced because stored power is used for forced cooling of battery packs. Passive two-phase vacuum thermo-siphons do not consume power but pose a packaging problem because the condenser must be above the evaporator. We wanted to show that novel passive thermo-siphons can operate with the condenser below the evaporator.

What approach did you take to address the challenge?

In novel cooling technology using vacuum two-phase thermo-siphons, buoyancy of vapour from boiling drives a rotor close to a hot surface. This sweeps bubbles off hot spots and fresh liquid over the surface, thus delaying critical heat flux. The vapour also drives Archimedes screws to produce power. Our study showed that this is sufficient to pump condensate from a lower condenser up to an evaporator.

What are the potential benefits?

The sweeping rotor improves cooling of hot spots in computers and electronic drives. We achieve energy savings in several ways. Buoyancy power, from two-phase boil-off, drives fans to improve convection, without consuming power, and the fan continues after power is cut until the temperature drops. Working off the temperature difference, without using power, our technology can autonomously cool and ventilate closed spaces, such as attics, building cavities, boats, caravans, parked cars.

What are the next steps?

We have an agreement with a leading LED manufacturer and have produced prototypes for them, but we need to penetrate major electronics and auto companies at management level so that we can accelerate development by licensing or joint venture. We also need partners for varied niche applications.

TerOpta Ltd

Intelligent control system for next generation optical access transceivers

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TerOpta was formed in 2010 and our highly experienced team perform R&D and offer consultancy services in optical systems for communications and sensing applications. Our expertise covers photonics, analogue and digital electronics, software and innovative embedded optical device control.

What was the business need that motivated the project?

Next generation optical Internet access systems will utilise wavelength division multiplexing, for which new types of optical component are required. In 'head-end' systems, multi-channel integrated transmitters will be employed, containing potentially dozens of optical sources. While much research concentrates on their optical design, little exists on electronic control of these complex devices. Low-cost, compact, low-power control techniques must be identified.

What approach did you take to address the challenge?

Our study investigated methods of implementing an intelligent embedded control architecture capable of closed-loop control of up to 100 lasers, using a single, highly compact, low-cost reconfigurable System-on-Chip device. Innovative implementation and careful partitioning of the design between analogue/digital hardware and software were required to compress the necessary functionality into this efficient platform. We produced a working 'proof-of-principle' demonstrator, with full graphical user interface (GUI) to confirm the feasibility.

What are the potential benefits?

The techniques we identified during this study will enable us and partner companies to produce very compact, highly functional optical components for ultra-high-speed optical access systems expected to begin roll-out from 2015. Such systems will be an essential part of the UK's communications infrastructure and will underpin future economic success by enabling new high-bandwidth services for business and society. The expected addressable European market for head-end systems is around $6bn.

What are the next steps?

Continued interaction with optical device manufacturers will help define detailed specifications for subsequent product development and further refinement of the multi-channel control techniques. We will also pursue applications in the active and growing optical sensor field, which may represent a second and more immediate route to market for the technology.

View Holographics Ltd

Holographic Animated 3D Display

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View Holographics' mission is to manufacture holograms in volume for the advertising and technical markets. We employee seven people with holographic, optical and engineering expertise and are about to launch our first products.

What was the business need that motivated the project?

3D is the the next big thing in films, gaming and entertainment but content providers are struggling to sell products to consumers at point-of-sale. Hollywood studios therefore want to replace cardboard cut-outs in cinema lobbies with 3D holographic technology. Our displays are real 3D, without glasses, that wow audiences and have six times more impact than other forms of advertising.

What approach did you take to address the challenge?

We aim to show that digital holograms can be transformed into animated displays, for a stationary observer. We have developed a holoprinter that can print colour digital reflection holograms while Edinburgh-based Holoxica has developed a holographic display based on sampled transmission holograms. Our project combined these technologies, enabling a fixed number of 3D-images to be pre-encoded into a holoscreen and replayed in any sequence for animation.

What are the potential benefits?

The benefits of holographic images are comfortable and natural viewing without the inconvenience involved in viewing through 3D glasses or other displays like lenticulars. The benefit for content providers is the 'wow factor' associated with holographic technology, driving increased sales. Our project resulted in a number of scientific and technical breakthroughs. These could lead to low-cost and easy-to-make displays with a fully digital design/development cycle for production via holoprinting technology.

What are the next steps?

We want to take the basic technologies developed in this study and refine them further to make a demonstrator. This would include key components such as the holographic screen and the optical shuttering sub-system. The next stage could be a proof of-concept project.

Zettlex UK Ltd

Radio frequency identification (RFID) technology demonstrator

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Zettlex makes inductive position and speed sensors for extreme environments. Our main markets are in aerospace, defence and industrial sectors. Many of our sensors are currently on 'active service' with NATO forces on land, air and sea.

What was the business need that motivated the project?

We identified a requirement for a low-cost, lightweight, accurate and robust position sensing technology. In particular, we needed a demonstrator that would allow us to show prospective customers the technology in a neat, compact, easily demonstrable form.

What approach did you take to address the challenge?

Our approach was a fairly traditional one of specify, design, build and test. It needed a multi-disciplinary approach so our team contained physicists, electronics engineers, software engineers and mechanical engineers.

What are the potential benefits?

It offers high-accuracy, lightweight, eco-friendly, robust position and speed measurement at low production cost. The potential for lightweight sensors has a significant environmental benefit in aerospace – since weight has a substantial influence on carbon footprint. A modern jet might typically use more than 100 such sensors. This technology could save more than 50kg per aeroplane. When this is multiplied by the number of aeroplanes and the miles travelled per aeroplane the effect is large.

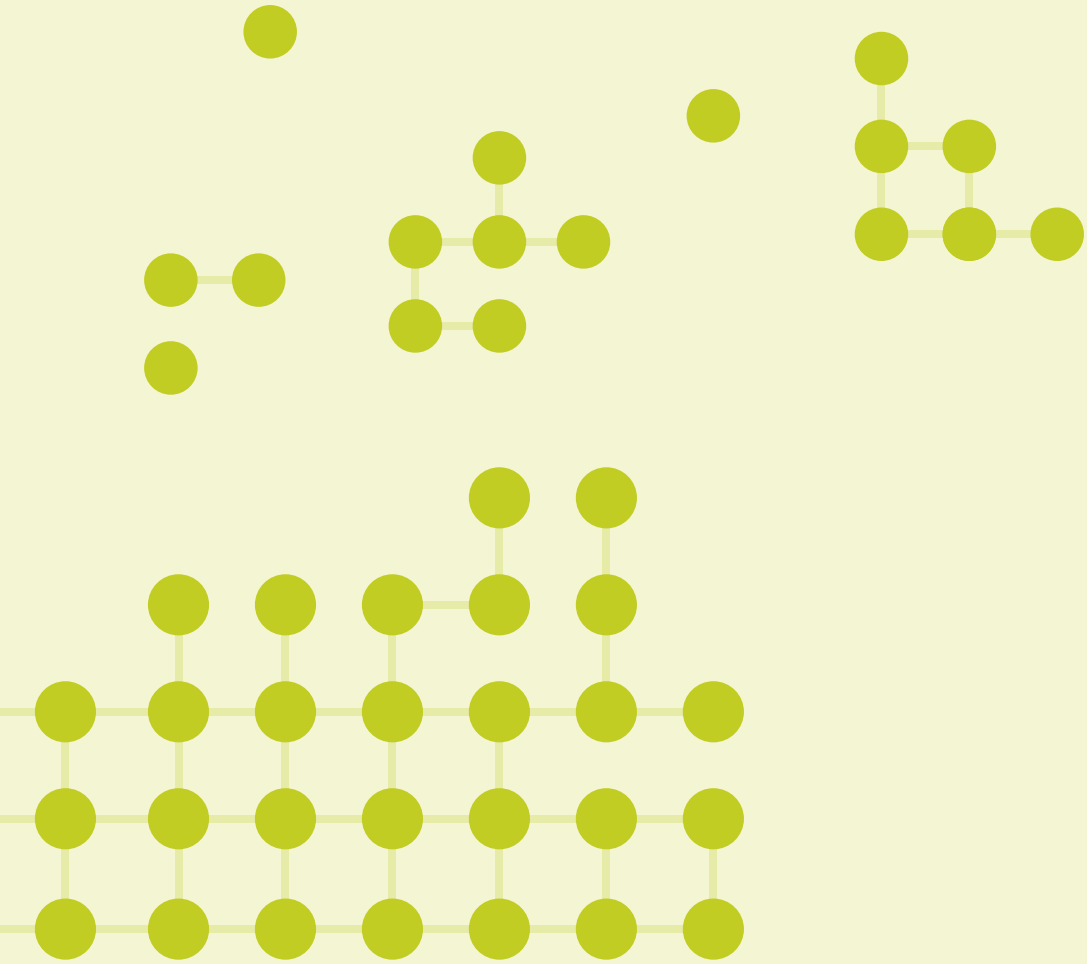
What are the next steps?

We need to develop the basic technology into a product. We have put together a concept for a miniaturised motor encoder.

Collaboration Nation

Technology-inspired feasibility projects

High Value Manufacturing



3P Innovation Ltd

Extending the capability of a pharmaceutical powder filling system to enable lower and more accurate dosing into capsules

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3P Innovation Ltd has grown over five years to some 20 engineers developing special-purpose equipment to manufacture innovative products for high-value-added industries such as medical devices and pharma. We also have a range of powder handling equipment.

What was the business need that motivated the project?

Our innovative high-speed gravimetric powder filling equipment ('Fill2Weight') offers the ability to dose small quantities of drug substance at both laboratory and commercial scales. This increases the throughput of new drugs while eliminating scale-up issues. We can increase sales if the system capability can be extended to weights of 1mg and less.

What approach did you take to address the challenge?

The critical technical challenge was to improve accuracy and control of all elements of the system. To this end we tested various weighing systems, re-designed the powder dispensing nozzle and exchanged all control systems for higher specification items. These new systems required both mechanical and electrical packaging. The primary output is an easily transportable 1mg demonstrator unit available for customer trials.

What are the potential benefits?

The grant catalysed an investment in powder filling technology. Rather than talking about potential enhancements with clients, we can now physically demonstrate them with representative materials. We have a number of clients interested in this technology for a range of applications. The probability of sales has increased as a direct result of this work. We and the UK economy benefit by additional turnover for high-technology equipment, primarily for export.

What are the next steps?

Our next steps primarily concern sales and marketing of the technology, to ensure a wider audience is aware of the technology and its benefits. In addition we are arranging client trials on the new equipment we have produced.

AM Technology

Multi-stage approach to scale up for fast and slow reactions

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AM Technology is a process engineering company specialising in design of continuous chemical reactors. We collaborated on this project with High Force Research (HFR), a chemistry R&D company specialising in making novel organic compounds.

What was the business need that motivated the project?

The challenge is to develop reactors that can handle processes where the reaction conditions change markedly over time. While our Coflore ACR design is, on its own, not designed for fast reactions, it can provide a compelling solution for scale-up of such processes if used in combination with a micro-reactor, with advantages in equipment and running costs.

What approach did you take to address the challenge?

We built a micro-tubular module while HFR looked for a suitable model reaction to test the ability of the equipment to handle fast reactions in an efficient way. We then performed tests to compare the behaviour of the micro-tubular only, the Coflore ACR only and the two together in series. The Coflore ACR performed better than expected, raising more questions in terms of the relevance of mixing over plug flow.

What are the potential benefits?

The market potential for the Coflore could increase by an order of magnitude if we can demonstrate the benefits of using it in combination with micro-reactors to achieve scale-up without loss of performances. For HFR, this is a valuable way to better understand the benefits of flow equipments.

What are the next steps?

We need to conduct more tests to clarify the effect of mixing and plug flow for different types of nth order reaction. Also, the use of commercially available micro-tubular systems would be of great interest. This could be investigated with a new project including an end user partner too.

Axon Automotive Ltd

Applying the ARM business model to a vehicle manufacturing technology

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Axon designs and prototypes lightweight vehicle structures and vehicles using composites and other appropriate materials.

What was the business need that motivated the project?

We wanted to diversify from our main business model, which is based on being a vehicle producer under the Axon brand. This project allows us to design vehicles for others and to build a different business model based on taking a licence on the vehicles produced under our carbon fibre structures patent. This allows a much larger reach and faster growth for the company.

What approach did you take to address the challenge?

We developed an early stages expert system for vehicle design parameters. We then established input conditions such as: vehicle size, how many occupants, load carrying capacity, stiffness (sportiness), ruggedness (off-roadness), vehicle type (open top, estate, car) as primary constraints on the vehicle beam structure. This allowed us to create a generic vehicle model of Axontex beam elements and structural panels, bulkhead, floor and roof.

What are the potential benefits?

Using the expert system as an engineering design, cost and emissions simulator gives us a greater level of interaction with potential OEM (original equipment manufacturer) customers. Typical project size would be £5m-20m consultancy plus ongoing licence income. The licensing model has the potential to yield greater CO2 and fuel savings than by growing the Axon brand as a small OEM. We have had much interest in Axontex vehicles from emerging nations.

What are the next steps?

From the technical side, we foresee new fuels and motive power units creating opportunities for novel platforms not considered so far. These are typical 10,000-volume-a-year applications which is where much of our business advantage lies. We also want to integrate the structural analysis engine for Axontex into existing CAD and financial modelling.

BioBullets Ltd

BioBullets for the enhancement of shellfish aquaculture

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BioBullets Ltd is a biotechnology company specialising in solutions for control of invasive biofouling pests. We have global patents and have received numerous accolades, winning the UK Research Councils' business plan competition and the Entec Medal for environmental innovation.

What was the business need that motivated the project?

Global aquaculture of shellfish has seen annual increases of 18% since 1990. Seed 'spat' production is becoming increasingly domesticated, facilitating greater control over brood stock quality and reliability. At present, cultivated spat are fed on an algal diet with very low levels of key nutrients. This limited nutrient value of current diets constrains the productivity and viability of shellfish aquaculture.

What approach did you take to address the challenge?

Our objective was to develop a cost-effective method for delivering enhanced polyunsaturated fatty acid (PUFA) loadings to hatchery-reared shellfish. We could thus maximise growth rates, minimise time in hatchery and maximise survivorship through improved body condition. The innovation lies in encapsulating active ingredients (in this case PUFAs) in edible products which the mussels filter and ingest without closing their valves. We tested products in a Greenshell mussel hatchery in New Zealand.

What are the potential benefits?

Achieving 20% market penetration would deliver around £2.4m annual revenue, plus material environmental benefits. By increasing the viability of hatchery-reared spat, we have the additional benefit of potentially removing the need for collecting wild spat, which can have environmental consequences and also leads to annual fluctuations in production. Our technique is applicable not only to the Greenshell mussel industry, but also to other shellfish such as oysters and scallops.

What are the next steps?

The study achieved our primary objectives of a proof of principle. We need to work with commercial hatcheries to further optimise our products (size, active ingredients, shape, breakdown times), and to develop repeatability of formulation. We also need to conduct tests against a range of different species (oysters, mussels, scallops).

Bioinduction Ltd

Improvements to implantable antennas

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Bioinduction was founded in 2003. We are based in Bristol with a subsidiary in Brisbane Australia. We design and manufacture neuromodulation devices, primarily focused on pain management.

What was the business need that motivated the project?

Data transfer between active medical implants and their external controllers have historically employed inductive communication. The emergence of the Medical Implant Communication Service wireless radio standard offers potential for higher data rates and improved convenience because transmitter and receiver do not have to be closely coupled. However, uptake has been limited by concerns over reliability of the link.

What approach did you take to address the challenge?

Safety and regulatory issues limit transmitter power to 25uW. We examined various known antenna configurations and concluded that these were either inefficient or added considerable volume to the implant. Through computer modelling and experimentation, we were able to devise a unique configuration that added minimal volume to the implant without unduly compromising efficiency.

What are the potential benefits?

The trend towards more compact active medical implants is a key driver for wider adoption of neuromodulation therapies. The antenna design we devised in this study has the advantage that it provides optimal performance while adding less than 1cc to the implant volume. Its small size makes surgical implantation quicker as it allows the implant to be sited close to the point of application.

What are the next steps?

Our intention is to incorporate the technology from this study into a technology demonstrator of a working implantable device as a precursor to licensing this device to an established medical technology company.

BiSN Technologies Ltd

Development of a novel downhole tool for abandonment of oil and gas wells

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BiSN Technologies is an oil and gas service company. Our team has over 30 years' experience in the oil sector and we specialise in investigating the effects of bacteria on the reservoir and in developing a new wire line tool.

What was the business need that motivated the project?

We had established the concept of using an expandable alloy to seal abandoned oil and gas wells. After talking with operators and services companies we realised that we had to make significant changes to ensure the product was accepted by the industry. Our main challenges are the creation of a new heater and a working prototype.

What approach did you take to address the challenge?

The main way of abandoning oil and gas wells is to use a cast iron bridge plug with cement. Our technology uses an alloy that is heated downhole and expands on solidification. Creating a full size prototype tool that can withstand the harsh downhole environment was challenging. Reliability is one of the main factors we have to overcome, as well as reducing deployment time.

What are the potential benefits?

We estimate that there are more than 20 million oil wells in the world. Each one needs to be abandoned safely and in a way that does not affect the environment now or in the future. We believe we have the solution to a problem that has exercised the oil and gas industry for more than 100 years. It will also create employment opportunities in a vast market.

What are the next steps?

Our next step is to finish workshop testing and carry out field trials. We will need to raise funds to cover the costs of the trials and secure a partner with wells that need to be abandoned. We are also looking at developing the product for different applications.

Croft Engineering Services

Energy reducing filter

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Croft Engineering Services, established 25 years ago, is a filter manufacturer, with woven wire mesh and perforated plate as our main ingredients. We employ 21 people and are innovative, good at solving customers' problems and deliver quality British-made bespoke products.

What was the business need that motivated the project?

We identified the need to manufacture filters that offered energy efficiency by reducing the amount of power needed to pass the fluid through the filter. The design of this type of filter had not changed for decades and an investigation into modern methods of production was needed.

What approach did you take to address the challenge?

The technical challenge was to improve the resistance to passing fluids through a filter. So we reviewed different manufacturing methods to reduce friction of the fluid through the filter body. This required a study of modern manufacturing and production methods. We analysed various methods before we developed a prototype that showed a reduction in pressure loss in the filtration process.

What are the potential benefits?

Our initial study showed a reduction in energy usage with the new design compared with existing methods. In an industrial environment this will require less energy to pump fluid through process pipe work and could benefit a range of industries, from power generation through to agricultural irrigation. With continued increases in energy costs, this product will have a cost benefit to business while also reducing environment impact.

What are the next steps?

Initial studies indicate there is a benefit in improving the existing manufacturing method. We require further studies to develop the product further. This will include improving its performance and looking at innovative materials to enhance the range of industries in which it could be used.

EPL Composite Solutions Ltd

A new rapid pre-forming and post-fusing technique for complex thermoplastic composite sports goods

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EPL Composite Solutions specialises in the application of advanced polymer composite materials. Our business covers research, design, development and prototyping of novel products and processes across a wide range of industries including transport, utilities, energy and infrastructure.

What was the business need that motivated the project?

Some 90% of composite products currently use non-recyclable thermoset resins, because of the high processing cost and low performance of recyclable thermoplastics. Consumer demand in the winter sports goods industry is for high-performance, sustainable, eco-engineered products. We and our partners wish to exploit this $47bn industry by developing a new, rapid technique to make complex, high-performance thermoplastic components.

What approach did you take to address the challenge?

Our major challenge was to develop a process that could rapidly create various formats of thermoplastic materials and combine these to produce sports components of high structural integrity. We did this by combining a novel diaphragm forming process with a developed post-fusing technique. The major achievement was a series of working prototypes for live evaluation. These are thought to be the first of their kind.

What are the potential benefits?

The potential benefits of this technology are that an environmentally sustainable option is now closer to market for consumers in the winter sports goods sector. Successful exploitation would lead to UK job and wealth creation by establishing a UK manufacturing facility. A 10% market share would be worth £2.9bn and save up to 1 million tonnes of landfill. Our project has potentially reduced the time to market for this technology.

What are the next steps?

We want to trial prototype structures in the winter sports environment, optimise the process and validate the technology for higher volumes required for this industry. We would need significant capital investment for the latter step but our aim is to protect and commercialise a technology template for a range of industries.

Innoval Technology Limited

Novel processing of self-regulating trace heating polymers

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Innoval is a technology consultancy involved primarily in light metals but also in technology developments. Our partners are Heat Trace, a manufacturer of self-regulating heating products, and Polyfect Solutions, who offer proprietary process technology with potential to enhance Heat Trace's products.

What was the business need that motivated the project?

Several business needs motivated this project. First, there was the issue of preventing product counterfeiting, an area of increasing concern. Second, there was potential to achieve a competitive technological and commercial lead through novel processing technology. Third, there was the economic opportunity to cut materials usage while reducing environmental impacts.

What approach did you take to address the challenge?

Using our novel technology, we processed a range of polymer materials – virgin, recycled, with and without taggant material and with different additive loadings. This produced sample materials for assessment of conductivity, thermal properties and microstructures. We compared outputs to more conventionally processed materials to determine if benefits could be achieved and, if so, to identify actions to progress developments.

What are the potential benefits?

Our study clearly demonstrated the capability of the process to distribute the taggant evenly throughout the polymer matrices. We will assess scale-up which, if successful, will result in effective anti-counterfeiting measures. The reduced additive levels did not achieve the hoped-for conductivities but the characterisation studies suggest the prospect of further collaboration beyond the time frame of the project. If successful, we will have a market-leading product.

What are the next steps?

The partners are continuing their collaboration with a view to progressing beyond the feasibility assessment exercise.

LimitState Ltd

Design of structurally optimised components for additive manufacture

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LimitState develops and markets software products designed to allow rapid analysis and design of engineering components and structures. Our software incorporates state-of-the-art optimisation methods not traditionally used in the engineering industry.

What was the business need that motivated the project?

The immense potential of additive manufacturing ('3D printing') techniques is clear. However, there are no commercial software applications available which allow the rapid and rigorous design of optimised structural components, designed to be as strong and light as possible.

What approach did you take to address the challenge?

We developed a software demonstrator incorporating state-of-the-art optimisation techniques. We used this in conjunction with existing industry standard software packages to enable automatic design of highly optimised components suitable for production by additive manufacturing systems.

What are the potential benefits?

The optimisation techniques embedded in our software enable designers rapidly to generate designs for engineering components that are significantly stronger and lighter than would have been possible by alternative means. The lower material usage and reduced manufacturing times also improve the efficiency of the production process.

What are the next steps?

We plan initially to offer a bureau service for companies wishing to optimise specific structural components. In the longer term we aim to further develop the software into a fully-fledged commercial application.

Marine Biopolymers Ltd

High value polysaccharide extraction from UK seaweeds

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Marine Biopolymers Ltd is a recently established company which aims to re-introduce the manufacturing of polysaccharides from seaweed in the UK. We intend to differentiate through developing our own superior technologies. We have already proven a new alginate process at small scale.

What was the business need that motivated the project?

We want to extend the range of polysaccharides extracted from UK seaweed beyond the well established product of alginate, and to be the first in the UK to do so. We would achieve this from the same seaweeds and would enhance project attractiveness in several ways. Other polysaccharides, apart from alginate, are also potentially more valuable than alginate, by orders of magnitude.

What approach did you take to address the challenge?

We took a three-pronged approach, covering market evaluation, laboratory-scale technical extraction work and analytical characterisation and method development. The work has confirmed that there is a growing and valuable market for the target polysaccharides. It also showed that extraction is feasible in conjunction with a new alginate process, using the same seaweed supply, and that straightforward analysis for the target products, as well as for contaminants, is possible.

What are the potential benefits?

If the project can be commercialised at full scale, it could double the projected revenue from the same seaweed quantities, compared to alginate extraction alone, to £40m annually. It could also lead to an additional 20-25 permanent jobs on South Uist, an economically fragile part of the UK, and would add further indirect local economic benefits, for example by the use of more renewable energy.

What are the next steps?

Our next steps are to carry out a more detailed work programme. This is not only to develop the successful aspects of this feasibility work, but also to address some of the technical and analytical obstacles which have inevitably been encountered and to define more clearly our route-to-market options.

Micropore Technologies Ltd

Formulated particles using continuous membrane emulsification

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Micropore Technologies manufactures equipment for emulsion and particle production and provides contract services for formulation. From a spin-out of Loughborough University in 2003, our annual turnover is now around £200k, with highly skilled staff serving a wide customer base.

What was the business need that motivated the project?

Membranes are now being used to manufacture high-value particles from emulsions. That is because they improve the quality of the product by reducing material losses and they have the potential to operate on a continuous basis, improving efficiency. We decided to build and test a lab-scale membrane system for the continuous production of high-value coacervate particles.

What approach did you take to address the challenge?

The challenges involved maintaining the droplets in suspension while avoiding droplet breakage. We devised a plan to investigate the key operational parameters and a system was designed based on a pulsed flowing liquid, coupled with a baffled plug flow reactor. We achieved particles with good uniformity in a continuous process.
The innovation lies in our ability to control particle size using a membrane coupled with a specialist continuous flow reactor.

What are the potential benefits?

For us, it was that the technical challenges were overcome, allowing us to showcase the system to clients using encapsulated particles in their products. For those clients, the financial benefits are difficult to quantify at this stage but it will yield significant cost savings and a reduced carbon footprint through less waste and lower energy requirements. Our fabricators and suppliers will also benefit from up-scale design and construction.

What are the next steps?

Our next step is to construct a larger scale prototype facility to demonstrate that we can make greater quantities of particles. We will also need to test different types of particle because the liquid formulation is an important parameter. We will seek further investment for the next stage.

MTG Research Ltd

Chitosans for sustainable effluent treatment

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MTG Research provides research and consultancy services relating to environmental performance in the printed circuit board (PCB) and related manufacturing areas. We were established in 2003 by Professor Martin Goosey who has an international track record in sustainable technology development.

What was the business need that motivated the project?

PCB and related industries generate large quantities of metal-bearing effluent that has potential to pollute the environment and which needs careful and expensive treatment. This effluent often contains significant quantities of metals such as copper and nickel, which could be recovered for reuse. There is a need for new, more cost effective and sustainable metal treatment and recovery processes.

What approach did you take to address the challenge?

We used a waste product from the seafood industry, crab shells, to capture copper from the PCB processing effluent. Then we used electrowinning technology to recover the copper absorbed by the shells and regenerated the shell material for subsequent reuse.

What are the potential benefits?

Our approach shows how waste from one industrial sector has the potential to treat waste from another sector and to recover valuable resources, such as copper, that would otherwise be consigned to landfill. The key potential lies within the seafood and PCB/metal finishing sectors, where there is opportunity to develop new materials, processes and equipment that can offer a more sustainable approach to raw materials use, recovery and recycling.

What are the next steps?

Initial results indicate that we need to undertake a significant amount of further process and materials development work to optimise the process. We have identified a broader consortium of interested partners from across the requisite supply chain and there are plans for a more substantial project to take the technology towards commercialisation.

NGenTec Ltd

Heat pipes in electrical machines for improved thermal performance

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NGenTec is a developer of electrical generators for low speed or direct drive wind turbines. Our company was spun out of Edinburgh University in 2009 to commercialise a novel lightweight permanent magnet generator. We have 12 employees and are expanding.

What was the business need that motivated the project?

Reliability of offshore wind turbines poses a major business challenge in terms of reducing operational and maintenance costs. Electrical generators produce heat, which is generally removed by forced cooling methods requiring ancillary equipment. A passive method of cooling, without moving parts, would eliminate one source of potential component failure, adding further value to the unique selling propositions of our technology.

What approach did you take to address the challenge?

Forced air cooling is used in our current prototype, with an impact on mass and structural design. The feasibility project allowed us to investigate the use of heat pipes on an existing prototype generator; we measured a reduction in temperature of up to 20 degrees centigrade. Heat pipes are passive with no moving parts and, being integrated into the winding, add negligible mass. This reduces the impact on structural design.

What are the potential benefits?

Utilising a passive cooling method increases the robustness of our technology and provides a competitive edge and further differentiation over other generator developers. It has the potential to reduce generator capital cost while improving reliability, which is the key to the success of offshore renewables. Further development of heat pipes into our technology has the potential to accelerate the company's entry into the offshore wind market.

What are the next steps?

We will be conducting further investigation into heat pipes with Edinburgh University and we will work with suppliers on design of a heat pipe array to optimise performance. We will also manufacture a module for testing on our own 1MW prototype; final validation will allow integration into our commercial products.

Orthox Ltd

Development of affordable, patient-customised cartilage repair implants

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Orthox is a medical device company founded to exploit FibroFix™, a novel silk-based bio-material platform, for the repair of injuries to cartilage and bone. FibroFix™ combines exceptional strength and resilience with a porous architecture and tissue regenerative potential.

What was the business need that motivated the project?

FibroFix™ Meniscus is a high-strength, resilient, silk-based meniscal repair implant with the potential to effect both a functional and regenerative repair of damaged meniscal tissue. In order to maximise the beneficial effect delivered by FibroFix™ Meniscus, the shape of devices must be precisely matched to the injury site to ensure smooth, uninhibited function over numerous knee load cycles.

What approach did you take to address the challenge?

We explored the feasibility of developing affordable manufacture of a patient-customised FibroFix™ implant by using routine MRI scans of the damaged joint to develop rapid prototyping CAD files for mould production. From these moulds, we and our collaborative partner, 3T-RPD Ltd, developed implants that precisely replicated the contours of the cartilage at the injury site. This enabled improved replication of the kinematics and tribology of the original tissue.

What are the potential benefits?

There is a pressing, unmet, clinical requirement for early intervention knee cartilage repair products. They allow patients to resume healthy, active lifestyles and prevent knee joint deterioration and the enormous expense associated with osteoarthritis and total knee replacement. A patient-customised FibroFix™ implant, with precise kinematic match for the joint, is likely to result in a shortened rehabilitation time and an increased implant lifetime.

What are the next steps?

Having established feasibility, further development of a patient-customised FibroFix™ implant will require equity finance and/or grant funding to take it forward to proof of concept in a human indication. This would fund the development of an enhanced MRI scanning protocol, access to tissue for scan comparisons and clinician input.

Plasticell Limited

Manufacture of human hepatocytes by directed differentiation of pluripotent stem cells

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Plasticell Ltd is a biotechnology company focused on a proprietary high throughput technology platform, CombiCult™. CombiCult™ tackles the problem of identifying efficient stem cell differentiation protocols and allows tens of thousands of differentiation pathways to be tested simultaneously.

What was the business need that motivated the project?

Current pre-clinical models for assessing drug toxicity are ineffective, costing the pharmaceutical industry billions of dollars a year in failed clinical trials. Primary hepatocytes are the closest available model to *in vivo* liver function but have many disadvantages. They are in short supply, vary significantly between batches, do not retain functionality upon culture and cannot be mass produced.

What approach did you take to address the challenge?

Our approach is to generate hepatocytes by directed differentiation of human pluripotent stem cells. This has the potential to offer a consistent, limitless supply of human hepatocytes for pre-clinical toxicity studies. We have developed several novel protocols for the generation of hepatocytes from human embryonic stem cells. These protocols are ideal for progression to a manufacturing bioprocess in terms of reproducibility and cost effectiveness.

What are the potential benefits?

Our approach provides significant benefits for the consistent, reliable, large-scale supply of hepatocytes for drug toxicity testing and offers the ability to generate hepatocyte panels from different genetic backgrounds. This would mean a decrease in the number of drugs failing in clinical trials because of toxicity issues and deliver huge cost savings to pharmaceutical companies. Patients would also benefit from the provision of clinically safer products.

What are the next steps?

We demonstrated that our differentiation protocols are applicable to multiple pluripotent stem cell lines but that the hepatocytes generated do not have all the functional attributes required for use in toxicology testing. Next steps will be to further optimise the protocols so that we can generate mature functional hepatocytes.

RBJ Reinforced Plastics Ltd

Reinforced polymer concrete REPCON

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RBJ is a specialist pultruder and designer of fibreglass and carbon in custom and standard profiles. We are a small, high-quality company established for 30 years, producing precision pultrusion profiles for a number of original equipment manufacturers in high-tech fields.

What was the business need that motivated the project?

There is an opportunity in the construction market to introduce a novel composite material that can replace conventional materials in a range of applications. The new material is based on polymer concrete. This is a highly filled material analogous to conventional concrete but where the hydraulic cementitous material is replaced by an organic polymer.

What approach did you take to address the challenge?

We needed to characterise the particular mixes by manufacturing a set of structural components that would allow us to carry out mechanical testing. We knew the material and manufacturing costs so we determined the total cost of a product which could perform specific structural tasks and compared it with traditional materials and components. Thus we demonstrated the feasibility of penetrating the market.

What are the potential benefits?

The advantages are that the structural elements can be mass produced off-site and delivered just in time, so reducing costs, weight, energy and time. Our material has superior properties, lower weight and faster processing. It is much easier to recycle as the entire material can be pulverised and reused as aggregate for other products. It has the potential to act as a repository for recyclate from other processes.

What are the next steps?

We have shown the viability of the overall technology. There are several sub-technologies that we now want to investigate and develop to ensure optimum performance and cost. This will then allow commercialisation via licensing opportunities. We will seek further partnerships to introduce expertise in appropriate market sectors.

Skalene Limited

Architecture for a low-cost, next-generation vehicle black box

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Skalene designs and builds electromechanical systems for industrial control and measurement. With our in-house manufacturing capability, we have a particular expertise in System on Chip (SoC) design for data capture systems that analyse and stream data in real time.

What was the business need that motivated the project?

The adoption of automotive black boxes, or Event Data Recorders (EDRs), suffers from a fragmented approach. We have identified that a significant contributor to this inertia is the cost and complexity of the current offerings in the market. The aim of our study was to devise a full specification EDR for less than a $20 bill of materials cost.

What approach did you take to address the challenge?

We adopted a single processor/multiple sensor architecture, using the capabilities of modern SoC technology. Because of the diversity of the peripherals that either exist on the SoC or can be simply integrated using the many interface ports, a cheap and compact EDR platform can be economically realised.

What are the potential benefits?

The purpose of an EDR is to allow a vehicle collision to be reconstructed in great detail, ultimately leading to the saving of lives. The system will collect all the relevant parameters relating to the operation of the vehicle and store them every hundredth of a second. The data can then be used to paint a detailed picture of the vehicle's situation before and during an event, which can be downloaded and analysed in detail.

What are the next steps?

The next step is a parallel track of exhaustive field tests of the hardware created in the study combined with extensive development of the software to extract and analyse the data generated. We are in the process of preparing funding applications for this approach.

Tribosonics Ltd

Feasibility of using a novel ultrasonic technique to detect scuffing in engines

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Tribosonics Ltd employs nine people using, developing and manufacturing novel and unique ultrasonic technologies for use in the field of tribology. We operate in a number of markets, including Formula1, nuclear, internal combustion engines, medical and civil engineering.

What was the business need that motivated the project?

Catastrophic scuffing can occur on cylinder liners in large marine diesel applications, resulting in complete loss of power to the ship. Losses associated with this problem are estimated at £10m annually worldwide. If the onset of scuffing can be detected, however, remedial action will allow a vessel to reach port.

What approach did you take to address the challenge?

We looked at three main areas, first developing a theoretical understanding of scuffing and the interaction of ultrasonics. Second, we designed and built a test rig and sensors to try out some of the concept sensors and the output from the first task. Last, we developed signal processing techniques to extract relevant information from the acquired signals.

What are the potential benefits?

This project has given us the resources to pursue a sensor concept and develop it to a stage where it is de-risked sufficiently to embark on an industrial trial with a customer. It has expanded our expertise in the area of ultrasonics and tribology, keeping us at the forefront of this technology. We expect shortly to receive industrial investment of £20k and to create one full-time job.

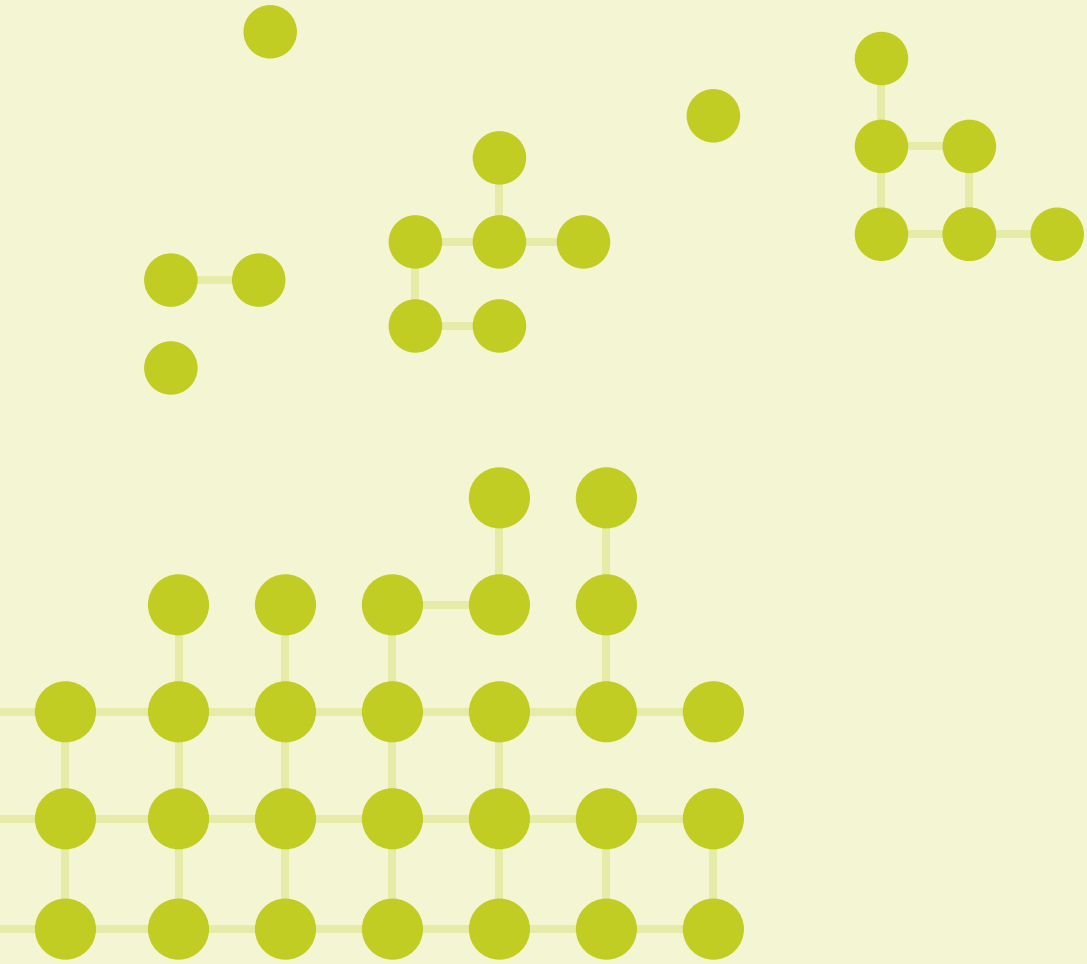
What are the next steps?

We are organising an industrial trial with a customer on one of their applications. We have started further work on the back of the project, developing the sensors, electronic hardware and signal processing to get closer to a commercial product.

Collaboration Nation

Technology-inspired feasibility projects

ICT



Actual Analytics Ltd

Intelligent human behaviour analysis to improve sport performance.

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Actual Analytics is a software development company established in 2010. We develop video analytics solutions for the drug discovery industry.

What was the business need that motivated the project?

We have been looking for related markets where our unique technology could be applied. These include advanced internet-based video sharing and statistical approaches to annotation. Sports analytics was identified in an internal market review.

What approach did you take to address the challenge?

We collected film of sports activities, such as golf, that could be used as a proof of concept. We then modified and extended our existing platform, which was originally optimised for animal tracking, to handle sports footage. We also interviewed experts in parallel fields with these activities to gain a deeper understanding of the market needs.

What are the potential benefits?

Our feasibility study has opened up the opportunity to start exploring the broad markets of human behaviour analysis, more specifically sports analysis. The overall market is attractive and has a high adoption rate for new technology although most sports require specific customisation and branding or endorsements.

What are the next steps?

We now have the code in place to demonstrate our capabilities in this area or, with relatively little additional technical effort, to examine other closely related fields. Our immediate goals are to continue the sports market assessment activity and explore partnership opportunities.

Audio Analytic

Sensing direction of violence, crimes, incidents and events by audio analysis

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Audio Analytic produces software which automatically recognises sounds by means of computer analysis. Our award-winning technology was developed as a result of three years' cutting edge research in sound recognition.

What was the business need that motivated the project?

Security guards have to watch hundreds of screens of video-feeds, trying to detect harm to person or property. Our software classifies a range of sounds by computer analysis, from aggression to car-alarms. It can alert security operators to the presence and location of crimes and incidents in real-time by detecting specific sounds, using microphones built in to modern security cameras.

What approach did you take to address the challenge?

We developed specialised, real-time algorithms to optimise our sound recognition system.

What are the potential benefits?

Our sound recognition system provides the ability to detect crimes and incidents which are simply not apparent with video-only surveillance. These could involve car crime or theft in the dark corner of a multi-storey car park or a nurse being verbally or physically threatened at 2am in an NHS accident and emergency department. We can now give security professionals the right tools to protect person or property quickly and effectively.

What are the next steps?

We intend to sell our unique sound recognition software to security equipment suppliers such as camera, video recorder and intercom manufacturers.

Barnard Microsystems Ltd

INMARA intelligent machine reasoning and action

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Barnard Microsystems develops and manufactures unmanned aircraft systems and related services. We market them throughout the world for use in scientific (ash cloud monitoring), commercial (oil, gas and mineral exploration and production) and state (land and maritime border patrol) applications.

What was the business need that motivated the project?

We need to introduce machine reasoning and intelligence so that unmanned aircraft can perform predictably in spite of their flight status. For example, they may lose power to one of two engines or encounter adverse weather conditions, yet need to take action to avoid a collision with another airborne object.

What approach did you take to address the challenge?

Our control software monitors the status of the unmanned aircraft, notes changes in the external environment and senses any abnormal behaviour. Using a database of collective past experience and sensor readings, it then applies reasoning to identify the cause of the anomalous behaviour. This technology is applicable to a wide variety of air, ground and sea-based robotic systems.

What are the potential benefits?

Our 'intelligent' and adaptive flight control system should prevent the loss of expensive payloads and airframes. Such an approach should allow us to assume a world-leading role in the export of intelligent unmanned aircraft for use in scientific, commercial and state applications.

What are the next steps?

Our feasibility study was more successful than we had expected. We are continuing this work at our own expense to develop a prototype system for use on our InView unmanned aircraft. We will make a submission to the Technology Strategy Board for R&D support to shorten our time to market.

Cortexica Vision Systems

Visual search for retail products

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Cortexica Vision Systems is the award-winning creator of a bio-inspired vision system enabling intelligent image recognition, using principles derived from the human visual cortex.

What was the business need that motivated the project?

We believe that one day visual search will become as ubiquitous as text search is now. Image recognition of retail products could transform a customer shopping experience, both in-store and at home. Our challenge was to successfully recognise a real-life object from any viewpoint by matching it against a database of previously acquired images.

What approach did you take to address the challenge?

Our project focused on automatic computer recognition of retail products. We supplied a computer vision system with images of retail products from multiple viewing angles. We then determined the optimal viewpoints for capturing the multi-view representation with a minimal number of images. We wanted to offer a service that can guarantee recognition of images of products taken at any viewpoint by a lay user.

What are the potential benefits?

Our project has contributed to a better understanding of the limits in representing multiple facets of a 3D real-life object. Our vision recognition system is essentially a platform technology which could be integrated into a number of different retail systems. The market potential from this technology is huge, but it requires a retailer to recognise and invest in it.

What are the next steps?

We need to work with leading retailers to explore how we can take this project further. Retailers want to make it very easy for people to buy their products; mobile shopping offers instant add-to-basket functionality at a reduced cost and lowers the barrier to entry for users.

Embedded Technology Solutions Ltd

Animal health diagnostic services

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Embedded Technology offers decision support technologies that improve the efficiency of operations within the farming sector. Our core product is an on-farm system that automatically monitors the behaviour of livestock, reducing the overall operational costs of functions carried out by humans.

What was the business need that motivated the project?

Sub-acute ruminal acidosis poses increasing problems in dairy herds through decreased milk production, impaired cow health and high rates of involuntary culling. Changes in rumination activity are an early indicator not only of acidosis but of other health states. We are seeking to develop a service model for the indication of the onset of animal health problems derived from rumination patterns.

What approach did you take to address the challenge?

Our cow-mounted collar is an enabling technology platform that allows the collection of activity data and its correlation to rumination patterns as recorded by other means, such as camera observation of each animal within the test environment. We used activity behaviour in three dimensions of individual animals as input to develop a model of cow states as indicated by head positions.

What are the potential benefits?

Agriculture contributes an essential revenue stream of some £19bn to the UK and employs more than 500,000 people. This study has laid the foundation for development of a decision support platform that promotes the implementation of precision farm management. In order to sustain the sector – to balance rising feed, labour and infrastructure costs – there is a growing reliance on new technology to carry out core functions.

What are the next steps?

We will contract out manufacture of the product and market its software and hardware platform through one or more partners globally. We have had initial discussions with a number of potential partners with regard to trialling a solution that will not only validate its efficacy but engage with potential customers.

ETher NDE

Advanced algorithms for solving real world measurement problems in the application of eddy current conductivity meters

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Ether NDE manufactures and supplies equipment, probes and accessories for eddy current non-destructive testing.

What was the business need that motivated the project?

We wanted to create a market-leading product.

What approach did you take to address the challenge?

We used a combination of modelling and practical experiments to develop an algorithm. We are using a much more sophisticated but more robust approach to probe calibration. We based this on leveraging recent improvements in processing power and memory for handheld devices developed by the mobile phone industry.

What are the potential benefits?

Our product with the developed logarithm will be a market leader. It will be used to ensure the ongoing safe and reliable operation of aircraft, power stations and other safety critical structures.

What are the next steps?

We want to see the algorithm incorporated into a product which we will be able to sell commercially.

Functional Technologies Ltd

Enhancing sensor pattern noise for digital forensic applications

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Functional Technologies Ltd was founded in January 2009. We have three employees specialising in multimedia forensics and security, multimedia retrieval, computer vision, analysis and processing of high-volume data, and art and design.

What was the business need that motivated the project?

Recent years have seen the development of source imaging device identification based on the use of sensor pattern noise (SPN). Our project studies the feasibility of reducing demosaicking distortion to the SPN in order to bring the applicability of SPN to a commercial level.

What approach did you take to address the challenge?

The key challenge is that the demosaicking techniques are usually either proprietary or covered by patents, meaning that the configuration of Colour Filter Array and the demosaicking algorithm are not known. We have circumvented this difficulty by extracting the SPN from separated colour channels to prevent the demosaicking distortion diffusing from interpolated (artificial) components into the physically captured colour components.

What are the potential benefits?

The success of this project allows us to improve the applicability of the SPN in source device identification and gives us greater advantage in the global market. The annual EU bill for police image forensic investigation is around £29m annually while the worldwide digital forensic litigation costs for licence/intellectual-property-rights infringement law suits range from £11m to £24m.

What are the next steps?

We will collaborate with a forensics company to commercialise the developed technology and explore the possibility of integrating it with Vdentifier – a video identification technique developed in Iceland.

Kiloni Ltd

ICDIAL – Interactive Communication Data Integration Active Link

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Kiloni Ltd prides itself on innovation, electrical design and product selection. We bring leading products to the market through our global supplier networks and relationships and are actively innovating as part of our growth strategy.

What was the business need that motivated the project?

Verification of identities is commonly achieved through plastic cards with EMV (Europay, MasterCard, Visa) chips or RFID (radio frequency identification) solutions with traditional user/ password combinations, biometric interfaces or through security tokens. These limited systems often carry static information which can be copied or intercepted or require specialist equipment at point of confirmation.

What approach did you take to address the challenge?

We encountered several complications, including multiple coding languages, hardware limitations and layers of technical specialisations. The key to delivering such complex projects was strong communication, teamwork and a 'problem solving engineering mindset'. Our findings showed that an ICDIAL system could be used to verify and conduct identity verification over the internet and phone without the need for specialist data packages or hardware – albeit within a limited lab environment.

What are the potential benefits?

The ICDIAL (interexchange carrier dialling) system is particularly useful in verifying identities where an individual may not be physically present and verification is necessary to eliminate risks of fraud or misrepresentation. By leveraging off existing network architecture the underlying technology could be deployed globally to overcome identity misrepresentation or fraud. Specific uses could include financial transaction processing where 'card not present' fraud is an ongoing risk for internet identity verification.

What are the next steps?

Our project will require further development to take the technology at least to prototype stage. The cost of investing in advanced scalable technical architecture to enable testing of commercially attractive prototypes is likely to exceed £500k. We would like to see collaboration with a financial institution and communications network.

Medicsight PLC

Automatic colorectal polyp segmentation using a Markov random field model for an optical biopsy system

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Medicsight is a research-driven business providing innovative healthcare products for colorectal disease detection. Our ColonCAD API is a software module that automatically detects pre-cancerous polyps in CT (computerised tomography) images of the colon.

What was the business need that motivated the project?

Narrow-band imaging (NBI) can be used for *in vivo* characterisation of colorectal polyps from an image, without the need to perform a polypectomy or take tissue samples. In earlier work, we demonstrated the feasibility for an optical biopsy system but it required manual image segmentation of the polyp. In this project, we developed a novel method to segment the polyp automatically.

What approach did you take to address the challenge?

Segmentation of polyp is challenging, because of complex textures, variation in background, lighting, shape, and scale. Our proposed segmentation approach consists of two steps, pre-processing to remove specular reflections and constrained hierarchical segmentation (ultrametric voronoi tessellation, or UVT) developed by the Berkeley segmentation group. Our results show that the segmentation is technically feasible, with about 90% accuracy, and exceeded our initial expectations.

What are the potential benefits?

We made excellent progress by developing a radically new segmentation method for polyp imaged by NBI. Our experimental results show strong segmentation performance, particularly when compared to other techniques. Our method can remove the barrier of an optical biopsy computer-aided diagnosis (CADx) system by making automatic polyp segmentation possible.

What are the next steps?

We want to combine our segmentation method with a classification component jointly developed with Imperial College to make an automatic CADx prototype for *in vivo* polyp classification. Once the prototype is developed, we will perform clinical studies to investigate the impact of the CADx system on endoscopists' performance.

Medicsight PLC

Numerical optimisation of Ricci flow for corresponding prone/supine surface visualisation and computer-aided detection in CT colonography

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Medicsight is a research-driven business providing innovative healthcare products for colorectal disease detection. Our ColonCAD API is a software module that automatically detects pre-cancerous polyps in CT images of the colon.

What was the business need that motivated the project?

Computerised tomography colonography (CTC) is an examination of the colon using two CT images and it relies on a radiologist to match findings to detect polyps. In earlier work, we demonstrated feasibility for a registration technique to align these two colon views but it was impractically slow. In this project, we developed a fast solution for the computational bottleneck, Ricci flow.

What approach did you take to address the challenge?

Ricci flow is a partial differential equation used to conformally map the surface of the colon to a cylinder, where the registration is easier to compute. Our objective was to improve the speed of the Ricci flow, which initially took over a day to run for a single patient. Using a Newton optimisation technique, we were able to solve the Ricci flow in 60 seconds.

What are the potential benefits?

Having now shown it is technically feasible to compute Ricci flow on a colon surface in about one minute, we are in a much better position to develop a complete prototype for prone/supine registration of CT images. We expect this prototype will assist radiologists in screening CT images of the colon for polyps. Improved detection, in terms of both accuracy and speed, promises to improve patient care and reduce cost.

What are the next steps?

Our next step is to develop a complete, end-to-end prototype for prone/supine registration. Our now-rapid Ricci flow is an essential part of this system. Once the prototype is developed, we will test it clinically and perform any subsequent optimisations prior to commercialisation.

NPComplete (Satalia)

Secure and economical implementation of cryptographic digital circuits

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Satalia takes the complexity out of solving the most difficult and critical optimisation problems. We use our expertise in intelligent algorithm management, cloud-computing and proprietary technologies to produce better optimisation results for industry's problems, faster than ever before.

What was the business need that motivated the project?

Gate-efficient implementation of integrated circuits (ICs) is a well known optimisation problem in the semiconductor industry. Importantly, cryptographic processing commands a very substantial gate count and/or CPU (central processing unit) load in many products, including smart cards, mobile phones and web-servers. Academics are devising gate-efficient cryptographic algorithms that could be implemented in billions of ICs, yet these are being underexploited.

What approach did you take to address the challenge?

Our goal was to develop a software prototype that takes arbitrary cryptographic S-boxes and a number of target optimisation options. It then makes calls to the Satalia SolveEngine, finds the solution, converts back the results and finally produces a small circuit description ready to be implemented in hardware. We collaborated with UCL which has software that encodes the circuit optimisation problem in a compatible format.

What are the potential benefits?

For small ICs, such as those used in cryptography, we have shown that we can optimise the implementation in a novel way. Cryptographic processing commands a very substantial silicon gate count and/or CPU load in many products and is therefore the focus for power consumption and heat dissipation. The outcome of our work suggests that the resulting designs can be used in many low-power devices.

What are the next steps?

The timely nature of our project means that it addresses both security challenges and low-power silicon IP design. These problems are an industry focus and we are now seeking partners to help exploit our optimisation and new design of well-known ciphers. We may also patent the software process.

Onteca Limited

Using autonomy orientated computing (AOC) to rethink computer game production

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Onteca is a digital entertainment developer and micro-publisher. We develop applications for iPhone, Wii and other digital channels and offer consultancy services on social, interactive and multi-screen television usage. We are registered developers for Nintendo, Sony and Apple.

What was the business need that motivated the project?

Console games have huge development budgets. Large numbers of artists and designers spend considerable amounts of time building game levels both visually and functionally. We wish to apply artificial intelligence algorithms to reduce the cost and time spent within game level building. We already make strategy games for console so we focused on that area for our project.

What approach did you take to address the challenge?

Autonomy orientated computing (AOC) presents a generalised model which unifies analysis, modelling and simulation of the characteristics of complex systems. AOC uses autonomous entities or agents to simulate and solve complicated problems and these solutions are often designed to minimise human involvement. We applied AOC techniques to the creation of computer game content and were able to create effective stylised game worlds with an easy but powerful user interface.

What are the potential benefits?

We have created a toolset which already gives us a better workflow in our own game production processes but, more importantly, creates a new product for us to take to market. We are able to reduce our time to market and improve the quality of our content. We will also be able to access a new market segment based around the sale of technology rather than content.

What are the next steps?

We are currently taking forward the toolset we created for a release via digital distribution channels. We are initially releasing it for 3D modelling enthusiasts to use as a tool that allows them to quickly create landscapes. Over time we will develop the product into a full game engine.

Openia

User experience profiles (UXP): profiling the psychology of 'things'

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Openia specialises in user experience (UX) research as well as web systems development and infrastructure. With emphasis on open source technology, our team has broad experience in supporting academic, public and industrial clients and also undertakes in-house research and development.

What was the business need that motivated the project?

Enhancing people's experience with websites ultimately leads to direct business gains for website owners. In 2009, the UK user experience research market was worth over £214m annually. Deloitte identified 'analytics' and 'user engagement' as two of the top five deployment priorities. The challenge lies in actually 'measuring' people's experience. This is notoriously difficult, time-consuming and involves costly researchers.

What approach did you take to address the challenge?

Academic research has revealed insights into the nature of user experience. This led us to a radically innovative approach to this problem, where we use advanced algorithms to provide a direct handle on the psychological aspects of websites. We are able to generate machine-readable user experience profiles (UXP), akin to a DNA profile. These have the capability to disrupt the UX market by enabling increased automation and lowering costs.

What are the potential benefits?

UXP services provide data for advanced and dynamic 'user engagement' techniques, to improve business performance. This has a wider impact, opening up sub-markets for automated UX evaluations and spawning third-party services. Even though our project was focused on websites, the technology can be applied to a wider range of technological artefacts (software and physical) as well as non-technical areas such as fashion.

What are the next steps?

We have shown significant progress but further technical development is still required. We are looking for capability in artificial intelligence and natural language processing, and funding to commercialise the products. Our next step is a 'proof of market' project, which is being partly funded by a further Technology Strategy Board grant.

OptoSignal Ltd

AcoustiCam – the acoustic camera

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OptoSignal is involved in the design, manufacture and selling of specialist optical and acoustic communication test systems.

What was the business need that motivated the project?

We wanted to investigate the feasibility of an acoustic camera, to image the sources of sound, and particularly noise, within a narrow and selectable frequency band. We were particularly interested in sound from systems where it can be difficult to pinpoint the exact sources of noise, such as in aircraft or a noisy workplace.

What approach did you take to address the challenge?

We considered a 2D array of acoustic sensors, such as the new MEMS IC (micro-electromechanical systems integrated circuit) microphones. A novel aspect of our investigation was the synchronisation of the acoustic sampling with optical imaging, for example with every image from a machine vision camera. The ability to time-step, frame by frame, through overlapping displays of the acoustic and the digital images will help to identify sources of impulsive noise.

What are the potential benefits?

Potential benefits include the use of active imaging, in which we transmit a chirped acoustic signal and use the acoustic camera and subsequent data processing to generate a 3D representation of the view. We could use our product to monitor turbines in power stations and aircraft at airports or we could image the acoustic qualities of a concert hall. There are also military applications, such as locating gunfire or explosions.

What are the next steps?

This feasibility study has given us the confidence to invest our own money in developing a prototype system for demonstration to potential customers throughout the world.

Sensonics Ltd

Dynamic displacement measurement algorithm for intelligent sensor networks

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Sensonics designs, develops and manufactures sensor systems for the measurement of vibration, position and speed on critical assets. We offer protection systems for rotating machinery in the event of an impending failure as well as earthquake monitoring for nuclear infrastructure.

What was the business need that motivated the project?

There is clear market demand for dynamic displacement monitoring on critical assets across a wide range of industries. Although machine condition monitoring is a mature market, equipment and installation costs are a limiting factor for many potential applications. This drives the requirement for development of a software algorithm capable of providing processed measurement data on a low-cost wireless platform.

What approach did you take to address the challenge?

We first ratified the market case and specification details, then followed up by prototyping a low-cost, low-power hardware platform suitable for the software algorithm development. We used mathematical modelling in conjunction with C++ coding to develop the embedded code through appropriate software tools. With sensors fully integrated into our prototype, we tested the algorithm by characterising measured displacement versus actual displacement across a range of frequency events.

What are the potential benefits?

Offering low-cost wireless access to processed dynamic displacement data unlocks a wide industrial market for us, with the complement of wireless mesh networks and IP-driven access to data clouds providing added value. This will open new revenue streams for us at home and abroad, with the extra opportunity of licensing our technology through partnerships.

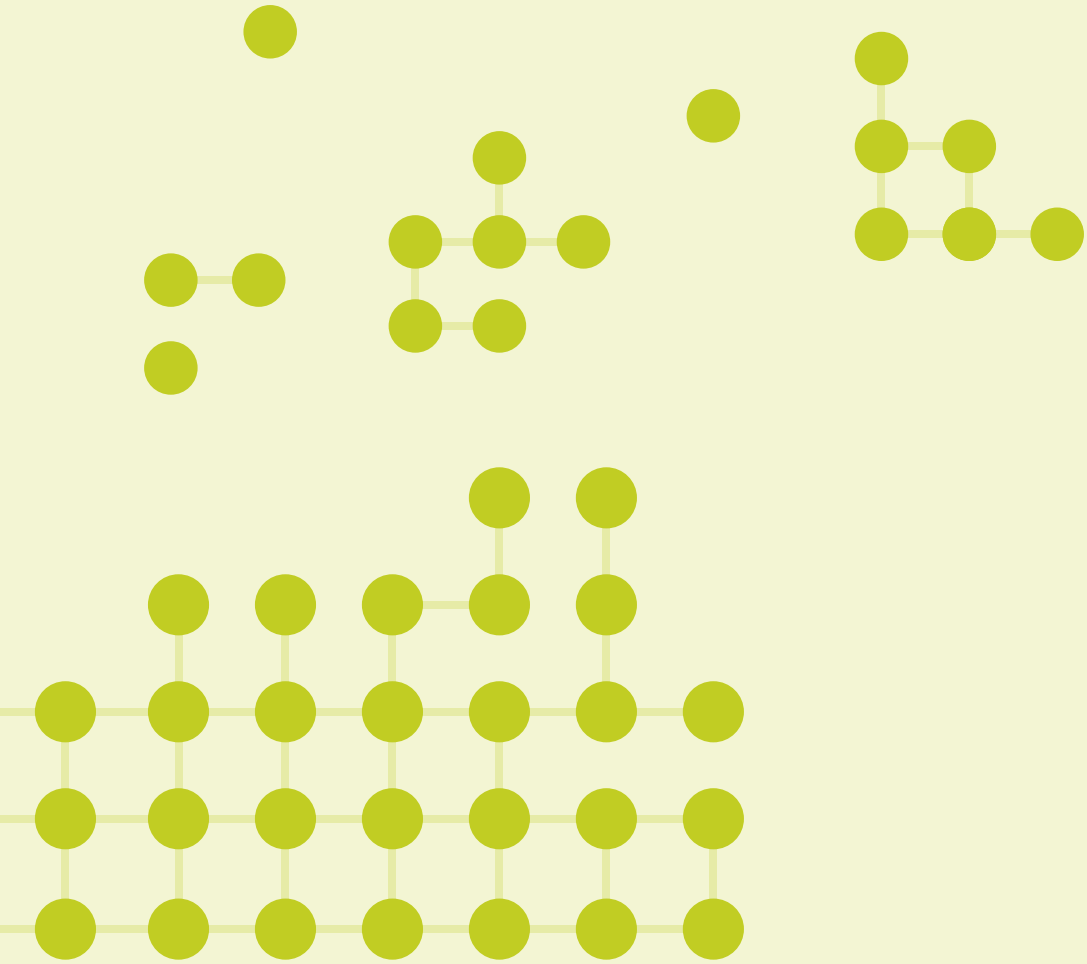
What are the next steps?

We must undertake further work to improve the low-frequency performance of the algorithm and to fully develop the three axes sensor measurement. We also need to achieve full integration with a suitable wireless architecture, ideally through a technology partnership with a company sharing similar market interests.

Collaboration Nation

Technology-inspired feasibility projects

Nanotechnology



Archimedes Polymer Technologies Ltd

Eco-continuous flow process for the separation and sorting of carbon nanomaterials

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Archimedes Polymer Technologies specialises in the development of polymer-based solutions for nanomaterials, from preparation of carbon nano tubes to incorporation and characterisation of materials. We focus on application development, particularly electronic materials and biosensors.

What was the business need that motivated the project?

The majority of nano materials contain contaminants, either heavy metal residual catalysts or, in our case, forms of carbon such as 'onions' (concentric spheres) and multilayer graphites, in addition to carbon nano tubes. The need is for a scalable, environmentally friendly separation process that can be incorporated into the process chain to purify and release the value of the specific products

What approach did you take to address the challenge?

We had attempted combinations of centrifuging and filtration to achieve separation, which proved effective. But it was very slow and not economically viable. Then we undertook preliminary investigation into 'Counter Current Chromatography', developed at Brunel University, which showed potential. We used this process to investigate separation of our available product, Ros1 mixed short multi-wall carbon nano tubes, from 'onions'/graphites. The equipment successfully separated the various phases, proving the process's potential.

What are the potential benefits?

We have successfully scaled up the Brunel process to provide an important new tool for the biotechnology sector. This research demonstrated that our technique can be transferred to the 'harder' materials under investigation. The process is environmentally friendly and can be scaled up. If we can successfully transfer it to other carbon nano tubes, and particularly to single wall types, the potential of the product can be valued at £100m.

What are the next steps?

Our team has been preparing an application within the EU Framework Programme. We have identified some partners and welcome the opportunity to carry the research forward. We are open to collaborations in the area of standardisation of nano particles, environment, health-and-safety testing and carbon nano-based medicines.

Asymptote Ltd

Nanoscale coatings for ice nucleation

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Asymptote Ltd is expert in cryopreservation and crystallisation, particularly as applied to cryopreservation in IVF (*in vitro* fertilisation), freeze drying and chemical engineering. We develop and license technology to major end users and also supply specialist equipment.

What was the business need that motivated the project?

The control of ice nucleation is important to the outcome of biological cryopreservation. We know a number of materials provide ice nucleating activity, such as the bacterium *Pseudomonas syringae* or crystals of silver iodide. But such materials cannot be used in the processing of substances intended for clinical delivery, so we need to identify an alternative.

What approach did you take to address the challenge?

We investigated a wide range of substances for their nucleating activity, with emphasis on biocompatible materials. We used the data from screening of these materials to build up a molecular model as to why the actively nucleating materials work. We coated on to substrates those materials shown to be most active and examined them for nucleation of ice in both water and aqueous cryoprotectant solutions.

What are the potential benefits?

Our success in identifying a new class of ice nucleators which are both biocompatible and suitable for application as a coating will yield products with a large market potential. Our product will enable increased viability and functionality upon thawing of cells intended for clinical delivery. In addition to improving cell-based therapies and reducing costs, it can contribute to a highly efficient cGMP (current good manufacturing practice) cold chain.

What are the next steps?

We will progress the application of these new nanomaterials for use in both medical research and in clinical application as a nanoscale coating. It is likely that we will need to agree joint ventures or licences with major producers of cryocontainers to exploit this opportunity.

AvantiCell Science Ltd

Human cell isolation for personalised medicine

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AvantiCell Science is a biotechnology company specialising in cell biology and cell culture technology. We deliver cell-based analysis with application in drug discovery, the evaluation of natural products and traditional medicines and in nano-safety screening.

What was the business need that motivated the project?

Our project focuses on an opportunity to develop personalised cell-based assays capable of determining individual patient sensitivity to chemotherapeutic drugs for the treatment of cancer. A successful outcome will deliver a platform technology with the potential to inform selection of an optimal drug therapy for individual cancer patients, using their own tumour cells as the test system.

What approach did you take to address the challenge?

We aimed to determine if nano-structured materials could be used to stabilise cancerous cells dissociated from breast tumours, enabling their incorporation into cell-based assays for chemotherapy screening. We tested cells obtained from breast tumours for their interaction with biomaterials engineered for cell anchorage. Our cell-based analysis indicated the feasibility of biomaterial-assisted cell harvesting and the potential to manufacture a device for semi-automated cell isolation during transport from surgery to laboratory.

What are the potential benefits?

Our study did not achieve its original goal because one element of the technology was found to be impractical. Essentially, experimentation demonstrated that the selected biomaterial did not offer a means of stabilising freshly-isolated primary cancer cells en route to personalised, donor-specific cell-based analysis. However, redesign of the enabling technology offers an alternative means of achieving the original goal, which may simplify automation of the isolation device.

What are the next steps?

This is part of a wider R&D programme to build a device capable of transporting tumour tissue from surgical source to analytical laboratory for personalised cell-based analysis. At the same time it will digest the tissue to its constituent tumour cells en route and stabilise those cells before laboratory harvesting.

AvantiCell Science Ltd

Population-based nanotoxicity testing using human stem cells

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AvantiCell Science is a biotechnology company specialising in cell biology and cell culture technology. We deliver cell-based analysis with application in drug discovery, the evaluation of natural products and traditional medicines and in nano-safety screening.

What was the business need that motivated the project?

Assessment of the risk to human health from nanoparticles present in domestic and industrial environments lacks robust, predictive tools. Cell-based analysis offers an ethically-acceptable means of assessing nanotoxicity, and should predict health risk if performed with physiologically-relevant cells. The study aimed to build assays using a novel source of human blood-derived stem cells, which offer potential for population-based nanosafety testing.

What approach did you take to address the challenge?

Our strategy was to grow and bank blastomere-like stem cells isolated from human blood. We use them as the basis of nanotoxicity assays that evaluated the cells' response to standard nanoparticles. Once a standard assay format had been derived from a single population, we would exploit the unique advantage of the stem cell source to examine differences within the human population in nanotoxic response.

What are the potential benefits?

We developed methods for successful propagation and cryopreservation of stem cell isolates. However, following systematic variation of cell-based assay conditions, we concluded that the totipotent form of stem cell did not offer a sensitive platform for cell-based nanotoxicity screening. In an alternative approach, we drove totipotent cells toward a differentiated, multipotent cell lineage, which offers prospects of realising the original objectives for a sensitive assay.

What are the next steps?

We have continued to invest in realisation of a population-based stem-cell-derived nanotoxicity assay based upon a lineage-specific multipotent cell phenotype.
We will take the technology forward through partnerships established within the European Nanosafety Cluster, by membership of two Framework Partnership 7 projects for capacity building ('QNano') and training ('NanoTOES').

Bio Nano Consulting

Nucleic acid aptamer-based nanowire diagnostic system

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BNC provides research, problem-solving and product development services through access to UCL, Imperial College and London School of Pharmacy. Formed in 2007, we have an international client base and have delivered projects in biotech, pharma, environmental and ICT sectors.

What was the business need that motivated the project?

In addition to creating intellectual property for our clients, we are looking to develop our own products. A meeting with our partner, Applied Nanodetectors (AND), generated an idea we wanted to explore together. The Technology Strategy Board grant allowed our two companies to assess the idea and begin a collaboration.

What approach did you take to address the challenge?

AND brought knowledge in nanowire sensors for gas sensing while we had the biological/biosensor expertise. That combination allowed us to work together to immobilise the aptomers on to AND's nanowires and assess whether a drug binding to the aptamer would produce a measurable signal.

What are the potential benefits?

The system under development would be a small 'point of care' device for therapeutic drug monitoring. For drugs with narrow therapeutic windows, monitoring levels in the patient is the only way to ensure efficacious dosing without causing side effects from overdosing. The market for drug monitoring systems is predicted to grow rapidly as regulatory bodies become more stringent and personalised medicine becomes more mainstream.

What are the next steps?

Our project had a successful outcome, demonstrating specific detection from the nanowires using aptamer ligands. The two partners are currently reviewing how we should take the system forward. We are seeking the further funding necessary to develop the system.

Cambridge Nanotherm Ltd

Nanoceramic printed circuit boards (PCBs) for light-emitting diodes (LEDs) and other electronic devices

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Cambridge Nanotherm was set up in November 2010 to utilise its proprietary nanoceramic substrate technology. We produce high-thermal-performance printed circuit boards for LED lighting.

What was the business need that motivated the project?

The problem we are addressing is the efficiency of thermal management of LED lighting systems. Too much energy for lighting is lost as wasted heat because of poor thermal management. Solid-state lighting is a pivotal technology that promises fundamentally to alter lighting in the future, contributing to energy and climate change solutions.

What approach did you take to address the challenge?

We have developed, produced and evaluated our first LED light fitting prototype based on nanoceramic substrate. Nanoceramic films with compact nano crystalline structure provided a high thermal conductivity (6-7.5 W/m°C) and a high dielectric strength (60-100 KV/mm), values ahead of alternative solutions. Key features of LED fitting based on nanoceramic substrates, such as light efficiency and lifetime, proved to be superior to current LED products.

What are the potential benefits?

The results allow us to strengthen our performance claims and speed up the commercialisation of the developed thermal management substrates. Use of nanoceramic substrates will increase energy efficiency by up to 10% and double the lifetime of LED lighting systems, with consequent impact on carbon footprint. In the UK, based on 5% market penetration, there would be a reduction of 1.2 million tonnes of CO_2 per annum.

What are the next steps?

First, we need a manufacturing unit for nanoceramic substrates. Then we will devise a sales and marketing strategy, creating awareness in the LED industry. We will also investigate opportunities for applications in power semiconductors, telecom chips, optical transceivers, power microwave devices, digital signal processors and RF (radio frequency) devices.

DELIVERICS Ltd

Development of biodegradable nano-sized carriers for *in vivo* RNA delivery: an R&D product with gene therapy applications

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DELIVERICS is a young biotech company established to commercialise proprietary technology and know-how in the R&D reagent and pharma markets. We develop and manufacture easy-to-use kits to help researchers deliver biomolecules and therapeutics into and on to cells.

What was the business need that motivated the project?

We aimed to develop a novel biodegradable nanotechnology able to transfer ribonucleic acid (RNA) into cells *in vivo*. Such an advanced delivery vehicle, so-called LIFEctin Transfection Reagent, is intended to address a commercial opportunity that exists in the R&D and pharma industry. They need a truly-safe method to transfect cells *in vivo* required for animal studies and gene therapy drugs.

What approach did you take to address the challenge?

Based on our own intellectual property and expertise, we synthesised and tested RNA delivery reagents designed to undergo complete intracellular enzymatic degradation into harmless materials. This was to develop a safe delivery tool for *in vivo* RNA transfection studies. Based on outstanding transfection results with stem cells, we expanded the initial project scope to develop a simple-to-use kit to transfect both RNA and DNA into stem cells without toxicity.

What are the potential benefits?

First, this project has allowed the in-house development and launch of a new product, SAFEctin-STEM Transfection Reagent, the second R&D kit of our product portfolio. This product will help researchers to improve the reliability and safety of their stem cell-based studies, a highly-profitable market estimated at $21.5bn. Second, the data generated demonstrated the feasibility of our project, which must be explored further because of its potential in gene therapy.

What are the next steps?

While we have developed and launched a new product (SAFEctin-STEM), the main objective of the project (LIFEctin) is under development. We have identified novel reagents with improved solubility and transfection properties and these are lead candidates for developing LIFEctin. We will explore additional funding sources to complete this exciting project.

Intrinsiq Materials Ltd

WIN waste stream remediation approach for manufactured inorganic nanomaterials

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Intrinsiq Materials is an innovative nanotechnology company, founded in 2002 and focusing on advanced materials. We have developed various applications, including nanoscale metal inks for inkjet, screen and other print technologies, applied to the printed electronic, display and PV (photovoltaic) industries.

What was the business need that motivated the project?

The production and use of nanomaterials require the separation and removal of materials from liquids. That is necessary whether as an integral part of the production process or as part of the remediation of waste streams if more toxic materials are used. As the complexity and hence the value of materials increases, the need is to recover rather than filter.

What approach did you take to address the challenge?

We know that certain biomolecules will attach to specific inorganic surfaces. In this programme our company, working with the National Physical Laboratory, started to assess the potential of these novel materials to be used as a selective recoverable element as part of the production process. Materials were coated on to substrates and exposed to nanoparticle-doped water; subsequent characterisation showed that particles were captured and could be released.

What are the potential benefits?

Initial tests have proved that these molecules can capture inorganics. If taken to its logical conclusion this would enable both toxic and complex inorganic nano particles to be recovered efficiently and selectively from waste streams. This will be particularly significant in economic and environmental terms as the complexity – and therefore value – of future nano particles increases, .

What are the next steps?

We need to develop further partnerships to enable longer term testing on a scaled-up system to target specific optimal production processes as proof of principle. This would include both molecule and substrate optimisation as well as further characterisation trials.

Intrinsiq Materials Ltd

FLAM novel fluorescent labels for the medical diagnostics market

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Intrinsiq Materials is an innovative nanotechnology company, founded in 2002 and focusing on advanced materials. We have developed various applications, including nano-scale metal inks for inkjet, screen and other print technologies, applied to the printed electronic, display and PV (photovoltaic) industries.

What was the business need that motivated the project?

The worldwide market for molecular diagnostics is $3.3bn and growing at 17% annually. There is a gap in the market for biotags – sitting between expensive and toxic quantum dots and organic fluorophores that suffer from stability issues. The novel materials developed in this feasibility study are designed to address this unmet need.

What approach did you take to address the challenge?

It was a collaboration between ourselves, UK's largest and most advanced nanoparticle development company, and internationally recognised experts in the field of medical diagnostics from Bath University. Our role was to develop the nanoparticles while Bath University tested and attached the necessary biological species to complete the benchmarking analysis against industrial standards.

What are the potential benefits?

The benefits lie in the creation of a new product in the medical diagnostics market that offers cost effective and superior stability to existing biotag solutions, without any toxic side effects.

What are the next steps?

Although the initial study has been promising, we will need to seek further support from the Technology Strategy Board and other government bodies to take the product from feasibility to product prototype. Then we can approach industrial partners for commercialisation.

mLED Ltd

Nano texturing of sapphire for enhanced light extraction of microLED arrays for deep electrode insertion

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mLED provides unique solid-state optical micro-projection systems suitable for a range of applications. Our 'mini light engine' technology is based on many years of development at Strathclyde University. We have exclusively licensed this world-leading capability, offering generic and customised systems.

What was the business need that motivated the project?

The field of optogenetics has grown exponentially in recent years. The study of selectively targeted cell stimulation has been made possible by modifying cells to respond to specific wavelengths of light. This nascent market requires novel and easy-to-use light sources for biologists – in particular, light-emitting deep insertion probes for localised stimulation without excessive localised heating.

What approach did you take to address the challenge?

We fabricated gallium nitride LEDs on sapphire with emission through the sapphire. As light reaches the interface, a change in refractive index results in light being reflected. This reduces output and increases thermal load; we also needed to drive the devices at higher currents. However, excessive heat generation raises the risk of tissue damage. We have therefore developed surface nano texturing techniques in an attempt to reduce this unwanted effect.

What are the potential benefits?

Our enabling technology allows us to address the nascent optogenetics research market and build upon established links with US research groups. We hope our technology, once proven, will be adopted by UK and European markets. This is a new branch of neuroscience which may help in the understanding of central nervous conditions. This will require advanced optics and our device may guide future neurodegenerative treatments such as for Alzheimers, Parkinsons, depression and chronic pain.

What are the next steps?

We have demonstrated a number of the building blocks. The next stage is to partner or trial our capabilities with leading neuroscience departments who specialise in genetic studies, also accessing grant funding. Working with such luminaries will provide us with a valuable route into the scientific research market.

Naneum Limited

Personal monitoring system for exposure to manufactured nanoparticles

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Naneum develops and markets novel instruments for the detection and characterisation of airborne nanomaterials. Our instruments offer leading edge performance, but are designed to be robust portable and easy to use.

What was the business need that motivated the project?

The growth in manufactured nanomaterials, particularly engineered nanoparticles (ENP), presents an increased risk of exposure for humans and the general environment. Monitoring and measuring presents challenges unique to ENP. Having an effective system to monitor personal exposure of workers in the industry and the general public is an essential prerequisite for the safe exploitation of nanotechnologies.

What approach did you take to address the challenge?

We have developed a novel nano-scale surface-enhanced Raman spectroscopy (SERS) technique which we have combined with a personal nano-sampler. The result is an affordable, near on-line system suitable for monitoring exposure to ENP in the workplace during use and disposal of novel nanomaterials. Our system is easy to use too.

What are the potential benefits?

There have been massive public and private investments in the development of nanomaterials. These offer exciting technological and economic benefits in diverse fields, including engineering, climate change and health. However, there are concerns about the potential health effects of exposure to nano materials in the workplace, in use and disposal. Our affordable easy-to-use system will enable the safe and sustainable exploitation of these technologies.

What are the next steps?

We need to find funding for further development to move from a prototype device to a final commercial unit.

Nanomerics

Anti-cancer peptide pill

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Nanomerics uses its expertise in pharmaceutical nanotechnology to overcome the limitations of current medicines. We develop products that deliver patient benefit in areas of unmet medical need.

What was the business need that motivated the project?

We wanted to test the ability of our molecular envelope technology (MET) to facilitate oral delivery of peptide drugs, specifically to understand whether it would be possible to use this to create an anti-cancer peptide pill.

What approach did you take to address the challenge?

We needed to synthesise and characterise the peptide and derivatives and incorporate them into MET nanoparticles. Then we had to establish whether, first, the peptide would be still active and, second, if it would be taken up in sufficient amounts after oral administration to allow control of a model tumour.

What are the potential benefits?

Our novel product could provide a safe, convenient and efficacious pill that would help to control cancer. We have shown the capabilities of the MET platform technology in delivering a range of therapeutically active peptides. We have also tested the system with analgesic peptides to create a peptide pill for improved control of severe chronic pain.

What are the next steps?

We must now take these products into clinical development and find partners who would like to enable their own difficult-to-deliver drugs, using one of our nano medicine platforms.

Paraytec Ltd

New image analysis software tool and hardware for characterisation and quantification of nanoscale materials in biologically relevant media

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Paraytec is a scientific instrument company producing a wide range of products for pharmaceutical and biopharmaceutical applications. Our patented ActiPix™ technology is a two-dimensional detection platform for ultraviolet-visible (UV-Vis) absorbance measurement, using capillaries or area detection through active pixel sensors.

What was the business need that motivated the project?

Nano-scale materials cause major concern to drug producers and regulators because of their potential immunogenicity. Our project addresses the characterisation of nano-scale materials and their binding to components in biologically relevant media, such as proteins. Our technology discriminates between dissolved and particulate forms of nano-scale materials and, uniquely, meets market needs to determine binding to other components in a biological medium.

What approach did you take to address the challenge?

A control printed circuit board (PCB) drives both UV and visible spectrum light emitting diodes (LEDs). As the sample passes through the capillary, rapid switching between the two LEDs allows simultaneous analysis at the two wavelengths. Our software tool allows presentation of the spatial distribution of the light intensity, changes in this intensity profile and absorbance values corresponding to the intensity changes. These results were correlated with the known absorbance and scattering properties of the samples.

What are the potential benefits?

In contrast to traditional methods, this technology provides high resolution UV images and readily discriminates between dissolved and particulate forms. Using the particle sizing capability of the technique, we can distinguish dissolved drugs and nano-scale materials which are bound to other components in a biological medium. This feasibility study has proven the basis of the approach to be sound and has opened up a significant new market to Paraytec.

What are the next steps?

We wish to proceed to fully functional alpha and beta stage units and eventually through to production of a saleable instrument. We would seek collaborators in both academia and industry. One route would be to collaborate with another larger instrumentation company as we have done with some of our other products.

Seacoustics Limited

Provision of lead-free piezoelectric ceramics for the electronics industry

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Seacoustics has been involved in the design and manufacture of many types of commercial and military sonar applications, ranging from Boeing 777 aircraft to hydrophones on all UK submarines. We have developed a number of innovative products.

What was the business need that motivated the project?

We have been keen to pursue environmentally-friendly lead-free transducers. There have been extraordinary efforts overseas to develop lead-free piezoelectric ceramic materials. Once there are viable lead-free products, legislation will surely be changed to outlaw lead-based PZTs (piezoelectric transducers). It is an opportune moment to capitalise on and secure the UK's share of the lead-free piezoelectric ceramics market.

What approach did you take to address the challenge?

Our approach was to define the materials, compositions and acceptable production methods necessary to enable lead-free ceramic materials suitable for production of sonar and electronic devices. Our desired outcome was for a convincing and risk-free business plan that would encourage major ceramic manufacturers to invest in lead-free ceramic products.

What are the potential benefits?

Our study provides an independent technological review of current and developing lead-free ceramics, including the material properties and the likely performance of sonar and other devices made from it. Our purpose is to provide evidence to legislative bodies that lead-free ceramics can and will provide an alternative to harmful lead-containing products, in what is potentially a $40bn market.

What are the next steps?

Ceramics manufacturers need funding to undertake programmes that will result in availability of lead-free ceramics. An important aspect of this is to initiate such work as is necessary to characterise these materials so that designers can develop satisfactory products.