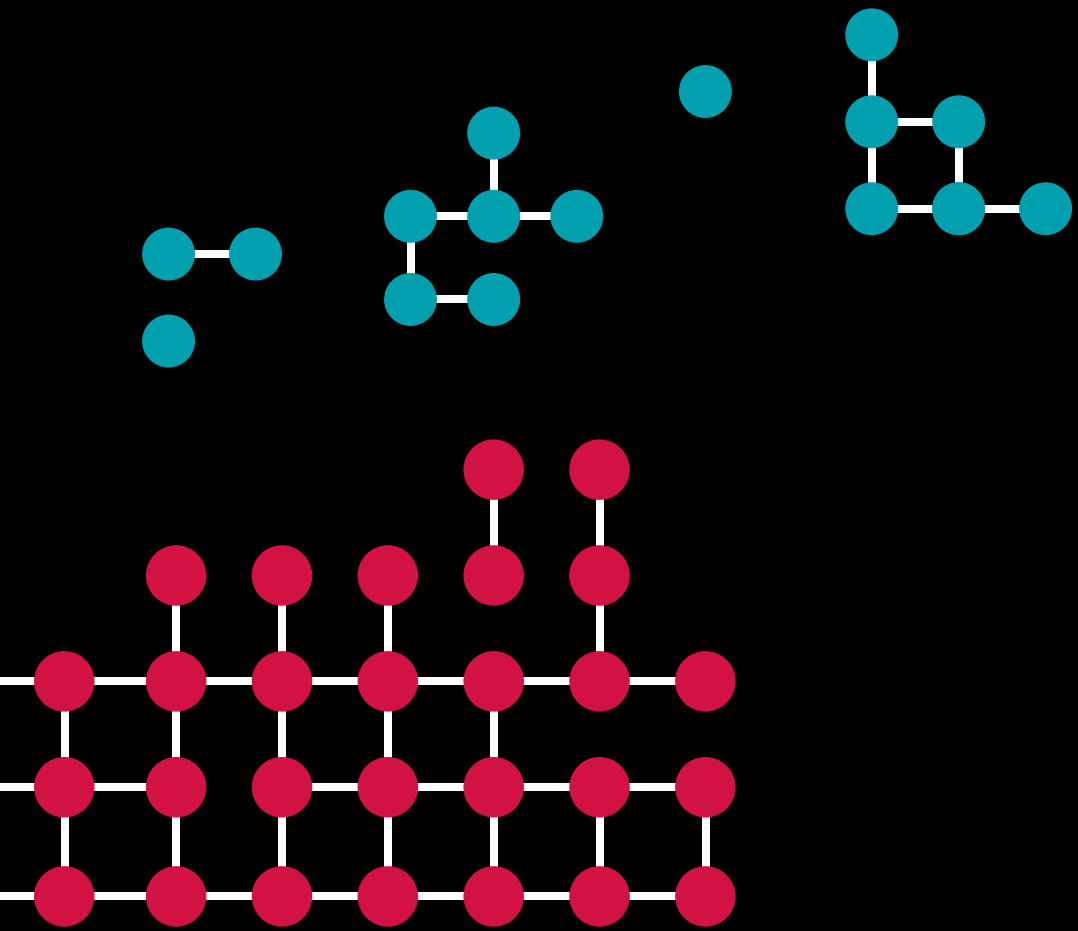
Technology Strategy Board
Driving Innovation

Collaboration Nation

Technology-inspired and Nutrition for Life feasibility studies



Disclaimer

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Introduction

The development and use of new technologies drives economic growth but early-stage innovation can be too high-risk for many small and medium businesses to undertake without support. Our feasibility study funding enables new ideas to be transformed into demonstrable technologies and techniques that can attract the partners, investors and future customers needed for successful and timely commercialisation. This directory showcases some of the feasibility studies we have funded.

Technology-inspired feasibility studies

All market sectors can take inspiration from innovations in enabling technologies that underpin competitive products and services. We funded 82 feasibility studies across four technology areas: advanced materials; biosciences; electronics, sensors and photonics; and information and communication technology. We invested up to £25k in each of the studies, lasting up to four months.

Nutrition for Life feasibility studies

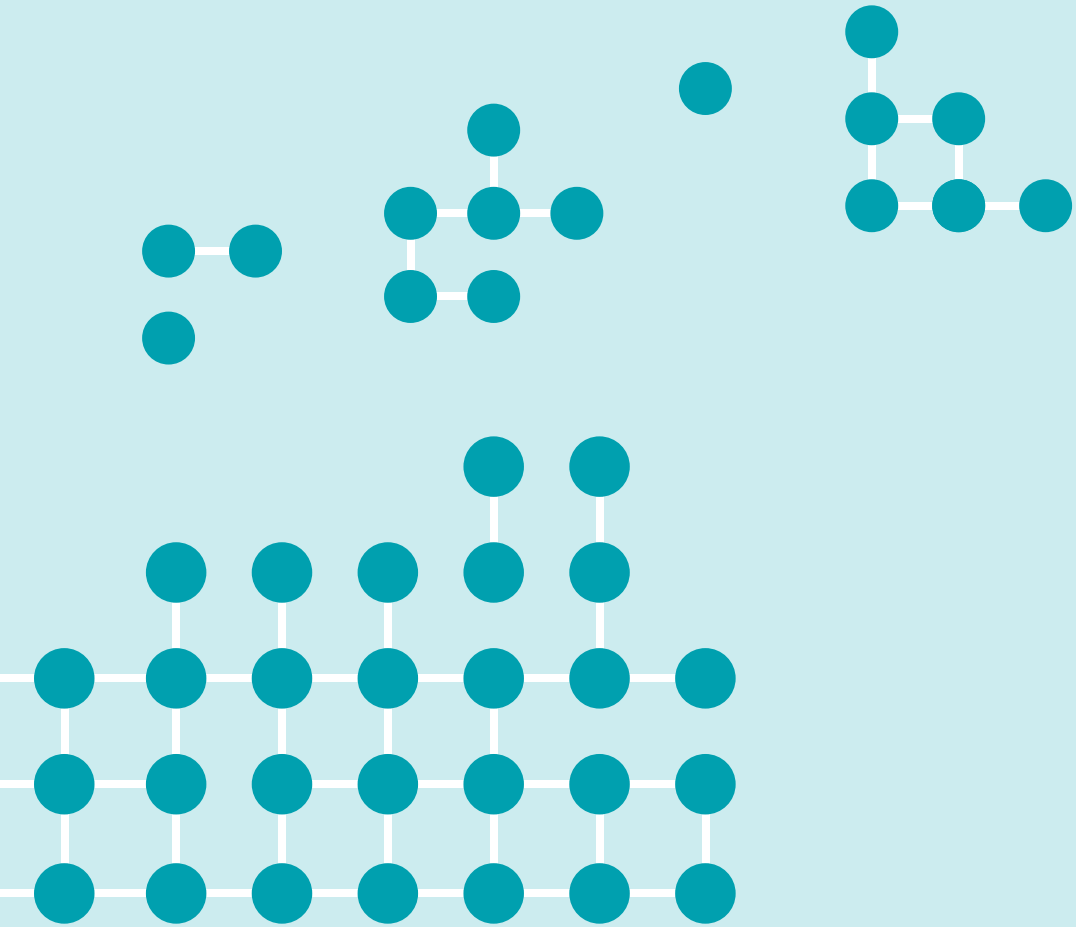
The food sector contributes significantly to the UK economy though its growth depends on innovation being at the heart of production and product. We funded 24 feasibility studies into innovative technologies and processes to enable the provision of healthy and safe foods. We invested up to £25k into each one, lasting between three and six months.

Zoe Webster
Head of Technology

Collaboration Nation

Technology-inspired feasibility studies

Advanced materials



3T RPD Ltd

Titanium thin-walled structures made using direct metal laser sintering

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3T RPD is expert in additive manufacturing, specialising in selective laser sintering and direct metal laser sintering (DMLS). We are the largest bureau in the UK, manufacturing parts for a range of industrial sectors, including automotive, aerospace, architectural and medical.

What was the business need that motivated the project?

Additive manufacturing can produce parts with intricate, lightweight internal structures constructed from advanced lightweight materials. The key objective and focus of this feasibility study was to establish the current limitations of this process in the manufacture of titanium thin-walled structures.

What approach did you take to address the challenge?

Our approach was to determine minimum wall thickness, as well as maximum build height, of primitive shapes with simple internal lattice structures. The innovative nature of this work lies in the way we simplify this complex process to quantify the physical limits of DMLS thin-walled structures, as opposed to the degree of complexity that can be built.

What are the potential benefits?

Understanding the limits of DMLS lightweight structures is likely to have an indirect impact on other sectors through the new range of components that can be built. Applications include lightweight structures for space applications, highly efficient heat exchangers for aerospace and automobiles and new implantable structures for medical devices. All of these benefit from the advancement and understanding developed in this study.

What are the next steps?

The knowledge gained allows our engineers and sales team to engage with companies expressing an interest in manufacturing components with thin walls. The next stage is the application of our knowledge to customer-specific requirements and to extend the boundaries of the DMLS technique.

Advanced Hall Sensors

Partner: CST Global Ltd

High performance III-V semiconductor materials for magnetic Hall effect sensors

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The project brings together AHS, a small-to-medium-sized business specialising in novel magnetic sensor development, and CST, a volume manufacturer of semiconductor devices. Both companies operate at the cutting edge of electronic component development, using high performance compound semiconductor materials.

What was the business need that motivated the project?

AHS has an established family of 'Hall effect' sensor products based on III-V compound semiconductors with distinct specification advantages over traditional silicon sensors, including very high sensitivity and high temperature operation. We see an opportunity to establish a high-volume sensor fabrication process to produce a higher specification, lower cost product which will expand the commercial viability of the technology for new applications.

What approach did you take to address the challenge?

The project brought together the product design team from AHS with CST's chip development and manufacturing teams. We modified the fundamental device design to be compatible with standardised chip manufacturing process flows in order to reduce cost and accelerate qualification for new market opportunities. In addition, the team developed a roadmap to adapt the manufacturing process to larger wafer formats which will offer further future cost reductions.

What are the potential benefits?

Demonstration of a volume manufacturing process with a competent partner will allow AHS to define a roadmap which will take our sensors from high-cost, niche products that will compete with mass market silicon solutions. This will drive III-V QHE sensors into the mainstream and present significant multi-million pound revenue opportunities for a UK-based chip design and manufacturing supply chain.

What are the next steps?

The chip prototypes demonstrated in the study will be packaged and characterised by AHS's existing supply chain in preparation for customer sampling by end users in the metrology, automotive and industrial control sectors. Qualification of the new manufacturing process will continue to derive long term ageing and reliability metrics.

Anaxsys

Development of a rapid prototype for the feasibility assessment of obstructive sleep apnoea

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Anaxsys has developed sensor technology that can identify respiratory conditions from breath profiles. We have a continuous respiratory rate monitor on the market in the EU and are developing other applications. We employ 11 staff in the UK and two overseas.

What was the business need that motivated the project?

Obstructive sleep apnoea is a common condition affecting 24% of middle aged men and 9% of middle aged women. Untreated, it causes high blood pressure, memory problems, anxiety and depression, as well as weight gain. It is associated with increased mortality and car accidents. Effective treatment is available but the major problem with managing sleep apnoea is in making a diagnosis.

What approach did you take to address the challenge?

We have developed a continuous respiratory rate monitor that can identify apnoea in post-operative patients. This project involves rapid prototyping of a data collection device that can be attached to a mask for patients to wear at home and a mask suitable for overnight use.

What are the potential benefits?

The prototype we have developed is currently being tested in the laboratory and we hope it will be used in a feasibility study involving 10 adults at a sleep clinic. As an indication of the potential benefit, only 10% of sufferers are thought to be diagnosed and the problem is increasing, since obesity is a risk factor.

What are the next steps?

A total of six prototypes are being manufactured for a clinical study to be undertaken by a sleep specialist, using current methodology in a sleep clinic. If successful the prototype will be commercialised and a study carried out in a primary care setting to confirm performance when used by patients at home.

Archer Technicoat Ltd

Tantalum carbide (TaC) coatings for high temperature barrier layers in the semiconductor industry

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At ATL we specialise in the process of chemical vapour deposition (CVD) to produce coatings for high temperature applications. ATL runs coating development projects, designs and manufactures CVD equipment and operates a facility for small batch production of coatings.

What was the business need that motivated the project?

Production of gallium nitride (GaN) currently uses CVD silicon carbide-coated graphite components which have only a limited lifetime in the corrosive process atmosphere of high temperature ammonia. Tantalum carbide is seen by the industry as a more resistant coating which can potentially replace SiC and give longer component life.

What approach did you take to address the challenge?

We aim to develop the coating process for TaC and produce a small TaC-coated demonstration piece. This requires modification of existing process equipment and an experimental programme to establish process parameters.

What are the potential benefits?

By developing a successful coating we should be able to produce longer lifetime components, increasing productivity and reducing costs in GaN processing. We will also gain expertise and develop wider capability in the coating of refractory carbide materials, which can be introduced into several other high temperature industries.

What are the next steps?

We hope to be able to coat component parts on a medium scale, provide large-scale TaC CVD coating equipment and also produce conversion upgrades to existing SiC CVD equipment in the coating industry.

Biomer Technology Ltd

Development of a clinically relevant prototype cell transfer sheet (CTS) to act as an artificial Bruch's membrane in the treatment of age related macular degeneration (AMD)

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Biomer, established in 2003, is a UK biomaterials company focusing on biologically-inspired polymeric solutions to medical device and therapeutic applications. Our lead technology, a coronary stent coating designed to promote vascular healing, is currently undergoing CE mark approval.

What was the business need that motivated the project?

In collaboration with the University of Liverpool we had developed an advanced polymeric biomaterial substrate able to serve as an artificial Bruch's membrane; this can be seeded with retinal pigment epithelium (RPE) or RPE-like cells and transplanted into the sub-retinal space. To translate this into a clinically relevant prototype, the film substrate needed a controlled fluid transport mechanism.

What approach did you take to address the challenge?

We had tested various techniques to achieve our objective, including solvent exchange (to form a membrane), microporous beads and leaching processes but these had compromised either the handling or overall dimensions of the proposed substrate. A more elegant solution was a laser-based approach to create discrete micron-sized holes within the film, controlling the rate of fluid transport by varying size and proximity of these holes.

What are the potential benefits?

If successful the project will have generated a clean, highly reproducible and cost-effective manufacturing solution to address the challenge of physical fluid transport across an inherently non-porous biomaterial. The process is ideal for 'short run' prototyping, yet is highly scalable to commercial quantities. The project will also provide the clinical grade prototype samples necessary to justify the further investment required to start pre-clinical and clinical testing ahead of commercialisation.

What are the next steps?

If successful, we will look for a significant grant-funded collaboration with one or more UK/EU academic institutions with the requisite skill sets in ophthalmic surgery and animal modelling. Alternatively, we could seek a partnership with a significant medical device or pharmaceutical company in the AMD field to begin pre-clinical testing.

Composites Evolution Ltd

Aligned viscose reinforcements for high performance biocomposites (Viscocomp)

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Composites Evolution is a supplier of innovative, sustainable materials to the composites industry. Our products include fibre reinforcements, resins and intermediates based on natural, bio-derived, recycled and recyclable feedstocks, which enable our customers to meet cost, weight and environmental targets.

What was the business need that motivated the project?

There is great demand for lightweight, sustainable materials in many industrial sectors. Natural fibre composites are lightweight, renewable and have good technical performance characteristics. However, natural fibres such as flax are discontinuous, of variable size and quality and have low impact resistance, making it hard to design and manufacture reliable products. Therefore there is a need to develop improved renewable reinforcement fibres.

What approach did you take to address the challenge?

Our project developed a new generation of high performance, renewable reinforcements for biocomposites, based on regenerated cellulose fibres such as high-tenacity viscose. These fibres, while 100% derived from renewable cellulose (wood), have the appearance, quality and consistency of synthetic fibres, with higher impact resistance and potentially lower cost than natural bast (plant) fibres such as flax.

What are the potential benefits?

Development of these materials will significantly increase the uptake of sustainable natural fibres as replacements to synthetic fibres such as glass and carbon, which are heavier, non-renewable and have high embodied energy. This will reduce the environmental impact of a range of products in the automotive, marine, mass transport and construction sectors –in manufacture, during use and at end-of-life.

What are the next steps?

We will first conduct in-depth testing to prove the performance of the materials in a range of applications, scale up the manufacturing of the materials to pilot and then industrial scale. Finally, we will work with potential customers to test the materials, develop prototypes and launch products.

Deliverics Ltd

Novel microsphere-mediated technology for the wide-ranging delivery of antibodies and proteins into cells

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Deliverics is a young biotech company established to commercialise proprietary technologies in the R&D reagent and pharma markets. We develop, manufacture and sell easy-to-use kits for researchers to deliver molecules and therapeutics into cells.

What was the business need that motivated the project?

We looked to develop a generally applicable method to deliver proteins into cells. Such an advanced delivery vehicle, known as TRANSprotein GST (glutathione S-transferase), will address a commercial opportunity in the R&D field, where an efficient and reliable delivery method is needed for therapeutically-relevant studies with antibodies and proteins of interest.

What approach did you take to address the challenge?

The goal was to develop a smart biomaterial which would conjugate, deliver and release into cells any antibody and/or protein for cell-based studies. To this purpose, we designed a microsphere-based delivery system that would bind indirectly to any protein through an 'affinity tag'. Our feasibility study involved the polymer synthesis and preliminary functional test of this novel kind of smart biomaterial.

What are the potential benefits?

The delivery technology will enable researchers to test proteins of interest in cells, using a first-in-class method that will be applicable to any protein regardless of its chemical nature; this has so far been the main barrier to obtaining reliable, therapeutically-relevant results. The development of such a technology will allow us to expand our portfolio of cell delivery reagents into the antibody/protein R&D field.

What are the next steps?

The project will continue with six to nine months of delivery studies with different GST-fusion proteins and cell types. These studies will be carried out in house, with the aim of launching TRANSprotein GST later in 2013. In disseminating this R&D kit we will target universities, biomedical research centres and pharma/biotech companies.

DZP Technologies Ltd

Printing graphene – from lab to market

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We are a technology development company working in the field of printed plastic electronics and opto-electronics. Our activities are focused on printed thin film photo-voltaics, printed highly conductive connectors for sensors, OLED (organic light-emitting diode) and other circuitry.

What was the business need that motivated the project?

There is a recognised need for new materials which can be used to produce low-cost yet efficient electronics and graphene is a material that can potentially meet many of the challenges. Yet for it to be integrated into electronic devices there needs to be a reliable industrial method for graphene processing.

What approach did you take to address the challenge?

Our project looked to develop new printing procedures for the fabrication of thin film, flexible graphene devices. As a result of this project, we were able to demonstrate the feasibility of using various grades of graphene as a component of new functional inks. These can then be used to produce graphene-based electronics, such as transistors and solar cells. The new procedures enable the cost-effective fabrication of graphene electronics.

What are the potential benefits?

Graphene printing has relevance to many high-value industrial sectors, such as display and solar cell production, thin film transistors and flexible sensors for healthcare. This is because all electronic devices require interconnects and very often, transparent electrodes, that can be made from graphene. This project helped us to take graphene printing closer to market and is expected to make a major contribution to our company growth.

What are the next steps?

We have obtained promising results from the feasibility study and we plan to continue our work on graphene printing in order to develop it into a commercially viable technology. We have also established some important business partnerships which will help us commercialise our technology.

Engineered Capabilities Ltd

THERMETEX – thermoelectric textiles

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We are an advanced manufacturing consultancy, with particular emphasis on aerospace and composites. We have been in business for six years, providing specialist advice in the business and technical aspects of the advanced engineering sector.

What was the business need that motivated the project?

Our project was motivated by the opportunity to use inherently deployable functional textiles for trace cooling, rather than unwieldy semiconductor material. We had experience in numerical simulation of the performance of textiles incorporating thermoelectrically active metallic elements and this provided the encouragement to create a physical demonstrator. The ultimate concept was an active ducting system.

What approach did you take to address the challenge?

The project was configured to create and test thermoelectrically active textile structures, enabling us to assess the manufacturing issues and, hopefully, to validate the previous numerical modelling.

What are the potential benefits?

Material physics militates against high energy conversion efficiency, although the processing steps are inherently low-cost and we see the potential for achieving either thermoelectric cooling or energy harvesting as an additional function of structural material.

What are the next steps?

We want to identify and work with organisations who hold the other pieces of this jigsaw, either through a directly commercial partnership or within further product or system level collaborative research and development.

Intrinsiq Materials

Partner: Cambridge Nanotherm

Cost-effective manufacturing for LED systems (CEMLED)

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Intrinsiq Materials, established in 2002, is the UK's leading developer of applications based on nanomaterial technology. Our company employs 25 people, most of them highly skilled engineers and scientists. We are working with Cambridge Nanotherm, who supply thermal substrates.

What was the business need that motivated the project?

We are addressing a £200m market by investigating low-cost manufacturing of novel light-emitting diode (LED) systems, using high thermal performance materials. Traditional manufacturing requires complex chemical processing which creates substantial environmental waste. Our objective was to produce LED prototypes based on a single-step screen print/curing process using nanocopper pastes, so reducing costs, increasing performance and limiting environmental damage.

What approach did you take to address the challenge?

Traditional technologies use insulated metal substrate, where LED circuitry is photo-imaged, developed and etched, or expensive silver screen pastes. We used low-cost copper pastes to produce sample LED structures; this posed challenges in developing paste and curing systems to produce equivalent or better performance in terms of electrical/thermal conductivity, voltage breakdown and adhesion. We adopted a fast-prototyping approach to test multiple formulations, with Cambridge Nanotherm providing fast product performance feedback.

What are the potential benefits?

The consortium is already in discussion with organisations who use LEDs for specialist spectroscopy applications and with multi-national corporations. There was significant interest when we demonstrated the prototype at this year's 'Strategies and Light' conference in Munich. We are targeting sales of 6,000-12,000 units in 2013, scaling up in 2014 to create both revenue and jobs. Without Technology Strategy Board funding, neither partner would have explored this opportunity.

What are the next steps?

We need to improve product reliability, specifically adhesion and reduction of paste porosity, to develop customer prototype samples for evaluation and to increase advertising/marketing. We are seeking funding from customers and other sources to develop our manufacturing strategy and to implement processes, supply chain and quality control systems.

Liquids Research Ltd

Magnetic nanoparticles with narrow size distribution

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We manufacture magnetic fluids (ferrofluids), primarily for use in semiconductor manufacture and ultimately for engineering and biomedical applications. Established more than 20 years ago, we employ up to eight staff and export more than 90% of our products.

What was the business need that motivated the project?

Our customers in Asia are looking for ferrofluids of three orders' magnitude lower vapour pressure than products currently available, all the while keeping the viscosity of the fluids at an acceptable level. In order to do this we needed to make larger nanoparticles of a more consistent diameter. This would allow us to use lower vapour pressure oils.

What approach did you take to address the challenge?

We took a standard chemical wet precipitation technique and modified it to allow us to control the growth of the nanoparticles. The challenge was to be able to control the distribution of diameters produced, also controlling the mean diameter. We produced particles with a log normal distribution of around 0.2, whereas the standard technique typically gives 0.4 or larger. This had never been achieved using this technique.

What are the potential benefits?

We would see sales of vacuum grade ferrofluids double in Asia. Project funding has brought the prospect of delivering samples to customers forward by approximately nine to 12 months. Other potential benefits are in biomedical applications, specifically for cancer therapies and drug delivery. Successful exploitation of the new technology would help secure existing jobs and create additional employment.

What are the next steps?

We need to purchase and build a residual gas analyser (RGA) to test vacuum properties and to carry out long term stability tests in-house. We would then send samples to customers for evaluation.

mLED Ltd

Feasibility of using colloidal quantum dots deposited within small volumes for efficient light conversion of micro-pixellated arrays

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mLED Ltd is a venture-backed, world leader in high brightness microLED array technology for the growing micro-displays and imager markets. Based in Glasgow, mLED has brought together an industry-leading team to deliver into a range of key applications.

What was the business need that motivated the project?

MicroLED arrays are pattern-programmable light sources with exceptional light intensities. They can be found in diverse applications, including embedded sub-miniature projectors, maskless photolithography and optical excitation of neurons in optogenetics. Until recently this was based on monochromatic operation. However, the versatility of the arrays would be improved considerably if multiple wavelength emission were available from a single array chip.

What approach did you take to address the challenge?

We investigated novel techniques to implement efficient colour conversion structures, using materials such as quantum dots on to the monochromatic LED array to produce, for example, a full colour pattern-programmable red-green-blue light source. We are developing micro-structures to enable integration and to enhance conversion efficiencies. This is currently the subject of a patent application; we are employing technologies such as ink-jet printing of the quantum dots.

What are the potential benefits?

Our ambition is to unlock the multi-billion dollar embedded imager market within portable consumer products. This market is forecast to grow at a compound annual growth rate of 80%. Issues of brightness, size, power consumption and cost – limited by current technologies – have been restricting market take-off. Our approach breaks down hitherto insurmountable technical barriers, promising the widespread adoption of microLED technology across previously unreachable sectors.

What are the next steps?

We are currently developing the capabilities of the technology. The next step is then to protect the concepts through patent filings and, if successful, to integrate this capability into our product roadmap. To that end we will raise further investment and look to co-operate with key players in the consumer market.

M Wright and Sons

Partner: Aztech Site Services

Cut-resistant innovative lightweight woven safety lanyards

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M Wright and Sons specialises in high performance narrow-woven products, using carbon, aramid and glass fibre as well as polyamide and polyester, for health and safety, medical, aerospace, military and industrial applications. Aztech Site Services is a process control company.

What was the business need that motivated the project?

Workers at height are currently protected by a full body harness and restraint lanyard which generally has a shock absorbing-structure to prevent injury, particularly to internal organs. Under new standards lanyards must have much-improved cut and abrasion performance but current manufacturing machinery cannot handle the type and weight of raw material without causing machine damage and wear.

What approach did you take to address the challenge?

We investigated an innovative retrofit to produce a lanyard lighter and functionally superior to metal alternatives, using electronics and embedded software to control servo motors performing the lifting operation. We addressed the size and position of the servo motors and gearboxes and designed the linkage between the servo motors and shedder gates. We introduced a programmable microprocessor to variably move the shedder gates at 1,000rpm.

What are the potential benefits?

We expect that our technology will be robust enough to produce innovative and high performance woven structures in a variety of materials, with the mechanical properties to fulfil legal and design requirements, fully tested for performance and legal compliance.

What are the next steps?

We must develop communication software to integrate between a computer-aided design system and mechanical movement on various types of machinery. We also want to meet companies working in advanced materials, aerospace, construction, defence, renewable energy, transport systems and vehicles.

M Wright and Sons

Partner: Techne Cast Ltd

Light weight screening shields for high-frequency power electronics systems

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M Wright and Sons is a long-established company specialising in technical woven products, such as carbon fibre and kevlar. Techne Cast Ltd, established 20 years ago, specialises in electrical insulation products to the electricity transmission and distribution sector, electronic drives and automotive industries.

What was the business need that motivated the project?

There is a need to reduce weight in low carbon, electric and hybrid electric vehicles (EV and HEV), to enhance their performance in range and efficiency. One area so far overlooked has been the weight of their electric distribution systems. These currently use heavy cables with equally heavy standard screening to minimise radio frequency interference from rapidly switching drive trains.

What approach did you take to address the challenge?

We are jointly developing effective lightweight screening materials based upon carbon fibre.

The technical challenges were to weave a suitable screening material based on a combination of different materials and to successfully impregnate such material with a thermoset resin, to made a usable series of components. Enhanced weaving technology has been developed together with improved resin impregnation methods and low viscosity material formulations.

What are the potential benefits?

The wider benefits to the industry are to revolutionise the design of EV electrical systems, enabling a lighter weight system to be employed for power distribution, thus easing the introduction of EV and HEV transport. For both companies these developments will lead to a new product range currently beyond the scope of current products.

What are the next steps?

We will next introduce such products to a technology demonstration level. The technology could be installed on an EV / HEV car or truck in collaboration with appropriate partners.

Neotherix

Feasibility of Neotherix electrospun scaffolds with additional anti-cancer functionality for regenerative medicine

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Neotherix, established in 2007, develops novel scaffolds for tissue repair and regeneration. Polymer electro-spinning provides nano-scale 3D structures into which healthy cells migrate to repopulate the wound space. Active agents can also be encapsulated within fibres, permitting local sustained release.

What was the business need that motivated the project?

The aggressive nature of some surface tumours, such as invasive non-melanoma skin cancers, plus the size, location and depth of penetration of the tumour may lead to a high number of cases of recurrence after excision or treatment. Intervention using topical anti-cancer agents or more extensive surgery has not resulted in a reliable reduction of tumour recurrence.

What approach did you take to address the challenge?

We have formulated and evaluated electrospun scaffolds containing encapsulated anti-cancer agents from a variety of chemical classes, including photoactive and non-photoactive agents. Regenerative scaffolds with anti-cancer functionality have the potential to improve the overall treatment of surface tumours treated by surgical excision, by reducing both the risk of recurrence and the number of Mohs surgery procedures required. They will reduce the need for systemic dosing and, consequently, associated side effects.

What are the potential benefits?

The scaffold's tissue regenerative function will accelerate wound repair and increase the likelihood of a better cosmetic outcome for the patient. Healthcare cost savings will result from lower tissue morbidity, reduced intervention rate and fewer clinic visits. Demonstration of the feasibility of anti-cancer functionality will open up a market opportunity of £287m annually. This is additional to sales projected for EktoTherix, targeted at non-melanoma skin cancer repair.

What are the next steps?

The success of this feasibility study will allow Neotherix to develop further expertise and expand our regenerative medicine portfolio and manufacturing capability. In collaboration with suitable development and marketing partners, we will use the platform technology stemming from this project to strengthen EktoTherix' market position and enter new markets.

NetComposites

Long fibre thermoplastic moulding compounds with reduced environmental impact: Eco-LFT

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NetComposites is a high-tech company that develops and commercialises composite materials. We have been established 10 years and have a team of 20 people. We have been active in the development and commercialisation of natural fibre composites for six years.

What was the business need that motivated the project?

Natural fibres from crop sources, such as flax, have equivalent stiffness to glass fibre at about half the density. Life cycle assessment studies show a far lower environmental impact than glass and natural fibres could yield lighter structural automotive parts. However, current forms of flax-reinforced thermoplastic are generally too expensive or the fibres too short to give equivalent mechanical performance.

What approach did you take to address the challenge?

We blended the flax and polymer fibres together, carded them to produce an aligned sliver and directly consolidated it in a continuous press to produce multiple parallel rods for pelletising. These natural long-fibre thermoplastic (LFT) pellets will be more cost-competitive and will enable a significant reduction in the environmental impact of LFT products.

What are the potential benefits?

The European market for LFT in 2011 was 75,000 tonnes, having grown at an average of 11% a year since 2008, and the global market is expected to exceed 310,000 tonnes by 2017, valued at $1bn. Natural fibre composites are a growing area within LFT.

What are the next steps?

The main output from the project will be sample pellet materials, moulded parts and mechanical test results, together with a technical report on materials development and processing. We will work with our automotive Tier 1 and OEM (original equipment manufacturer) customers to use the project results as the basis for further application development.

NetComposites

Novel bio-resins for 100% bio-based composite materials

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NetComposites is a high-tech company that develops and commercialises composite materials. We have been established 10 years and have a team of 20 people. We have been active in the development and commercialisation of natural fibre composites for six years.

What was the business need that motivated the project?

We previously developed a range of flax-based natural fibre reinforcements for polymer matrix composites, with clear sustainability advantages. The objective of this feasibility study was to identify and evaluate bio-based resins that would be suitable for use in conjunction with natural flax fibres in bio-composites.

What approach did you take to address the challenge?

The specific issues we addressed covered the sourcing and supply of the bio-resins, their compatibility with the available natural fibres, their processing characteristic, including viscosity, cure/melt temperature and surface finish. We also looked at material properties, such as mechanical performance, fire reaction and chemical resistance and their cost. We then benchmarked the performance – and eco-performance – of the 100% bio-based composites against conventional composites.

What are the potential benefits?

In terms of market impact, the natural fibre reinforced bio-resins will be targeted at existing applications that might already be using low-to-medium performance glass-fibre reinforced thermoplastics such as polypropylene or thermosets (polyester, phenolic). Such materials are widely used in the automotive, mass transportation, marine and construction sectors and the UK market for composite materials is conservatively valued at £800m a year.

What are the next steps?

NetComposites has good links with a number of companies in the automotive, mass transportation and construction sectors who are interested in 100% bio-composite materials. We share progress on developments with them in support of potential commercialisation.

Oxsensis Ltd

Alumina as sapphire replacement for extreme environment photonics sensor (ASREEPS)

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Oxsensis is an SME specialising in the development and manufacture of optical sensor systems for extreme environments. Application areas include gas turbine hot section monitoring, avionics sensors and oil and gas exploration and extraction.

What was the business need that motivated the project?

We currently offer a sapphire-based pressure sensor but the cost of the sapphire element restricts access to some market sectors. Replacing the sapphire with a lower cost alternative will enable us to market optical sensors for both pressure and temperature in a wider range of applications.

What approach did you take to address the challenge?

We carried out a study of available techniques for joining ceramic materials to metallic housings and then assessed these against the requirements for sensor assembly, accounting for the properties of both ceramic and metal. We then undertook an experimental bonding study using two approaches, one an all-metal joint and a second using high temperature adhesives. We also evaluated an existing sapphire bonding process using alumina parts.

What are the potential benefits?

Users of Oxsensis sensors in the gas turbine industry will see the benefits of ASREEPS technology in an expanded working range and subsequent cost savings from better engine monitoring and control. The annual market size for gas turbine sensors is some £200m and we expect the successful introduction of ASREEPS into product would increase our penetration of the market and, by reducing sensor cost, open up more cost-sensitive markets.

What are the next steps?

We will take the processes developed in ASREEPS and use them to build complete sensor assemblies which can be tested using Oxsensis existing facilities. We will then work with customers to trial the sensors in realistic conditions.

Promimetic Ltd

Partner: Dando Weiss & Colucci Ltd

In vitro evaluation of the effects of pluronic and tetronic-fibrinogen on survival and differentiation of mouse and human-induced pluripotent stem cell-derived mesangioblasts (MABs)

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Promimetic Ltd specialises in developing state-of-the-art biotherapeutics aimed at repairing damaged tissue via either reconstruction or blocking degeneration. We are currently focusing on biomaterial development, combined with either cells or bioactive molecules.

What was the business need that motivated the project?

Engineering skeletal muscle has potential for treating acute, chronic, rare and common conditions, such as muscular dystrophies, surgical tissue ablation and sphincter incontinence. We could provide therapy for these disorders by engineering an artificial muscle from a few patient cells. We would do this by reprogramming them to skeletal muscle stem cells via induced pluripotent stem (iPS) cells and biomaterial-induced differentiation.

What approach did you take to address the challenge?

Our project entails the differentiation of mouse and human iPS cells towards muscle-specific progenitors, the MABs. We are following a specific protocol to generate iPS cell-derived MABs. Our approach was in three major phases, each of them using different assays: development of a culture protocol of iPSC-derived MABs on biomaterials; inducing myogenesis with iPSC-derived MABs; and myogenic induction and terminal differentiation of iPSC-derived MABs on biomaterials.

What are the potential benefits?

The result would be highly applicable regenerative therapeutics that can be applied non-invasively. They will restore function of damaged tissue, enabling patients to continue in employment and reducing lost working days. It would also allow people to remain in the workplace for longer than the standard age of retirement.

What are the next steps?

We plan to scale up and to develop applicability to large animal models, also positioning of the therapeutic combination in small animal models. We must combine material with specific bioactives, to stimulate endogenous stem cells and block inflammation/fibrosis, and apply combinations to non-muscular degenerative diseases. And we need to raise £3m in funds.

RoboFold

Rapid prototyping sheet metal with six-axis robots

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RoboFold is internationally established as a pioneering company in robotic manufacture of aluminium facades. We recently completed the ARUM sculpture for Zaha Hadid Architects, which featured 500 unique panels, manufactured directly from our software, with no tooling required.

What was the business need that motivated the project?

The architecture field is at the forefront in adopting RoboFold technology. The forming process has the potential to share the same 'on-demand' production as 3D printing. Our challenge was to simulate material in real time as a way to provide geometry that accurately represents the final production output, but at an early stage in the design process.

What approach did you take to address the challenge?

The main goal was to ensure a smooth facade design workflow, without having to wait for material calculations. We used a physics engine, which provided a lightweight approach to material simulation, so that fast iterations were possible during design development. We found that we also needed to develop the facade design tool as an effective evaluation environment, to understand if we were developing appropriate tools.

What are the potential benefits?

The success of this project is in customer verification – we are receiving good feedback on both material simulation and ease of design with the facade design tools. The long-term benefits of this project point towards a web-based bureau service that can produce panels on demand. With the popularity of highly complex facade geometry requiring expensive tooling, we are well positioned to capitalise in this field.

What are the next steps?

We will test the software with a select group of architects, engineers and facade contractors in the UK, EU and US. By testing the software across existing commercial relationships, we aim to get feedback from real-world projects. We should evolve the software during this phase, to secure further production sales.

TISICS Ltd

SiC (silicon carbide) compression-enhanced polymer composites

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We are a pilot-scale manufacturer of silicon carbide fibre reinforced titanium composites, employing 15 staff and generating annual turnover of more than £1m. Our target markets are in space, civil aerospace and oil and gas.

What was the business need that motivated the project?

Polymer matrix composites (PMC) are strong and light but have poor compressive strength. We believe that our silicon carbide monofilaments can greatly improve PMC compressive performance, reducing its tendency to buckle and enabling greater use in compression-loaded structures. We are the only manufacturer of SiC fibre in Europe and aim to start a European capability in SiC PMC technology.

What approach did you take to address the challenge?

We approached a number of PMC system suppliers to identify best practice. Subsequent trials identified the need for a robust fibre winding system and the use of a resin infusion methodology. We trialled processes with assistance from several interested suppliers and made simple uniaxial samples using different resins for compression testing. SiC fibre handling, lay-up and infusion are critical to alignment and hence performance and differ from conventional polymer reinforcements.

What are the potential benefits?

Our project work indicates a mixed fibre system may work best with SiC fibre carrying axial compressive loads and carbon fibre hoop or transverse loads. The benefits are a better polymer composite system for compression loaded parts, a European fibre source and early UK-based expertise in the technology. The performance of SIC in compression and tension may provide better fatigue life for compression tension PMC than pure carbon reinforcement.

What are the next steps?

We intend to complete the comparison of performance against conventional PMC systems, to assess the pros and cons and to present this to composite system users to identify components where the performance can be exploited. Suppliers working with us have identified potential areas of interest for future research.

TISICS Ltd

Silicon carbide (SiC) re-facing core drills

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We are a pilot-scale manufacturer of silicon carbide fibre reinforced titanium composites, employing 15 staff and generating annual turnover of more than £1m. Our target markets are in space, civil aerospace and oil and gas.

What was the business need that motivated the project?

The large forces required to cut hard materials, such as rock formations and concrete and steel structures, limit the life of conventional drill bits. Replacing them increases operating costs. SiC fibre/titanium composite is a potential solution, extending bit life and improving efficiency through continuous replenishment of the cutting face. If successful this has wide-ranging applications in oil and gas, space rover missions, mining and decommissioning industrial plant.

What approach did you take to address the challenge?

We fabricated and tested several designs of tubular composite drill bit to assess the potential of SiC architectures within the supporting and sacrificial titanium matrix. We designed the SiC fibre orientations to maximise benefit from their longitudinal compressive strength and to provide the hardness needed for a cutting face at the end of the composite tube. Preferential wear of surrounding softer titanium continually exposes the harder cutting face of the fibres.

What are the potential benefits?

Our titanium matrix composite (TMC) drill bits would be suited for demanding drilling operations in harsh or remote environments. Low mass and cutting face replenishment will be attractive in space applications where mass reduction can be valued at £20k per kg. Oil and gas plant decommissioning, mineral core drilling and well drilling are large markets that could generate more than £1m annual revenue but this would require a qualification programme.

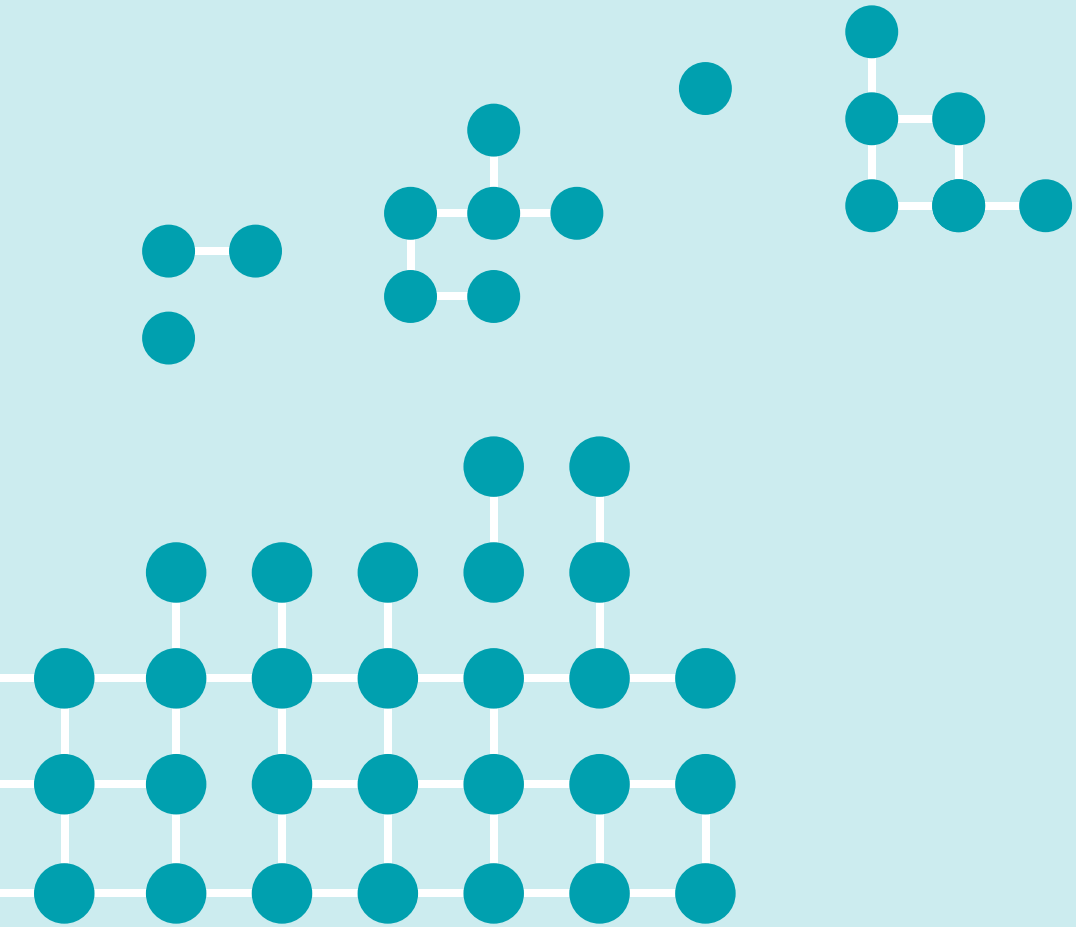
What are the next steps?

To build on the concept of TMC drill bits and to exploit the technology, we need to develop relationships with a manufacturer or end user within the space and/or oil and gas sectors. Within the space sector we are seeking support from the European Space Agency.

Collaboration Nation

Technology-inspired feasibility studies

Biosciences



AvantiCell Science Ltd

Cell-based assay reagent delivery using temperature-sensitive polymers

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AvantiCell Science is a biotechnology company which provides cell-based services and products to customers in the pharmaceutical, food, healthcare and nanotechnology industries. We specialise in human primary cells, in advanced culture formats and in the evaluation of natural product therapeutics.

What was the business need that motivated the project?

Cell-based assay kits offer user-friendly testing of materials for bioactivity and biosafety, and a cost-effective alternative to in-house assay development. The commercial market is estimated at £0.8-1bn annually. Kit performance is best when operator input and cell disturbance are minimal. Our project tests a strategy for synchronised, hands-free dispensing of assay substrate through temperature-controlled collapse of heat-sensitive polymeric capsules.

What approach did you take to address the challenge?

Our objective was to prove that encapsulation by a temperature-sensitive polymer would enable synchronous dispensing of assay reagent in multi-well, medium-throughput cell-based assays. The reagent we selected was an assay substrate generating a fluorescence-based read-out, which measured proliferation of human cells under established culture conditions. We based our methods for substrate delivery upon manipulation of temperature to induce the collapse and expulsion of a thermo-sensitive polymer pre-loaded with the substrate.

What are the potential benefits?

A successful outcome to our study was being able to demonstrate a novel strategy for synchronised, hands-free dispensing of assay reagents during cell-based analysis. The output represents an adaptable technology applicable to a variety of cell-based analytical situations. When combined with AvantiCell's platform of other specialist cell technologies, the potential for synchronous substrate delivery will create new, leading-edge products for the cell-based analysis market.

What are the next steps?

We will require a manufacturing partner in order to produce substrate-loaded polymer. Although we will initially take this product to market through existing commercial channels, in the longer-term we intend to sell it through an experienced life science product distributor.

Cambimune Ltd

Feasibility of applying an innovative bioprocessing methodology in a novel vaccine approach

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Cambimune is a Cambridge-based biotechnology company. We undertake research and development of innovative biomedical technologies which we commercialise via out-licensing and other collaborations.

What was the business need that motivated the project?

Our study addresses the need for technologies which can yield more efficient and therefore lower-cost vaccination programmes. In the case of rabies the cost of post-exposure vaccination keeps it beyond the reach of large sections of the population in the world's worst affected countries, China and India. Rabies still claims thousands of lives in these countries each year.

What approach did you take to address the challenge?

We investigated the feasibility of applying novel methodologies to generate a vaccine technology platform that could be deployed across a range of highly immunogenic, effective and relatively cheap-to-produce vaccines. In evaluating our approach to synthesising immunogenic proteins in complex 'virus-like particle' formulations, we focused on rabies. This was due to its suitability in demonstrating our concept and because of the economic and humanitarian need for lower cost rabies vaccines.

What are the potential benefits?

We believe we can use this technology platform to expand and take a significant market share of the global human rabies vaccine market, currently estimated at around £1bn. Affordable vaccines should allow widespread post-exposure vaccination, either through governmental or private vaccination, which could save many thousands of lives.

What are the next steps?

We will need further study to build on the knowledge gained, to test improvements to the concept and to look at applying the technology to other vaccine targets. We also want to combine our in-house expertise with that of a knowledge base provider in a more intensive feasibility study.

Cambridge Protein Arrays Ltd

'On demand' protein arrays for personalised proteomics

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Our company has pioneered a novel protein array method, printing arrays directly from DNA templates by means of cell-free protein expression, so developing a new concept in personalised proteomics. We employ three staff and are closely linked to the Babraham Institute.

What was the business need that motivated the project?

Protein arrays have great potential for biomarker discovery, diagnostics, proteomic research and drug-protein interactions, but existing methods are laborious, expensive and time consuming. Arrays are also difficult to store. Our goal was to achieve a big reduction in production time, along with reproducible quality, increasing availability of ready-to-use slides and significant cost saving, as well as expansion to the proteome scale.

What approach did you take to address the challenge?

We have developed a patented system 'DNA array to protein array' (DAPA) in which protein arrays are 'printed' directly and quickly from DNA array template slides by means of cell-free protein expression, enabling 'on demand' production. We devised a prototype system suitable for any user laboratory and enabling protein array copies to be created within two hours. To date we have printed more than 100 proteins in parallel.

What are the potential benefits?

As well as simplifying protein array production, we are leading a new concept of individualised proteome arrays as tools for personalised medicine, linked to sequencing of the genome and transcriptome (all RNA molecules in an individual cell or population of cells). By displaying the proteomes corresponding to the data output of DNA sequencing of individuals, DAPA arrays link next-generation sequencing and personalised diagnostics. This provides a platform for functional screening of variant proteins as potential targets for drugs or antibodies.

What are the next steps?

In this project, we have optimised conditions for establishing DAPA arrays so that it is now possible to produce complex protein arrays from DNA arrays in a few hours. We will take these conditions forward to explore protein function on the arrays and expand protein repertoire to a sub-proteome scale.

Celbius Ltd

Partner: Green Biologics Ltd

The application of power ultrasound to enhance the butanol fermentation process

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Celbius is less than a year old and combines ultrasonic processing with enzyme technology for faster, cleaner and cheaper bioprocessing to bioethanol, chemicals and pharmaceuticals. Our collaboration is with Green Biologics who have technology for the manufacture of biobutanol.

What was the business need that motivated the project?

Growing environmental awareness has focused attention on the production of biofuels from biomass. Biobutanol can be produced from renewable biomass via the Clostridia fermentation process. Our project identified a need for sonobioprocessing to speed up sugar conversion to solvents, to assist with product recovery and to improve butanol fermentation, industrial protocols and equipment.

What approach did you take to address the challenge?

Large-scale ultrasonic equipment can be readily retrofitted to existing bioprocessing infrastructure. First of all, we established a laboratory rig to look at the effects of ultrasound on Clostridia, mindful of how any processing might be scaled up. Secondly, we examined how acoustic cavitation could be used to assist in releasing butanol from the fermentation medium via solvent extraction/gas stripping.

What are the potential benefits?

Biobutanol is a next generation biofuel and a building block chemical for polymers and plastics. Commercialisation is hampered by low concentrations of solvent, end product inhibition and low volumetric productivity, all of which have an impact on production cost. Our aims were to facilitate faster rates, higher yield and reduced energy consumption. We wanted to help secure the manufacture of cheap carbon neutral biofuels in the UK/EU.

What are the next steps?

Ultrasonic processing principles and equipment designs can be applied to manufacture of biofuels and volatile renewable chemicals. Our partner, GBL, is ideally placed to exploit butanol manufacture but we will seek other partners too, including manufacturers of bioethanol. We will evaluate the beneficial effects of ultrasonic frequency on other cells.

deltaDOT Ltd

Rapid low cost formulation screening for protein self-interaction based on high performance capillary electrophoresis

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Established in 2001 from Imperial College London, deltaDOT produces high performance capillary electrophoresis (HPCE) instruments. Using patented data detection and processing technologies, with a strong in-house team, we transform HPCE into analytical solutions for a wide range of industries.

What was the business need that motivated the project?

Formulation of biopharmaceuticals brings unique challenges to the industry. The most common is protein aggregation, which affects the biopharmaceutical's effectiveness and safety. Current screening methodologies are out-dated, lengthy, empirical and incompatible with next generation formulations. We need a cost-effective, user-friendly, automated platform technology that allows rapid screening for protein self-interaction, leading to aggregation in formulated pharmaceuticals.

What approach did you take to address the challenge?

Our goal was to develop a platform analytical method for protein self-interaction screenings on deltaDOT's HPCE instruments. The innovative design of the proposed platform was based on established methodologies in self-interaction chromatography (SIC) and capillary electrophoresis chromatography (CEC), neither of which is widely used in the commercial sector.

What are the potential benefits?

The successful development and commercialisation of our proposed platform technology will bring substantial time and cost savings to the pharmaceutical industry. It will achieve that by reducing consumable cost, shortening product development time, allowing unsuitable products to 'fail faster' and enabling re-formulated 'bio-betters' with high efficacy and innovative delivery systems to be introduced to the market.

What are the next steps?

We will need a partner/mentor in biopharmaceutical manufacturing who can provide us with relevant materials and data to validate our platform. We also need expert knowledge on any regulatory challenges we may face.

DestiNA Genomics Ltd

Detection of bovine mastitis pathogens using novel nucleic acid testing technology

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DestiNA Genomics Ltd is a start-up (January 2011) molecular diagnostic company with a novel nucleic acid detection system. Using our patented SMART nucleobases, we are developing error-free, rapid point-of-care assays for pathogens, cancer, cardiac disease and toxicology.

What was the business need that motivated the project?

The dairy industry needs a test for mastitis in cattle which can yield results in less than two hours. Current microbiological testing takes two to three days, and even polymerase chain reaction (PCR) testing is not fast or accurate enough. With 23 million dairy cattle in the EU there is a multi-million pound market waiting for a new 'best-in-class' assay.

What approach did you take to address the challenge?

Testing of our technology involved experiments to determine the most effective detection platform and detection system, whether fluorescent, colourimetric or other, while developing sample preparation methodology. To develop the assay we used a selected set of bacterial nucleic acid target sequences, along with synthesis of complementary DestiNA probes and SMART nucleobases to test for sensitivity/selectivity.

What are the potential benefits?

Current tests are either too slow (microbiological) or still not fast enough (PCR). A rapid, low cost and error-free test could create a global multi-million pound business, while ensuring the commercial success of DestiNA. Support from the Technology Strategy Board has enabled us to accelerate development into the animal health market. Validation of the technology here will enable improved collaboration opportunities in developing clinical diagnostic assays.

What are the next steps?

With the success of the feasibility study, we will synthesise a full set of bacterial sequence DestiNA probes to proceed to commercial testing and launch. We will also identify a clinical diagnostic assay developer partner to begin development of rapid clinical diagnostic assays for infectious diseases using DestiNA-patented technology.

Forsite Diagnostics Ltd

Partner: Aptamer Diagnostics Ltd

Incorporating aptamers into lateral flow devices to evaluate their use in the manufacturing of on-site test kits.

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Two Yorkshire-based companies are collaborating through this feasibility study, bringing their individual expertise to the task of harnessing the use of aptamers (single-stranded RNA or DNA oligonucleotides) within routine development and subsequent, large scale production of lateral flow devices.

What was the business need that motivated the project?

There are growing requirements for on-site or point-of-care testing across life science industries. If successful the methodologies we have developed will enable the routine use of aptamers in commercially available products through existing contract service offers.

What approach did you take to address the challenge?

The key focus throughout the study has been the development of methodologies that can be used routinely for large-scale manufacture, while maintaining optimum sensitivity and specificity. We expect to deliver one or more prototype assays: a mycotoxin, to demonstrate aptamer use for small molecule detection in a competitive format, and a pepsin assay where the aptamer will be utilised in a sandwich format.

What are the potential benefits?

This study can help us to maintain a position at the forefront of lateral flow device developments and achieve first-mover advantage on exploiting aptamers in the point-of-care market, while maintaining the shared intellectual property. The study has helped the collaborators to work in a more formal and time-managed approach, ensuring dedicated resource with a time limited project.

What are the next steps?

The methodologies will become a standard service available to all customers and Forsite has existing customers who commercialise the two prototypes, utilising the standard antibody version. However, both are limited by the current sensitivities obtained or by stability issues which may be addressed as a circuitous result of this project.

Geoff Hale Developments Ltd

Transforming the functional analysis of therapeutic antibodies

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Geoff Hale Developments is a microbusiness involved in the development and analysis of therapeutic monoclonal antibodies. The company is operated by Geoff Hale as a sole trader, with a single employee, Alice Harrison. We have been operating since November 2011.

What was the business need that motivated the project?

Monoclonal antibodies are the fastest growing category of drugs, many with sales over £1bn. Drugs require safety and efficacy testing that reflects their mechanism of action but direct methods of testing are complicated, need expensive equipment and yield poor signals. As a result, researchers have turned to surrogate assays. We identified a need for a simple system to directly measure antibody function.

What approach did you take to address the challenge?

To measure antibody function directly, we required a target cell line which could bind the antibody and release a signal upon killing by an antibody bound effector cell. We achieved this by engineering DNA to encode a target protein and a signal enzyme. We generated effector cells by purifying and activating natural killer (NK) cells from peripheral blood mononuclear cells (PBMCs). There are currently no target cells, commercially available, which include a reporter.

What are the potential benefits?

The success of our project will be in providing a novel assay platform for the therapeutic antibody market. The global market for cell-based assays is projected to reach £6.7bn by 2015. A simple assay kit for the analysis of antibodies will enable the industry to access a high quality, reliable method for assessing drug quality. Once on the market we estimate we could generate £2m-5m a year from kit sales.

What are the next steps?

To take the project further we will establish the stable host line for routine production of a wide range of target cells and develop standard protocols for freezing and storing cells. To commercialise the product we will seek a partner for sales and distribution.

Green Biologics Ltd

Bacterial genome resequencing as a basis for rational strain improvement for solvent production.

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Green Biologics was established in 2003 and has 40 employees. We have raised more than $15m in equity financing. Our focus is on developing and commercialising advanced microbial technology for the production of renewable chemicals and biofuels.

What was the business need that motivated the project?

Bacterial butanol fermentation is hampered by butanol inhibition and the formation of acetone by-product. We have generated mutant strains which are devoid of acetone production and enjoy increased butanol tolerance. The genetic basis for these improvements is unknown and we are sequencing the mutant strains in order to identify what they are and to use this data for further rational strain improvement.

What approach did you take to address the challenge?

We sequenced a number of mutant strains and developed the bioinformatics pipeline needed to identify the DNA base changes (SNP: single-nucleotide polymorphism) and the insertions and deletions in the bacterial genome. We have already identified the likely mutations responsible for absence of acetone production. Our use of DNA sequencing and mutagenesis as an integrated part of strain development is novel.

What are the potential benefits?

We have demonstrated the potential of strain improvement through random mutagenesis and sequencing to identify rational gene-targets for re-engineering production strains. These strains will improve the economics of the butanol fermentation and will make the sustainable production of butanol as a chemical and biofuel closer to reality.

What are the next steps?

We must now recreate these specific genetic modifications in a wild-type background and demonstrate that these SNPs are responsible for our improved strains. We expect that these strains will then be characterised fully and added to our collection of commercial butanol-producing strains.

Green Biologics Ltd

Graphene-assisted recovery of acetone & butanol (GRAB)

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Green Biologics was established in 2003 and has 40 employees. We have raised more than $15m in equity financing. Our focus is on developing and commercialising advanced microbial technology for the production of renewable chemicals and biofuels.

What was the business need that motivated the project?

The capital and operational expenditure dedicated to product purification represent a significant proportion of the costs of butanol production. Conventional purification utilises distillation, where up to seven columns are typically used to purify the three ABE (acetone-butanol-ethanol) fermentation products. Any technology that can replace all or part of the distillation process could have a significant impact on process economics.

What approach did you take to address the challenge?

Product purification using membrane technology could reduce energy costs significantly. However, membrane costs, specificity, flux rates and fouling all have an impact on whether it can be used in a commercial biorefinery process. Academic research alerted us to newly developed material which selectively allows water to pass through a pervaporation membrane while retaining solvents. This project assessed the suitability of such membranes for ABE purification.

What are the potential benefits?

We discovered that the membranes can retain butanol and ethanol while allowing water to escape from the solution through pervaporation and we saw significantly increased concentrations of butanol. This technology requires rather more development before commercialisation, but the purification of solvents at room temperature has the potential to significantly reduce energy usage in a commercial biorefinery. This would have a positive impact on process economics and greenhouse gas emissions.

What are the next steps?

Positive results from this feasibility study indicate that we should undertake further work. The next stage will be to assess the commercial and technical feasibility of producing and using membranes and to investigate support materials and bonding agents that can increase the stability of membranes without negatively impacting process flux.

Inova Design Solutions Ltd

Partner: Progressive Sports Technologies

Portable hydration monitor

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Inova Design Solutions Ltd is a start-up biotech company set up in February 2011, with a single director. We are involved in research, development and commercialisation of innovative technologies to improve the monitoring of various vital sign parameters of the human body.

What was the business need that motivated the project?

Dehydration is a threat to the health and well-being of individuals exercising or working in the heat (athletes, fire officers, military personnel) and also the vulnerable, such as older people, the chronically ill or hospital in-patients. Fluid balance cannot be determined in the field, nor simply or non-invasively elsewhere. In a clinical environment, it is often recorded inadequately or inaccurately.

What approach did you take to address the challenge?

To arrive at an improved solution, we had to understand the limitations of existing apparatus and methods and review the status of physiological research. Our innovation is wide-reaching and provides real-time, non-invasive, continuous, automated, portable, wireless and monitoring. There are no existing hydration monitoring methods and apparatus that offer a combined solution like this.
The aim of the feasibility study was to validate the underlying principle of the innovation.

What are the potential benefits?

Our innovation will make hydration monitoring available to a much wider audience than current methods allow and will enable improvements in the monitoring of hydration status to prevent morbidity and mortality.
The feasibility study has successfully proved the principle of the hydration monitor and this validation will enable our project to progress to product development phase, with consequent growth in staffing and company value.

What are the next steps?

We have three key areas of focus. We will first undertake detailed physiology research to generate additional data sets and refine algorithms, to be followed by development of the technology and commercialisation.
We will then be seeking funding and at least two industry partners to complete these work packages.

M Squared Lasers Ltd

Direct diode-pumped titanium sapphire laser for multi-photon imaging of biological tissue

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M Squared Lasers develops and manufactures next-generation diode-pumped solid-state lasers and related systems. We have longstanding experience and success in delivering innovative products and meeting customer application requirements, and of delivering the highest levels of customer service and support.

What was the business need that motivated the project?

Expensive and complex titanium sapphire lasers dictate the multiphoton imaging and spectroscopy markets. Their impracticality and costs are attributed to their complex pump sources. Addressing these shortcomings would give a significant competitive advantage in a major market. BCC Research shows that the global microscope market will be worth $2.1bn in 2012, with optical microscopy having approximately a 25% share.

What approach did you take to address the challenge?

We investigated the suitability of using low cost and compact gallium nitride (GaN) diode lasers to replace expensive and cumbersome neodymium-based systems to pump titanium-sapphire lasers. GaN diode lasers are an order of magnitude lower in price and foot print but currently offer limited output power which requires careful laser design to obtain useful systems.

What are the potential benefits?

We envisage the commercialisation of a compact, hands-free and low-cost laser system capable of catering the multi-photon imaging market. OptoIQ (Aug 2009) reports that hundreds of nonlinear optical microscope systems are installed each year, with the market showing strong growth. We expect that after a further development program this project will result in annual direct sales to original equipment manufacturers in excess of £4m by 2015.

What are the next steps?

In the next phase, we will need to build a prototype system to verify that the specifications as predicted by the feasibility study can be transferred to a final product. In this context, we will need to develop dedicated components and control systems.

Plasticell Ltd

Optimising secretion of therapeutically active proteins from stem cells

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Plasticell Ltd is a biotechnology company focused on its proprietary technology platform, CombiCult®. CombiCult® addresses the problem of identifying efficient stem cell differentiation and maintenance protocols by allowing tens of thousands of media cocktails to be tested simultaneously.

What was the business need that motivated the project?

Many types of stem cell exert their therapeutic effect through secretion of trophic factors. Yet stem cell culture conditions have not been optimised to maximise secretion of these factors, potentially limiting clinical efficacy. We wanted to test our high-throughput cell culture platform, Combicult®, to identify optimal media formulations that increase secretion of trophic factors from stem cells.

What approach did you take to address the challenge?

We investigated the feasibility of adapting the Combicult® platform to detect protein secretion from cells by combining our existing technology with a new readout system. As proof of concept we tested novel media formulations for their ability to increase secretion of vascular endothelial growth factor (VEGF), a protein that promotes blood vessel growth, from mesenchymal stem cells (MSC).

What are the potential benefits?

Being able to utilise a high throughput platform, such as Combicult®, to discover cell culture media that increase the secretion of trophic factors from stem cells could greatly speed up clinical development and improve efficacy of stem cell therapeutics. By extending the Combicult® readout system to functional cell assays, the platform could be broadened to screen for culture conditions that enhance stem cell therapeutic effects.

What are the next steps?

We hope to extend the read-out assays to include a variety of proteins and therapeutic effects so as to find optimal media cocktails for many applications. We would like to partner with stem cell therapeutic companies to further validate the use of the Combicult® platform for this application.

Protein Technologies Ltd

A novel platform technology in cryopreservation

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PTL specialises in protein engineering. We have been established for two years during which time we have filed four patents in large-scale liquids processing, smart phone diagnostics, near infrared (NIR) proteins and biosensors.

What was the business need that motivated the project?

The business need that motivated this project was to improve standards of patient safety in cell therapy. Our objective was to examine the feasibility of combining two cryopreservation technologies: protein biosensors which change colour when damaging ice-crystals are formed and polymers with lower toxic side effects than those of the industry standard cryopreservative, dimethyl sulfoxide (DMSO).

What approach did you take to address the challenge?

Our study tested model proteins and mammalian cells in laboratory freezers in conditions that promoted detrimental ice-crystal formation. We monitored the effects of ice-crystal formation through functional assays of protein activity and cell viability, these results in turn being used to validate the sensitivity of the biosensor. We also made comparisons between the samples stored in DMSO and cryopreservative polymers. This novel approach will allow customised reagents in standardised packaging.

What are the potential benefits?

The co-utilisation of these two technologies will drive improvements both in cold chain supply management and patient safety. This will simultaneously reduce the risk of spoilage before administration and dangerous side-effects afterwards. More than a million patients have already received stem cell therapy and the global market is forecast to triple in size by 2015. Our hope is to create a novel packaging/formulation system to support this important growing market.

What are the next steps?

We need to undertake further validation of the technology to demonstrate that it can be 'tuned' to a wide variety of biotherapeutics. Once in possession of a comprehensive experimental data set, we intend to co-develop/license this technology with an international packaging supplier.

Q Chip Ltd

Method for manufacture of biodegradable microsphere as matrices for control and stabilisation of aluminium containing vaccine adjuvants

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Q Chip is a biotechnology company focused on drug delivery systems designed to improve patient compliance and experience through the development of long-acting injectable therapeutics. We have developed a proprietary manufacturing platform for the production of drug-loaded microspheres.

What was the business need that motivated the project?

This project is part of our plan to advance development of a new manufacturing process for structural and functional, biocompatible and bioresorbable materials for enhanced delivery of biologically-derived products. We are keen to apply our technology in innovative ways, allowing us to diversify the application of our system and to enter new sectors within the life sciences sector.

What approach did you take to address the challenge?

We have had to develop a novel approach to precisely controlling the nanoscale morphology of our microspheres. This has allowed us to address the key innovative challenge of the project – forming and controlling crystal growth within the microporous network. By applying and developing our polymer etching technology in combination with specific morphology control, we have successfully formed vaccine-pertinent crystals within our microspheres.

What are the potential benefits?

This project has enabled us to make significant progress in an area not currently part of our core business. We have been able to demonstrate the application of our technology in an innovative way that has real potential to provide commercial and public health benefits. These new processes may well form part of our company's future commercial offerings and have cross-over with core projects.

What are the next steps?

Further technical development is required, but this project is not far short of the point where we will look to partner with an institution with specific vaccine knowledge. We intend to use the outcomes of this project to attract investment and/or collaboration, enabling us to build towards a scalable technology.

Reinnervate

Development of a perfusion system for routine three dimensional cell culture

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We are a biotechnology life science company of 25 staff, established in 2002. We specialise in the development of 3D cell culture to improve cell-based assay data generated in the laboratory. This is relevant to the development of pharmaceuticals and toxicology.

What was the business need that motivated the project?

Cells are currently grown in a laboratory in conventional Petri dishes. Alvetex 3D cell culture technology enables enhanced cell growth and function, improving the quality of data produced from cell-based assays. There is demand to improve such culture models still further and to create dynamic models that more closely mimic real tissues and hence require medium perfusion.

What approach did you take to address the challenge?

This project introduces a novel medium perfusion system, creating a dynamic model that is more physiologically relevant.
The perfusion device has been designed for ease of use in routine applications and is based on an industrial standard culture plate platform. The model incorporates well-to-well flow and 3D cell culture, enabling different cell types to be cultured in series, more closely mimicking the functionality of real tissues.

What are the potential benefits?

Researchers will now be able to create more advanced in vitro assays and to model more closely the growth, differentiation and function of human cells in the laboratory. This will radically improve the quality of data coming from such assays, which in turn will inform decisions about project progression and, ultimately, cost savings. Such models will in some instances be a compromise for animal experimentation hence reducing animal usage in research.

What are the next steps?

We need to fully optimise the perfusion device. We have identified specific applications that are commercially attractive and will improve the R&D process in certain areas, such as liver toxicology. We will develop protocols and standard operating procedures in line with customer requirements.

Solus Technology Ltd

Cost effective dual laser system for nonlinear CARS (coherent anti-Stokes Raman scattering) microscopy

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Solus Technologies brings innovative semi-conductor disk laser technology (SDLT) to the market place. SDLT is a powerful fusion of semi-conductor and diode-pumped solid-state laser technologies, which provides our customers with an unprecedented level of performance flexibility, reliability and value.

What was the business need that motivated the project?

The complexity, costs and difficulty of operation of optical parametric oscillators and titanium-sapphire lasers have made coherent anti-Stokes Raman scattering spectroscopy a niche technology. We have tried to circumvent this issue by developing a compact, hands-free and cost-effective laser.

What approach did you take to address the challenge?

We investigated the suitability of using two pulsed optically pumped semiconductor disk lasers (SDL) operating at dissimilar wavelengths for use in CARS microscopy. The SDL format combines a wavelength flexible design, ultra-short pulse generation and high output powers with a low cost point and compact footprint. It therefore has the potential to significantly reduce the price while increasing the practicality of CARS systems.

What are the potential benefits?

Our technology will replace the need for two large and expensive titanium-sapphire systems with two cost-effective and compact SDLs. BCC Research forecast the microscope market to be $2.1bn in 2012, with optical microscopy taking a 25% share. OptoIQ reported that at least a few hundred nonlinear optical microscope systems are installed each year, leading to predicted direct annual sales in excess of £4m by 2014.

What are the next steps?

We need to generate application data showing the capabilities of dual SDL CARS systems through collaboration with research institutions of potential end users. Once the technology has been verified, we have to develop the SDL systems into a prototype before commercialisation.

Solus Technology Ltd

Femtosecond semiconductor disk laser for cost effective nonlinear microscopy

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Solus Technologies brings innovative semi-conductor disk laser technology (SDLT) to the market place. SDLT is a powerful fusion of semi-conductor and diode-pumped solid-state laser technologies, which provides our customers with an unprecedented level of performance flexibility, reliability and value.

What was the business need that motivated the project?

We have recently shown that a mode-locked Semiconductor Disk Laser (SDL) can provide excellent multiphoton microscopy images. The SDL is small, compact and less expensive than a comparable titanium-sapphire (Ti:Sapphire) laser. However, although the laser is suitable for many multiphoton microscopy techniques its typical pulse length is 1.5ps. Reducing the pulse width into the femtosecond regime would open up more applications.

What approach did you take to address the challenge?

We set out to determine the feasibility of taking a standard mode-locked SDL and externally compressing the pulse into the femtosecond regime while retaining the high output power. The resultant demonstrator device would provide the basis for a turnkey, hands-off ultrafast illumination source for multiphoton microscopy.

What are the potential benefits?

We intend to develop a compact, hands-free ultrafast laser system to replace the state of the art nonlinear microscopy laser (Ti:Sapphire). BCC Research predicted the global microscope market to be $2.1bn in 2012 with optical microscopy taking a 25% share. OptoIQ reports that at least a few hundred nonlinear optical microscope systems are installed every year, suggesting predicted annual sales by us to original equipment manufacturers (OEM) of £4m by 2014.

What are the next steps?

We need to verify the technology along with end-customers or research institutions in this field. Once this has been achieved, we will develop the laser systems into prototypes before taking it to the market. This would ideally be through deals with original equipment manufacturing customers.

Tecrea Ltd

Non-toxic platform for biomolecule delivery into cells

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We are a small and independently owned biotechnology company. Our mission is to provide vastly improved cell delivery technology for research and the clinic. We are developing products that are uniquely non-toxic and effective for transfection applications.

What was the business need that motivated the project?

We needed to improve our products and learn more about how they compare with those of competitors. In particular we wanted to differentiate our products, to learn more about their toxicity properties and where we felt that we had a strong competitive advantage.

What approach did you take to address the challenge?

In the first place we have worked to improve the product, basically by making iterative changes and assessments using rapid efficacy measures. Secondly we used quantitative measures to ensure that our improvements were real and that our measures were accurate. Thirdly, we are measuring the toxicity properties, an ongoing process.

What are the potential benefits?

We will see benefits in three main areas: our products will perform better when they reach the market; the results can be used to help differentiate our products from those of the competitors; details of the protocols in new products are potentially patentable, or at least supportive of our current intellectual property application. All three promise to improve our market position.

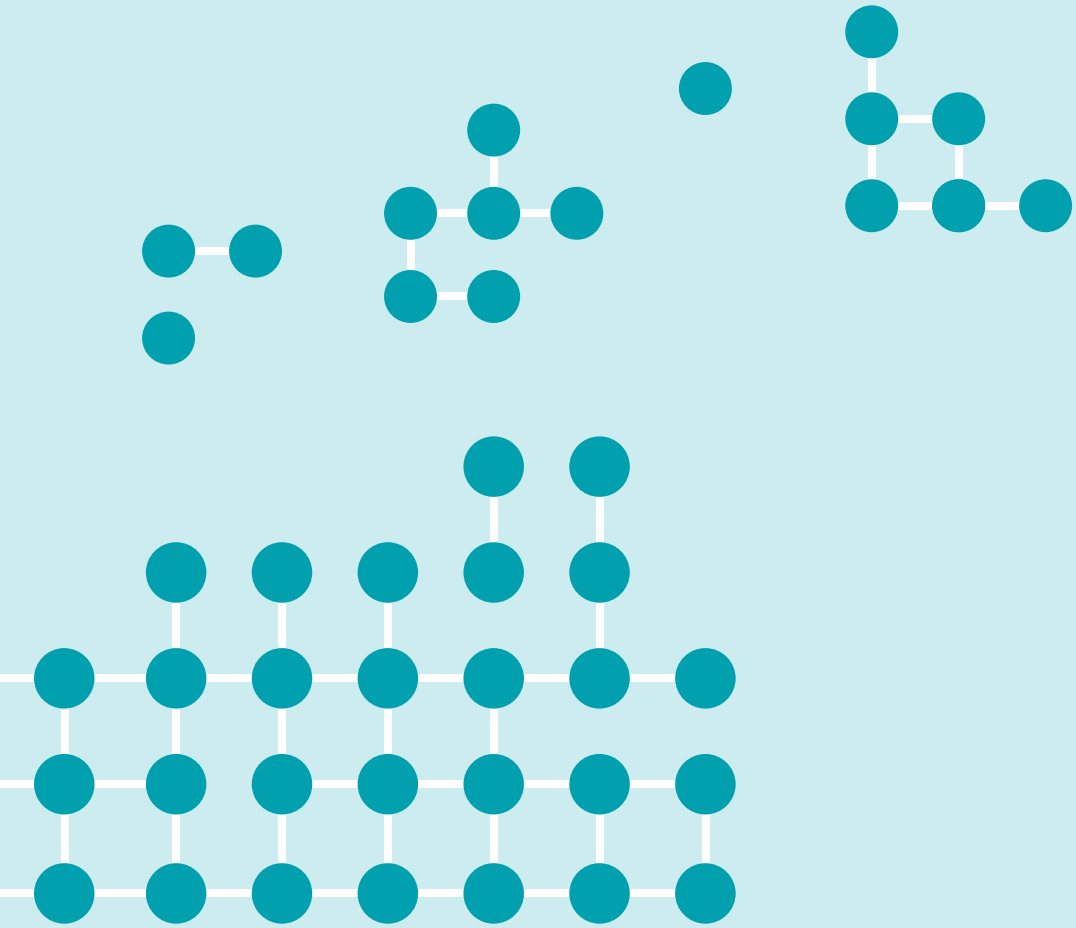
What are the next steps?

We will seek product distributors who can take our products to the market in different regions, particularly outside of the UK. We will also look for co-development partners, both for drug and cosmetics applications. We will further pursue EU Framework 7 grant applications, which we have already initiated.

Collaboration Nation

Technology-inspired feasibility studies

Electronics, sensors and photonics



Alterix Ltd

Large scale interactive multi-touch displays

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Alterix has developed and patented a novel, highly efficient and inherently low-cost sensor system for large-scale touch-screens. The method scales easily to large sensors (up to 85-inch diagonal) and is compatible with flat-panel TVs.

What was the business need that motivated the project?

Disruptive changes in large-scale displays have created an unanswered need for new technical approaches capable of positioning large interactive TV panels as a replacement for interactive whiteboards. Yet current touch sensing solutions, while adding thousands of pounds to the cost of a display above 24-inch diagonal sizes, are striving to meet the technical specification required for Windows 8 certification.

What approach did you take to address the challenge?

The technology we have developed provides pervasive multi-touch interfaces by carrying out ultrafast but highly sensitive measurements of the signals in a large projective capacitive grid sensor fitted to the display. Our approach allows the use of inexpensive off-the-shelf electronics and achieves a substantial improvement in the signal-to-noise ratio over existing systems. Our technology will enable TV panels to enter the interactive whiteboard market and disrupt it.

What are the potential benefits?

If successful, a cheaper sensing solution from Alterix could mean that an advanced user interface for large screen applications would be affordable by the mass consumer market. In addition to the whiteboard replacement market, our technology can enable additional lower volume applications such as collaborative displays for office meetings, interactive conference tables, public displays for interactive advertising at shopping centres, or displays for interactive exhibits or museums.

What are the next steps?

High-level discussions with major players have confirmed that delivery of a proof-of-principle prototype will allow us to commercialise our technology through strategic relationships with commercial partners. The first data achieved in the project allowed us to provide enough evidence to establish active negotiations with a strategic investor.

Applied Nanodetectors Ltd

An investigation into the fabrication of nanosensor arrays on plastic substrates using inkjet printed nanowires: a low cost sensor platform

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Applied Nanodetectors Ltd is a leading supplier of nanosensors for the healthcare and medical markets. Our main focus is to develop point-of-care diagnostics for respiratory disease, based on breath analysis.

What was the business need that motivated the project?

Nanowire based devices have emerged as ultrasensitive chemical and biosensors and have great potential for the point-of-care market. There are many techniques to fabricate silicon nanowires (SiNWs) but the high cost of supplying low volumes of sensors using silicon manufacturing processes has become a major barrier for commercialisation of innovative Si-Nanowire sensors.

What approach did you take to address the challenge?

Inkjet printing solutions for Si-nanowires on plastic substrates could provide an economic scalable method to distribute nanowires and fabricate high performance sensor arrays. In this feasibility project we investigated the fabrication of nanosensor arrays using inkjet printed Si-nanowires and measured their performance.

What are the potential benefits?

This project was successful and now opens up new market opportunities in the chemical and biosensor markets. Our novel inkjet material deposition processes could be applied to deposit nanowires for use in flexible displays and other flexible electronic components. These types of sensors also use very low electrical power consumption (less than a microwatt), and could be used in wireless sensor networks for condition monitoring.

What are the next steps?

We are planning to seek further grant funding to develop the sensor prototypes and to create the manufacturing supply chain. We will also engage with different end users to understand their market requirements.

Bluefrog Design Ltd

Partner: KBO Dynamics Ltd

Intelligent emergency sign and lighting feasibility using photopolymer optical control

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Bluefrog is a product design and development consultancy with a strong history of innovation, KBO Dynamics has expertise in electronics and control system design. Our complementary skills sets made the feasibility project possible.

What was the business need that motivated the project?

Conventional emergency lights have a fixed message and a set illumination level, which may not provide the necessary information in, for example, smoke-filled buildings. The concept we investigated was to use holographic photo-optical components with LED/laser light technologies to develop signs that can respond to and penetrate smoke and be compatible with intelligent systems actively identifying safe routes.

What approach did you take to address the challenge?

The innovation lies in the potential for intelligent messages, active light levels and smoke penetration, using minimised power. Our approach benchmarked illumination performance of current in-market lights and identified suitable lighting, proofs of concept and projection methods. We tested the samples developed and integrated them into a proof-of-principle prototype.

What are the potential benefits?

The potential is for enhanced emergency lighting adaptable to specific regulatory regimes. The project has allowed us to demonstrate the feasibility of the approach and to identify routes forward. Eventual benefits include improved public safety together with potential for a 5% share of the £80m annual UK market by 2014, plus export sales through Europe/N America of £50m by 2017

What are the next steps?

Following proof of principle our next step will be to refine the design and technologies to a level suitable for manufacture. We are investigating the involvement of a lighting manufacturer in this stage.

D4 Technology Ltd

Demonstration of a self-powered smoke detector for ducting systems

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D4 Technology is a high tech design consultancy and development company founded in 2002.

What was the business need that motivated the project?

Systems that completely remove cabling of any sort are very attractive to many business sectors, particularly infrastructure monitoring and building management. These systems bring advantages in ease of installation as well as reductions in maintenance costs, since no wiring is required and there is no need to replace batteries.

What approach did you take to address the challenge?

We developed a new type of energy converter. This can convert airflow energy to electrical energy, with less complication and higher efficiency than a wind turbine for small-scale applications. We sought to demonstrate the principle by creating a self-powered smoke detector for easy retrofitting to air-conditioning systems. This was an example of a smart autonomous system, enabled by its unique power supply.

What are the potential benefits?

The benefits include cost savings on both installation and maintenance, which can be very significant. For example, a study at the Pacific Northwest Laboratory estimated that the cost of installing a 120-node wireless sensor network was $85 per node, compared with $500 per equivalent wired node – a saving of 85%. Wireless sensor networks are potentially a disruptive technology.

What are the next steps?

A successful demonstration of the generator technology will lead to application-specific developments, and collaborations with companies who are already operating in the application space. We already have interested parties from a major utility and a building sensor company and we are looking to progress these opportunities.

Evance Wind Turbines Ltd

Wireless sensor design for wind turbine preventative maintenance

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Evance Wind Turbines is a world leading manufacturer of small wind turbines. Established 12 years ago, we have a global footprint of more than 1,500 installations, helping home owners, farmers, schools and businesses to become green energy producers.

What was the business need that motivated the project?

Remote measurement of turbine parameters for condition monitoring is becoming feasible even with small machines, owing to the dramatic cost reduction in, and recent availability of, advanced sensor and low energy wireless products. This opens up a significantly larger market for small wind in telecommunications and remote communities in the third world, estimated to be over 1m units.

What approach did you take to address the challenge?

We looked at using low-energy Bluetooth devices connected to temperature, vibration and other sensors and powered either by button cell batteries with a three-year replacement cycle or via energy harvesting from solar sources. This is a unique implementation of a technology which is just becoming available. The Bluetooth transmitters are awoken and paired with a remote receiver in 3 milliseconds, transmitting the parameters to a receiver connected to the internet.

What are the potential benefits?

Continuously monitoring parameters on a small wind turbine allows us to predict the need for preventative maintenance. Annual servicing equates to as much as 2.5% of the initial installation cost for each of the 20 years of the turbine's life. If we can extend the service cycle to three years, then 60% of the service cost can be saved, as well as an estimated 70,000 tonnes of CO2 from vehicles.

What are the next steps?

We must first derive the signature of a correctly operating turbine from various sensors. We will then analyse the various modes of failure and how they can be predicted. We will seek collaboration with organisations working in this field and commercialise the development on existing machines.

Generic Robotics

Low cost, high-fidelity haptic interface

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We are a small, flexible and enthusiastic team of experienced engineers working in the fields of robotics, haptics, rehabilitation technology and virtual reality. We are R&D-focused and have extensive experience in EU and UK-funded research projects.

What was the business need that motivated the project?

Numerous research projects have shown that haptic devices (force feedback computer interfaces) can be used beneficially in a variety of educational settings. However, there is limited adoption of these technologies because of the high cost of devices with sufficient performance to be effective. Their use is currently limited to research and such applications as high-cost medical training equipment.

What approach did you take to address the challenge?

Our challenge was to produce a haptic interface at a price point affordable to a much wider range of users without sacrificing the performance necessary to be an effective training and educational tool. We are combining creative mechanical design and novel control techniques with our expert knowledge of haptics and human factors to avoid the need for the expensive components and manufacturing techniques used in current offerings.

What are the potential benefits?

The benefits of haptic technology in application areas such as education, training, rehabilitation and entertainment suggest that in the future, haptic interfaces will be widespread and mass-market when the technology is affordable. This study has helped us identify and solve key problems related to building affordable haptic interfaces and to move closer to becoming the first manufacturer of general purpose haptic devices in the UK.

What are the next steps?

The next steps are to work with our existing network of companies and research organisations to evaluate the feasibility prototype and gather evidence for the design benefits. We will combine this with our market research to approach potential partners and investors to secure support and next level funding for commercialisation.

Holoxica

3D holographic head-up displays

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Holoxica is an award-winning high-tech start-up working on the research, development and manufacture of a new generation of holographic 3D display systems. We also offer design services for custom holograms aimed at medical, scientific and engineering markets.

What was the business need that motivated the project?

Head-up displays (HUDs) have begun to appear in luxury cars over the past few years. Car dashboards are increasingly cluttered with information overload from various electronic subsystems, and risk becoming a distraction to the driver. HUDs show essential information through the windscreen, overlaid on the driver's view, so there is no need to look away from the road.

What approach did you take to address the challenge?

We designed and implemented a novel holographic optical element (HOE), which is large (20cm x 25cm) and behaves like a positive lens. We are able to image a projection screen to appear in mid-air, about 20cm away from the plane of the hologram. We have it working on the lab bench with a laser projection system and it produces bright and crisp images. This could be integrated into a windscreen.

What are the potential benefits?

HUDs show information such as speed, distance and rpm, projected through the windscreen and focusing at around 4 metres, so that the driver does not have to look away from the road to read the dashboard.
This has safety implications where a glance and refocusing of the eyes can take hundreds of milliseconds but the distance covered during this blind period can be tens of metres at high speeds.

What are the next steps?

We intend to make further sets of HOEs to refine the design, although the current results are good enough for a demo. We will miniaturise all the electronics and compact the optics within a demo unit that can be taken out of the laboratory and shown to customers and investors.

IS Instruments Ltd

Fibre coupled, near photon counting, Raman Spectrometer development for operation in physically challenging industrial environments

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IS-Instruments is focused on the design, development and manufacture of compact, remote sensing instrumentation targeting the process industry. Our products are built around core technologies including Lidar (light detection and ranging) and laser-based instruments, Raman spectrometers, 3D imaging systems including Lidar and stereo-camera.

What was the business need that motivated the project?

Our goal was a commercially exploitable fibre-coupled Raman spectrometer. This spectrometer design provides 100 times greater throughput than a conventional diffraction grating-based system which in turn allows the use of large core fibres. It will improve sensitivity of Raman systems, allowing them to be used up to 5 metres from the target, while improving the instrument's reliability.

What approach did you take to address the challenge?

The team set out to build an instrument that could be easily reproduced and ultimately become a commercial product. To ensure success, we kept the target objectives of the project central to the development. A major challenge was to control speckle noise from the instrument, a consequence of using fibres with monochromatic light. We solved this by using a new approach which we plan to patent.

What are the potential benefits?

The primary benefit of the project is a prototype instrument that can be used in multiple applications, including Raman spectrometry. As this new instrument can be used with multi-core large aperture fibres, this opens the possibility of a range of products that can be developed and applied in a variety of applications. This includes monitoring chemical species in the process industry through to lab-based applications.

What are the next steps?

The team will take the instrument from technology readiness level 6-7 to level 9 and a final instrument for market launch. This may include a delivery probe for the laser in a Raman spectrometer, which will result in a highly competitive commercial product for identifying chemical species in the field.

IS-Instruments Ltd

Complete hemispherical thermal infrared camera development for collision avoidance on the rail network

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IS-Instruments is focused on the design, development and manufacture of compact, remote sensing instrumentation targeting the process industry. Our products are built around core technologies including Lidar (light detection and ranging) and laser-based instruments, Raman Spectrometers, 3D imaging systems including Lidar and stereo-camera.

What was the business need that motivated the project?

We are working on a range of projects for guided-vision sensors aimed at collision avoidance on autonomously controlled robotic platforms. The work focuses on Lidar and stereo cameras and we are investigating thermal infrared sensors to see if they can enhance the suite of sensors in terms of additional information, cost reduction, flexibility and robustness.

What approach did you take to address the challenge?

We first studied our clients' requirements to establish factors such as the field of view and resolution. Working with Mullard Space Science Laboratory (University College London) and using a thermal infrared wide-angle lens and a fish-eye lens, we investigated what information could be provided. We then built a demonstrator, which provided encouraging results in terms of image quality and robustness.

What are the potential benefits?

The simplicity of our concept suggests we could develop a cost-effective device. Being less susceptible to localised weather conditions, the instrument's sensitivity and robustness indicate it is ideally suited for autonomous controlled platforms, safety, security and surveillance applications. This project was particularly focused on rail safety and could lead to a step-change in maintenance procedures, enabling greater flexibility on the rail network

What are the next steps?

We need to review the lens designs and detectors with a view to reducing the cost and size of the sensor. That would enable wider use in both rail and security applications. This work will be completed in collaboration with clients to ensure that we focus on their needs.

M Squared Lasers Ltd

Active hyperspectral imaging for applications in the oil and gas industry

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Founded in 2005, M Squared Lasers Ltd develops and manufactures next-generation diode-pumped solid-state lasers and associated systems. We currently employ 33 people and we have demonstrated long-standing success in delivering innovative products for demanding applications.

What was the business need that motivated the project?

Leaks at oil and gas wells, pipelines and refineries constitute risks to health and safety and to the environment through pollution. They also cost the industry billions of dollars a year. The technology used to tackle these issues is not very well suited since it mostly relies on passive imaging/sensing systems of low sensitivity and/or large numbers of point sensors.

What approach did you take to address the challenge?

Active, hyperspectral imaging can address these issues by enabling high-sensitivity detection (one thousand times higher than passive solutions) of hydrocarbons and other relevant molecules at stand-off distances of hundreds of metres, with a very wide field of view. We have recently introduced such a system and propose to investigate applications for this novel device in the context of the oil and gas industry.

What are the potential benefits?

The impact will be seen in the transformation of asset integrity control in the oil and gas industry. Our system will enable detection of leaks at unprecedented sensitivities and at large stand-off distances. It will help the UK in maintaining this vital industry and in securing 440,000 associated jobs in the UK. In 2011-12, oil and gas paid £11.2 billion in tax on production (nearly 25% of UK corporation taxes).

What are the next steps?

Our next step is to engage with key players within the industry to verify the technology. We will need to optimise the system for the applications before developing a prototype. We also need to address regulatory issues, such as obtaining the required ATEX certificate, before commercialisation.

M Squared Lasers Ltd

Continuous wave intracavity optical parametric oscillator using second harmonic generation noise suppression

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Founded in 2005, M Squared Lasers Ltd develops and manufactures next-generation diode-pumped solid-state lasers and associated systems. We currently employ 33 people and we have demonstrated long-standing success in delivering innovative products for demanding applications.

What was the business need that motivated the project?

There is significant demand among customers for broadly tuneable, narrow line width sources in the mid-infrared that can be used for active hyperspectral imaging. The compact and high power intracavity optical parametric oscillator commercialised by us at M Squared has the potential to address these requirements. To date, however, the relatively broad line width has limited the spectral resolution obtained using this system.

What approach did you take to address the challenge?

We have redesigned our pulsed optical parametric oscillator to operate in continuous-wave mode and narrowed its line width to a single longitudinal mode. The challenge in this context was to overcome the complex relaxation oscillations that result from the intracavity pumping scheme, causing strong intensity fluctuations. To mitigate this, we have implemented a second harmonic generation module that critically dampens any build-up of intensity spikes.

What are the potential benefits?

The narrow line width will increase wavelength resolution for spectroscopy and hyperspectral imaging applications such as environmental monitoring, explosives detection and oil and gas prospecting and leak detection.
Our system will offer increased detection sensitivities and species recognition.
This will give us key differentiators in associated markets, leading to an expected revenue increase of £5-10m annually within five years after commercialisation.

What are the next steps?

We must advance this proof of concept system to an optimised breadboard demonstrator. Once this is achieved, we will investigate the system's capabilities for the target applications. When we have achieved the target specifications, we will develop a pre-production prototype before starting production.

M Squared Lasers Ltd

Microspectrophotometer using mid-infrared optical parametric oscillator

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Founded in 2005, M Squared Lasers Ltd develops and manufactures next-generation diode-pumped solid-state lasers and associated systems. We currently employ 33 people and we have demonstrated long-standing success in delivering innovative products for demanding applications.

What was the business need that motivated the project?

Microspectrophotometers are used in applications such as counterfeit pharmaceutical identification, contaminant identification and forensics. These applications need to identify the composition of small samples of compounds. Mid-infrared spectral fingerprints provide sufficient information to identify different substances. Integrating an optical parametric oscillator into the system provides a high-power frequency-agile light source that can be tuned easily over a wide wavelength range.

What approach did you take to address the challenge?

We have adapted our M Squared Firefly Imager, an active hyperpectral imaging system designed for stand-off detection at ranges of more than 100 metres, to image small objects at close distances with high spectral and spatial resolution. In this context, we have redesigned the optics of the outgoing laser beam, the raster scanning system and the microscope objective.

What are the potential benefits?

Our technology has potential to dramatically change a number of applications by offering a novel, flexible hyperspectral microspectrophotometer. A 2005 report by BCC Research estimated that process spectroscopy instrumentation would grow to $232m by 2009. Certainly, microspectrometers will be a large part of that figure. Combined with organic growth in other application areas, this suggests the microspectrometer market to be in the order of $200m-250m a year.

What are the next steps?

The next step is to advance this proof-of-concept system to an optimised breadboard demonstrator. Once this is achieved, we can investigate the system's capabilities for the target applications. After obtaining target specifications we will develop a pre-production prototype before starting production.

Oxsensis Ltd

Multifunction optical fuel sensor for aviation (MOFSA)

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Oxsensis is a small-to-medium sized firm specialising in the development and manufacture of optical sensor systems for extreme environments. Application areas include gas turbine hot section monitoring, avionics sensors and oil and gas exploration and extraction.

What was the business need that motivated the project?

We are involved in a larger collaborative Technology Strategy Board-funded project developing an optical system to replace existing electrical fuel quantity-indicating systems (FQIS) for large civil aircraft. It became apparent that in addition to measuring fuel quantity it would be beneficial to extend the system to provide information on fuel quality, particularly water content.

What approach did you take to address the challenge?

MOFSA examines an extension of our existing Fabry-Perot optical pressure system to identify information about the media in front of the sensor. This can provide an output indicating whether the sensor is in contact with water, aviation fuel or a mixture of the two fluids. Our technical approach was to carry out optical modelling of the system before then fabricating a small number of prototypes for laboratory testing.

What are the potential benefits?

Enhancing the FQIS with a fuel quality measurement increases the probability that the optical FQIS successfully displaces the incumbent electrical solution. The technique being developed also has potential to be deployed in other applications, such as process industries, where fluid identification or contamination measurements are required.

What are the next steps?

We are looking at how we might add the MOFSA capability to the sensors being developed in the larger FQIS project. This is the primary route towards exploitation of the technology. We will also look to identify partners with whom we can explore adjacent market applications.

PolyPhotonix

Feasibility study for an entirely new manufacturing process for organic photovoltaic devices

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Polyphotonix is a small-to-medium-sized business in North East England. Working with organic light emitting polymers and organic photovoltaic (OPV) materials, our approach is to develop high value bespoke applications by letting user requirements drive technological developments.

What was the business need that motivated the project?

To establish OPV as a key player in power generation, costs must be reduced. We have invented a new manufacturing process that has been proven to work with organic light emitting devices (OLEDs). The purpose of our project is to study the feasibility of this method of production for OPV devices, as it may provide a way of producing OPV cheaply.

What approach did you take to address the challenge?

We studied the component materials and production technologies used by the industry and in research to manufacture OPV devices. We chose materials sets and carried out small experiments to address the feasibility of these materials. Subsequently, we used larger scale experiments using bench-top versions of industry standard production tools, to produce OPV devices which we then characterised. We also carried out a detailed study of the IP landscape and supply chain.

What are the potential benefits?

Should the technology and the method of manufacture prove feasible then this could not only reduce the price of OPV but also lead to a new range of self-supporting OPV devices. These could open niches within photovoltaic power generation, allowing the manufacture of a number of consumer or design-based systems. Mass manufacture should be possible at low cost and with high levels of repeatability.

What are the next steps?

We would need a larger scale research project to study the systems and manufacturing processes to make OPV devices. This would initially be carried out at pilot scale, then on to larger scale in collaboration with an existing OPV/polymer manufacturer.

PPA Energy

Partner: ASH Wireless Electronics

Klick Fit sensors for non-invasive real-time power cable measurements for challenging conditions

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PPA Energy is a leading UK techno-economic and innovation consultancy in the energy and power sectors. ASH Wireless Electronics is an award-winning creative electronics design consultancy with expertise in wireless technologies. Both are used to collaborative working.

What was the business need that motivated the project?

With the advent of bidirectional smarter power networks the resource and cost-effective monitoring of power cables has become a real issue since few existing high-voltage and low-voltage circuits are provided with continuous monitoring. Our goal is to develop a suite of advanced sensors to enable fast, simple, safe and economic installations in challenging live environments without requiring customer interruptions.

What approach did you take to address the challenge?

We developed our understanding of the dynamics of complex magnetic fields and sensor options by using finite element analysis in conjunction with a specially produced automated test rig to validate a range of sensor concepts. We have developed a suite of advanced power sensor designs for much faster, simpler, safer and economic installations in challenging live environments. We have tested and evaluated prototype sensors ready for field trials by users.

What are the potential benefits?

The successful development of an innovative range of sensors to measure what could not economically be done before accelerates key aspects of smarter low-carbon networks and their environmental benefits, with potential global application. The tools and techniques successfully developed in this feasibility study pave the way for further collaborative ventures in tackling some of the key challenges of creating the smarter power networks of the future.

What are the next steps?

We will hold small-scale field trials, followed by refinements of designs, installation methods and development of auto-calibration systems. We will then expand the range of sensors from new concepts developed during the feasibility study. Production design and large scale field trials will follow in conjunction with an established commercial partner.

Precision Acoustics Ltd

An automated two laser system for interrogation of interferometric fibre-optic hydrophones

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Precision Acoustics is a leading manufacturer of ultrasonic measurement equipment, with an established worldwide customer base. We operate in sectors as diverse as medical equipment manufacture, industrial non-destructive testing, national standards metrology, academia and military research.

What was the business need that motivated the project?

The potential advantages of optical detection methods in the ultrasound industry are not being fully realised, by anyone. For Precision Acoustics to maintain its world leading position, our fibre-optic hydrophone technology must be continually developed and improved upon.

What approach did you take to address the challenge?

The technological challenge of this project was to reduce the noise floor of the existing system while maintaining or improving usability. To achieve this, we have integrated into the system a second laser with better coherence characteristics but slow tuning, to work alongside the existing, rapidly tuneable laser. Control is devolved to an FPGA (field-programmable gate array) platform with a view to creating a truly stand-alone system.

What are the potential benefits?

Our existing fibre-optic hydrophone system is already in use at research institutions such as the Institute for Cancer Research in the UK. Improved system performance would enhance their ability – and that of others – to develop new ultrasound based treatments for cancer. With improved performance, we expect the fibre-optic hydrophone will become the instrument of choice in challenging measurement environments.

What are the next steps?

This project has used the National Instruments (NI) compact RIO platform for development of the software and hardware control. Our next step would be to work with NI to transfer the system to their single-board RIO platform, which is more suitable for a commercial product.

Ruskinn Technology Ltd

Gas control simplification experiment (GCSE)

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Ruskinn Technology Ltd is a manufacturer of gas and temperature-controlled workstations for cell biology and microbiology applications. We have 15 employees and have been in business for 19 years. We have 1,700 workstation installations in more than 40 countries.

What was the business need that motivated the project?

We are expanding our business into tissue culture media conditioning, exploiting knowledge generated by Keele University. This requires a low oxygen environment but less control over carbon dioxide than in other Ruskinn products. It may be possible to limit the gas control scheme employed in the new product to single gas, which results in a substantial cost reduction.

What approach did you take to address the challenge?

At first we modified the present three-gas (nitrogen, carbon dioxide, compressed air) control scheme to operate on single gas, the software ignoring the other feeds. We then built a controller using single gas and ran experiments to assess the stability and gas consumption. Keele University assessed the impact of less carbon dioxide control on the acidity of the media, which was a major concern.

What are the potential benefits?

Ruskinn can enter the emerging tissue culture media conditioning market with a very cost-effective gas controller, making the product competitive with others who may build similar products later. The cost-reduced gas control scheme may be employed in Ruskinn's hypoxic workstation products, for customers who are not as concerned about carbon dioxide control. Further R&D and manufacturing jobs in the UK will result from our work.

What are the next steps?

We have de-risked the control scheme and it will be put through further testing and refinement. It will be introduced into a product that will be launched by year end. We will further engage hypoxic workstation to explore the potential for a cost reduction in their market.

Spiral Scratch Ltd

Partner: Modular Vision Ltd

Optical navigation system for the visually impaired

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The project is a collaboration between Spiral Scratch Ltd and Modular Vision Ltd. Spiral Scratch specialises in the development of image processing systems while Modular Vision is a developer of computer vision and electronics systems, specialising in 3d stereo vision.

What was the business need that motivated the project?

The partners identified a solution to a specific and pressing problem with all current navigation systems. The growing assistive technology market for visually impaired people is relatively new and somewhat fragmented, but one which the partners have little experience of. This project enabled us to address key technical challenges and to help the partners capitalise on this new opportunity.

What approach did you take to address the challenge?

We used an agile development process to develop an early prototype that could eventually be developed into a full product. We captured system requirements through consultation with a number of stakeholders, from which we could specify representative user scenarios against which the system would be tested. Alongside this we also undertook preliminary work to specify a next-level prototype of the system, using components closer to production level.

What are the potential benefits?

People with low vision frequently experience isolation, social exclusion, discrimination, frustration and financial disadvantage. This system will substantially improve the quality of life of visually impaired people by helping them to live in and traverse unfamiliar environments independently, a goal that cannot currently be achieved with any product that exists today. There are 40 million blind people worldwide and more than 120 million have significantly low vision.

What are the next steps?

Once the feasibility study is completed our next step will be to develop and test a compact pre-production implementation of the system based on the prototype. It is likely that this design task will require further funding to fully develop the system and bring it to market.

Collaboration Nation

Technology-inspired feasibility studies

Information and communication technology

Accentiva Ltd

Partner: ASH Wireless Electronics

Low cost, high accuracy, remote monitoring and automated analysis of subsidence and heave in clay soils.

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Accentiva is a commercial telecoms management consultancy while ASH Wireless Electronics is a creative design consultancy specialising in wireless technologies. Together, our expertise covers operational and business development, IT systems, telecommunications, innovation, wireless communications, sensor design and prototyping.

What was the business need that motivated the project?

We identified an opportunity to develop an added-value service using distributed low-cost, multi-sensors to provide accurate real-time data collection and automated analysis for a market sector which currently obtains such data only sporadically, using labour intensive processes. Attempts by industry to introduce remote monitoring in the past have failed owing to high costs and inappropriate technology.

What approach did you take to address the challenge?

Our challenge was to devise a solution incorporating a number of sensors at any one location transmitting data to a web server for up to 18 months, needing no maintenance, at a target cost never before achieved. The solution we developed incorporates innovative low power wireless links to a GSM data hub; we have built and successfully trialled prototype sensors and gateways transmitting data to the internet.

What are the potential benefits?

Significant benefits include the consortium forming a new company to offer monitoring and analytical services. Clients would see several benefits: resolving issues with current ways of working; vastly improving customer satisfaction and assurance; adopting a near-carbon neutral process; increasing profits and/or reducing cost and exposure. If successful, there is the opportunity to create an information hub by adding other applications, including those within the smart home sector.

What are the next steps?

We want to approach prospective customers to confirm our business case and identify other relevant opportunities. We will also begin a demonstrator phase, developing and trialling a number of pre-production sensors and gateways to confirm product quality, specification and cost. We need to secure financial support for this next phase.

AIMES Grid Services

Intelligent scalable technology adoption in cloud services (i-STAC)

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AIMES Grid Services CIC is an award-winning cloud technology company spun out from the University of Liverpool, providing data centre and application development services. We operate an ISO 27001 data centre facility at our Technology Centre on Merseyside.

What was the business need that motivated the project?

The task was to create a next generation cloud 'stack' (a hierarchy of virtual computing resources) to support emerging services from the Internet of Things (IoT) and Big Data analytics. Our aim is to evaluate the technical/commercial feasibility of new configurations of computer/storage/network compared to a 'traditional' cloud infrastructure to examine whether the same performance can be achieved with lower power consumption and hence lower total cost of ownership.

What approach did you take to address the challenge?

Our study is structured in three work packages. WP1 looks to configure the new ARM processor-based hardware components; WP2 integrates these components with Open Stack middleware; WP3 evaluates the new cloud stack using real applications and data. WP1 involves comparing two servers running the same benchmark test, followed by implementing the same commercial application (WP3), and comparing power usage.

What are the potential benefits?

From predicted growth rates in both the Internet of Things and Big Data analytics.domains, we estimate the potential market to AIMES for cost-effective cloud services to be more than £0.5m per year by 2015. Our project combines new hardware technologies more suited to energy-efficient and configurable private clouds with software components providing the more flexible and rapidly scalable services required by the IoT

What are the next steps?

We are planning three commercial evaluations using data from real-time transport services from commercial services providers. The project has led to the formation of a consortium of partners who have submitted a bid for a large-scale demonstrator project of the i-STAC concept, valued at more than £2m.

AIMES Grid Services

Maritime open data store (MODS) study

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What was the business need that motivated the project?

The challenge is to create an open data store integrating weather, port congestion and other traffic data with terrestrial/satellite automatic identification systems transport data. We then use this to create value-adding services. Our study demonstrates whether an open data store is commercially viable for ship tracking-based services and can create innovative digital maritime services.

What approach did you take to address the challenge?

Our project covered three main technical tasks, with commercial analysis, plus management/reporting activity. The technical tasks were: user and scenario analysis; service design; and prototype development and testing. We are working with ExactEarth (global vessel monitoring and tracking based on satellite AIS technology), ContainerPort (IT services to the container industry) and Liverpool Ports Authority as well as data providers, such as Tidetech and Exis.

What are the potential benefits?

According to the UN Conference on Trade and Development, 2010 saw record deliveries of new tonnage, 28% higher than 2009, resulting in an 8.6% growth in the world fleet; the dry bulk fleet almost doubled and the containership fleet more than tripled. This has led to problems of seaborne congestion and issues of maritime management and safety. Our MODS platform has focused on opportunities around congestion-planning applications for ports.

What are the next steps?

To verify the study we will use a trial application, b2b maritime congestion mapping, similar to land-based GPS systems. This will demonstrate whether an open data store approach is commercially viable. We have formed a consortium to deliver a large-scale demonstrator, potentially funded by the European Space Agency.

AnSmart Ltd

An intelligent self-testing of visual acuity and analysis suite for ophthalmic healthcare

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AnSmart Ltd is a research driven company developing intelligent software applications for mobile devices using advanced computer intelligent technology. We provide complete end-to-end mobile solutions to allow easy information access, health monitoring, data analysis and visualisation in mobile environment.

What was the business need that motivated the project?

Amblyopia is a condition where lack of training in early childhood causes poor vision in one eye. In this project, we are developing intelligent mobile apps, which will perform stereoscopic vision testing and training through mobile games. This is particularly useful to children, who often lack the concentration and willingness to undertake frequent eye testing.

What approach did you take to address the challenge?

Our main technical initiative was to separate two views from both eyes in order to allow separated training. This led to two types of testing and training: stereoscopic vision testing, which assesses the balance between eyes through testing on depth cues; and coordination between both eyes, splitting the foreground and background, forcing the patient to engage the weak eye with the active foreground.

What are the potential benefits?

With the prevalence of mobile internet devices, most parents could access these mobile games online to help detect and treat their children more frequently and easily. This reduces the burden on clinics and hospitals. Being able to detect and treat many more children with vision deficiency increases the chances of successful treatments. We can extend these principles to other types of eye testing.

What are the next steps?

Once we have developed our prototype mobile game, we will test it with our clinical partner, Moorfield Eye Hospital, and optimise the technology ahead of commercialisation.

AnSmart Ltd

Automatic eyelid movement detection using a Markov random field model on mobile devices for ophthalmic healthcare

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AnSmart Ltd is a research driven company developing intelligent software applications for mobile devices using advanced computer intelligent technology. We provide complete end-to-end mobile solutions to allow easy information access, health monitoring, data analysis and visualisation in mobile environment.

What was the business need that motivated the project?

Detection and tracking of eye movement can reveal indications of a large number of eye diseases, including facial nerve paralysis, which is a very common problem. Early detection and treatment involves constant monitoring of progress. Self-examination of eye movement can significantly improve patient care quality and reduce the healthcare cost.

What approach did you take to address the challenge?

Our objective was to build a framework to allow automatic tracking of eyeball and eyelid movement through multiple platforms, including mobile cameras. The challenge lies in the low resolution of eye regions in videos where lighting conditions are poor or the face may be at odd angles. We used non-instructive eye tracking technology and the core technique includes calibration procedure, facial movement detection, gaze tracking and eye parameters.

What are the potential benefits?

The eye tracking framework can be used in clinical context to significantly improve the work efficiency of ophthalmologist by simplifying the procedure of diagnosis of eye diseases. Patients can easily use the tool to constantly monitor the status of the disease. Moreover, we also anticipate that the principles and many fundamental techniques developed within this project have great potential for other applications, such as human computer interaction, attention detection, etc.

What are the next steps?

Once we have developed our prototype mobile game, we will test it with our clinical partner, Moorfield Eye Hospital, and optimise the technology ahead of commercialisation.

Audio Analytic Ltd

Acoustic ambient intelligence in the Internet of Things

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Audio Analytic produces software which automatically recognises sounds by means of computer analysis. Our CoreLogger™ sound recognition software detects a wide variety of sounds, depending on the SoundPacks™ installed. These sounds will match even with high levels of ambient sound.

What was the business need that motivated the project?

Modern security professionals have found advanced digital camera equipment to be of immense value in trying to protect people and property from harm. However, there is a drawback. When another camera is added, as part of a new building or to meet increased local need, there is less time available to watch each individual camera.

What approach did you take to address the challenge?

We have developed a unique sound recognition system that can be adapted to recognise a broad variety of specific sounds. We needed to acquire new knowledge of general acoustic ambience variation detection to allow us to offer a full set of acoustic awareness. This involved researching, developing and implementing a prototype system capable of learning an acoustic environment on embedded devices.

What are the potential benefits?

Modern cameras often have microphones already, making audio analysis a straightforward addition. The burgeoning video analytics market, which analyses video streams to detect crimes, incidents and events, is currently estimated to be worth $300 million and growing at 30% pa. We believe our ambient intelligent audio analytics could have a significant market impact by addressing detections of crimes, incidents and events beyond the capability of current systems.

What are the next steps?

We will deliver several working prototype units of a system that can learn an acoustic environment and determine when it varies from this, drawing on the PhD level research and development already conducted. The system will transmit alerts into an existing CCTV video management system.

Barnard Microsystems Ltd

FullView feasibility study

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Barnard Microsystems, established in 1986, has five full-time employees and is involved in the development of civilian unmanned aircraft systems for use in oil, gas and mineral exploration and production and in border patrol applications.

What was the business need that motivated the project?

In disaster situations and their aftermath, where the underlying terrain may be obscured by flooding, forest fires or volcanic activity, authorities and agencies need real-time information to inform rescue and relief efforts. Our challenge was to devise software that could automatically collate, manage and interpret streams of stereo images transmitted from unmanned aircraft, providing a 'living, moving map' in 3D.

What approach did you take to address the challenge?

We developed prototype code based on OpenGL to enable the use of 3D CAD and software, producing a 3D representation of the underlying terrain. The innovative feature of our FullView software was the automated management of the stream of incoming images, overcoming the problem of data overload. FullView can also be used to add and edit 3D shapes, so that structures can be featured in this 'living, moving map.

What are the potential benefits?

This software is targeted at situations in which it is important to derive a representation of the underlying terrain from numerous airborne photographs. This could be in a geophysical survey or in disaster relief efforts following flooding, a hurricane, tornado or forest fire. We are aiming to build a dynamic aerospace business in the UK based primarily on exports of goods and services to countries rich in natural resources.

What are the next steps?

We will submit a proof-of-concept proposal using data from our unmanned aircraft. This will ensure our FullView software can perform the tasks we expect of it and provide us with evidence of its capabilities.

Blue Bear Systems Research Ltd

Chameleon Eye - inexpensive video stabilisation inspired by insect vision

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Blue Bear offers customers innovative research and product development in the field of unmanned flight, avionics, and mission systems. We are committed to providing good value and effective solutions, and rapidly, in support of civil and defence markets worldwide.

What was the business need that motivated the project?

There is a market need for an inexpensive miniaturised stabilised camera, both in the sport and leisure market for action cameras and in the emerging unmanned systems and sensor network markets. In the sport and leisure markets, existing products provide limited stabilisation, giving rise to shaky video; in the unmanned systems market stabilised sensors are typically large and expensive.

What approach did you take to address the challenge?

One of the key technical challenges is devising a solution that can be scaled right down. Nature has developed some powerful yet simple techniques to stabilise the vision and motion of animals and our objective was to harness these to achieve the desired scalability.

What are the potential benefits?

The technology could underpin several products leading to high-value manufacturing in the UK. Furthermore, the technology spans established markets such as action videography and also emerging markets such as unmanned systems and sensor networks. The project has enabled us to tackle some of the key technical risks by developing a bench demonstrator of some of the fundamental concepts.

What are the next steps?

Our next steps are to achieve maturation of the technology and to develop prototypes for the sport and leisure and unmanned systems markets.

BMSHome Ltd

Predictive/adaptive energy consumption control system (PEACCS)

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BMSHome develops SMART Energy technologies to intelligently manage domestic and industrial energy consumption. We are currently trialling our first product. With an experienced entrepreneur and two systems engineers, our skills are in high integrity software, electronic hardware and systems integration.

What was the business need that motivated the project?

Many homes, particularly high-rise flats, are still heated by 1960s technology in the shape of electric storage heaters which charge up overnight for use the following day. They are notoriously difficult for occupants to manage efficiently. Retrofitting adaptive/predictive technology to learn about each room and its expected energy demand, further informed by three-day weather forecasts, could cut energy bills by 15%.

What approach did you take to address the challenge?

Our challenges were: to deliver a control philosophy; to implement predictive algorithms; and to design a robust and flexible system architecture and communications strategy. We achieved the following: a high integrity control system with predictive/adaptive response and a successful trial in an end-user setting. Our approach is: applying SMART Energy concepts to legacy systems and systems with significant latency; predictive energy profiling and adaptive control with forward forecasting; replacing current reactive systems.

What are the potential benefits?

This project will launch our first product and establish a platform technology for subsequent product range. Market potential is strong with clear B2B routes to market in UK, and major export opportunities. Successful product launch will generate income for BMSHome, create UK jobs, reduce energy consumption, reduce peak energy demand and improve carbon footprint. Users will see reduced energy bills, increased ease of use and improved comfort.

What are the next steps?

We will widen the product trial to encompass more residential properties and gather further evidence of ease of use, effectiveness and energy savings. We will then finalise the product for manufacture and establish the supply chain before securing second round funding, launching the product later in 2013.

CiteSeeing Ltd

CiteSeeing in the Cloud

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Citeseeing creates middleware for the unique identification, digital fingerprinting and search of multimedia objects.

What was the business need that motivated the project?

Citeseeing operates in the market for content identification. Content – authored material – is largely digital today, dominating the internet and transforming industries. It is a fundamental part of the digital ecosystem, essential for commercial monetisation, rights and asset management, and resource optimisation. Our project enables CiteSeeing fingerprinting and search technology to be offered as a service.

What approach did you take to address the challenge?

We investigated optimal routes to market, which underpinned business planning. We envisaged CiteSeeing technology applied in a variety of ways: as a 'freemium' model for highly-engaged users (crowd-sourcing metadata); for enterprise CiteSeeing servers, supporting rule-based access to both local and remote assets; and in differentiation of API access, to support a broad set of 'subscribers' to CiteSeeing data, able to search fingerprints and data and to present results.

What are the potential benefits?

The ability to uniquely identify – and retrieve – linked metadata offers substantial benefits to both publishers and users. It enables publications to be kept current, allowing usage to be measured, and for users, it reduces complexity, since individual objects are imbued with descriptive metadata and meaning. These are linked opportunities, which we are keen to address.

What are the next steps?

We will develop a feasibility toolset demonstrating the potential of the 'CiteSeeing in the Cloud' service. We will also seek venture capital for go-to-market funding, and drive organic growth via data partnerships and commercial development plans and releases.

Clinical Informatics Ltd

The feasibility of a rapidly reconfigurable user and services-centred surgical pre-assessment information management system

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Established in 1991, we develop software for preoperative assessment, anaesthetic charting and information management and postoperative follow-up. It is installed in major teaching hospitals in UK and Europe. We have a staff of nine software professionals, headed by Tom Hurrell.

What was the business need that motivated the project?

We are required to provide a generic software solution which can reflect the diversity of processes in pre-operative assessment services in the UK and overseas, each with specific work-flows, local clinical guidelines and rules. The software needs to be reconfigured rapidly by the user and/or service centre to meet the need for both effective multiple site deployment and diverse practice.

What approach did you take to address the challenge?

Internationally, post-operative assessment practice has many common elements but also considerable variability. Our challenge was to support configurability while maintaining interoperability. We analysed pre-operative assessment processes from the UK, US and the Netherlands to identify a superset of data elements, use cases and rules to create a common reference model to which local subsets are mapped. Other innovation includes full support for the Health Level 7 and SNOMED CT (Systematised Nomenclature of Medicine – Clinical Terms) standards.

What are the potential benefits?

If successful, it will allow the software to be re-engineered rapidly, cost-effectively, reliably and safely to allow deployment in multiple sites in the UK and internationally, on a variety of technological platforms including digital tablets and handheld devices. The savings in pre and peri-operative costs are considerable and demonstrable. We expect to create five additional jobs and to increase revenue by more than £500k by 2014.

What are the next steps?

We will update our product(s) to include the capability to pre-select specialty and site-specific configurations and to allow customisation on a site basis (preserving inter-operability data and standards).
We would seek partners to capitalise on the increased utility and scalability of the release available mid-2013.

Functional Technologies Ltd

CASE: compact attribute set of sensor fingerprint for imaging device forensics

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Functional Technologies, incorporated in 2009, specialises in multimedia forensics and security, multimedia retrieval, computer vision, analysis and processing of high volume data. We were medallists in the 2011 UK IT Industry Awards and have four employees.

What was the business need that motivated the project?

There is a need for a compact way of representing camera fingerprints to identify source cameras responsible for images under investigation. Our technique will allow us to reduce the size of camera fingerprint to enable web-based application and classification of large image sets. This will significantly increase the commercial value of our existing product, Forensic Image Analyser (FIA).

What approach did you take to address the challenge?

Our objective was to formulate a compact vector of unique attributes to represent the sensor pattern noise (SPN). We used mathematical transformation to characterise and reveal various aspects of the SPN. We then employed feature extraction, Gaussian mixture modelling, scale-invariant feature transform, statistical modelling and parameter estimation techniques to formulate a compact attribute set (CASE).

What are the potential benefits?

The feasibility grant allows us to gain extra resources to develop CASE so that it can compete with our main competitors. These include J Fridrich at the State University New York and another US-based business, Digital Assembly, who have been developing related techniques. The study will also enable us to realise the CASE concept for commercialising the award-winning FIA, to retain our competitive edge.

What are the next steps?

We will collaborate with Forensic Pathways Ltd (FPL) on the commercialisation of the CASE technique. FPL provides forensic products and services to law enforcement, security, telecommunications, and multimedia-related businesses. Their involvement will provide fast routes to markets.

HW Communications

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HW Communications Ltd is a technology developer specialising in transferring know-how from the research laboratory to the market place. A key specialisation at HW Communications is in location technology and we are at the forefront of applied research in the field.

What was the business need that motivated the project?

The multi-billion dollar location-based service industry is built on GPS. However GPS does not work indoors. Wi-Fi does, but detailed signal fingerprints of indoor spaces are costly to create. What is needed is room level accuracy in all indoor public spaces. Our aim was to assess the technical feasibility of alternative automatic methods of creating signal fingerprint maps and of their commercial exploitation.

What approach did you take to address the challenge?

We proposed to combat the well-known problem of rapid accuracy decay with dead reckoning-based positioning on smart phones. We investigated: route traces with matching Wi-Fi readings built up into a map; advanced techniques, such as intelligent trellis structures associating Wi-Fi readings with neighbouring readings to fit to known floor plans or building outlines; recruiting passive volunteers to run a background service on their phone to support the data collection required.

What are the potential benefits?

Consumers are yet to feel the full benefits of indoor positioning, which should have room level accuracy under 5 metres and be available in every public space. WiFi is the technology that can achieve this but no company can add new sites fast enough to establish dominance and bring the consumer the benefits of consolidation. We believe that our new way of fingerprinting buildings at high speed has commercial potential.

What are the next steps?

Our project has yielded encouraging results, which we are interested in taking forward. Following early prototype demonstrations we plan to engage more directly with potential partners with the aim of taking the technology forward to wide-scale deployment.

Icona Solutions Ltd

Immersive virtual perceived quality in automotive concept design

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Icona is a software/solutions business with offices in Sedgefield and Manchester. We have been developing and marketing aesthetica since 2006, enabling manufacturing companies to virtualise the impact of product variation on assemblies and improving the 'perceived quality' of consumer products for customers such as Bentley, Nissan and Audi-VW.

What was the business need that motivated the project?

A virtual perceived quality (VPQ) process can significantly reduce time and cost in the automotive concept design process, replacing expensive physical prototypes with digital models visualised in immersive virtual environments (Cave or Power Walls).
This valuable process can only be partially implemented using existing technology at the concept design stage so there is a need for solutions and benefits.

What approach did you take to address the challenge?

We studied the feasibility of adding two significant, innovative capabilities. They were: an immersive interface for designers to undertake interactive VPQ target reviews; and functionality for adjusting the split lines and fillets on concept surface models during VPQ design reviews. In addition to studying the technical feasibility, we reviewed the existing processes and tools used for concept design work and the specific requirements, together with potential business benefits, with prospective customers.

What are the potential benefits?

Our project will support the continued growth and development of our business within the UK and provide a competitive edge for UK manufacturing companies who will work with us on the next phase. If the functionality is technically and commercially feasible, it will lead to the development of an innovative solution and increased sales and open business opportunities with new customers and markets, leading to new jobs within the UK.

What are the next steps?

A successful project and compelling business case will lead to the development of the first commercial solution to support virtual 'design for variation' at the concept design stage.
This will create new commercial opportunities to expand our business worldwide with immersive perceived quality solutions in the design/concept phase.

Industrial Tomography Systems

Smart calibration of in-situ ultrasound rheological sensors for the long term characterisation of highly radioactive nuclear waste

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Industrial Tomography Systems plc (ITS) is a manufacturer of process sensors, based in Manchester since 1997. We are a world-leading company in electrical resistance process tomography, operating in pharmaceuticals, petrochemicals, nuclear, food, speciality chemicals and minerals processing.

What was the business need that motivated the project?

The clean-up of nuclear waste is a major environmental priority. High-level radioactive waste is stored in conditions which are rapidly deteriorating and which have the potential to lead to ecological and radiological disaster. Recovery requires an understanding of the characteristics of the materials. Ultrasound is a prime technology for this task, able to operate in opaque, high concentration materials.

What approach did you take to address the challenge?

We used statistical and model-based methods to detect the change in the performance of the transducer and to separate these from the changes in the sample material/environmental conditions, including the statistical distribution of values from the mean. We were also able to detect changes based on the assumed error model, along with a one-dimensional transducer model-based approach which used temporal and spectral information to isolate the changes from the transducer.

What are the potential benefits?

Successful development of this technology will enable safer recovery of radioactive waste and extend the operating envelope of the ultrasound spectroscopy method. It will have additional benefits in that our technology will increase the flexibility of the method in other aggressive environments and increase sales of the process ultrasound spectroscopy.

What are the next steps?

On completion of the feasibility study we will develop a new product for difficult environments. We will then seek partners in the nuclear decommissioning sector who could provide access to the necessary facilities for testing and evaluation and finally deployment of the system.

Metrarc Ltd

Assuring the provenance of distributed sensor networks via ICmetric-based encryption

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Metrarc Ltd. is a micro-spin-out company with highly novel and promising patent-protected technology for deriving secure encryption keys from the properties of digital systems. The generic technology is employed in PCs, mobile phones and other networked systems.

What was the business need that motivated the project?

The nodes within distributed sensor networks may be located in positions where their integrity of operation could be challenged by malfunction of the sensor node itself, owing to environmental conditions. The need to protect the integrity of nodes within such a distributed network has long been recognised, but the increasingly widespread adoption of such networks raises new challenges.

What approach did you take to address the challenge?

ICmetrics represents a ground-breaking approach to generating unique identifiers for embedded devices. This would enable secure encrypted communication between devices, potentially reducing to a significant degree fraudulent activity such as eavesdropping and device cloning. Unlike existing systems, ICmetrics has two major unique selling points. There is no need to store template data regarding the software/hardware configuration of the node or the digital signature or private encryption key.

What are the potential benefits?

Our technology will significantly enhance trust and confidence associated with systems employing wireless sensor nodes, helping to ensuring data integrity and enhancing their practical utility. It will assign unique digital signatures to remote sensor nodes using their operating characteristics, which may equally serve to produce encryption keys for secure communications. It will also increase confidence that sensitive remote sensor nodes have not been tampered with and do not contain malware.

What are the next steps?

We are poised to revolutionise network-based security for ICT and to help safeguard the electronic assets of business, government and consumers through our technology platform. We are looking to develop a stream of products to be licensed to the marketplace.

OptoSignal Ltd

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OptoSignal is an SME developing precision instruments to characterise the performance of optoelectronic and acoustic components and circuits. We also provide optoelectronic circuit design expertise on a consultancy basis.

What was the business need that motivated the project?

We have encountered opportunities for a stereo image processor operating in real time. It could be used for: an optic flow unit for use in vision-based navigation; a collision detection unit; an airborne sensor to collect data for digital elevation mapping; distance perception in a tele-operated robotic system; the removal of motion blur in photographs taken from a moving platform.

What approach did you take to address the challenge?

We are developing our stereo vision processor to create a 3D representation from each stereo image pair and to generate the translation and rotation vectors from two pairs of overlapping stereo image pairs. All this would be achieved in real time, at a rate of at least 10 frames per second, at a resolution of 640 x 480 pixels. The innovation is in an integrated sensor unit capable of real-time situational awareness.

What are the potential benefits?

We envisage completing the feasibility study by the end of 2012. If this is promising, and our work to date suggests that it will be, we would invest our own money and resources to develop a prototype unit in 2013. This would enable us to introduce our technology to the market place in mid-2014.

What are the next steps?

We need a high-end PC to perform the extraction in real time of the 3D representation of relatively low resolution images at 640 x 480 pixels. Early indications are that a field-programmable gate array (FPGA) will enable a smaller and less power-hungry solution.

Well Cow Ltd

Communication bridge

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Well Cow was established in 2003 to develop automated technologies for animal health and environmental monitoring. We have demonstrated the world's first automated continuous long term measurement of rumen pH and temperature in cows, using a wireless telemetry system.

What was the business need that motivated the project?

The current system for measuring results from our pH bolus, sitting in the cow's rumen, is cumbersome and difficult in the farm environment; it is time consuming to collect data across a whole herd. We needed to provide a total 'easy to use' package to help in calibration and deployment as well as data capture and analysis.

What approach did you take to address the challenge?

We wanted to create a 'communications bridge' that would link the bolus to the outside world, envisaged as an intelligent transceiver in a collar worn by the cow. We wanted to verify that data could be obtained, validated and transmitted onwards in a very challenging environment. The transceiver would be installed in a small case suitable for attaching to a cow collar.

What are the potential benefits?

The system will have removed one of the most difficult and time consuming operations required by our existing solution, allowing quicker diagnosis of health problems caused by inappropriate cow feed and nutrition. We will have contributed to improving the efficiency of milk production, making it more environmentally friendly because fewer cows and less feed is needed to produce the milk required.

What are the next steps?

If we can successfully demonstrate this technology then Well Cow will have created a world first in animal health communications in being able to provide real time remote data collection. We will look to develop a number of modules for demonstration purposes and to establish low-cost manufacturing capability.

Zenotech Ltd

Online reconfigurable engineering software in your pocket (zCFD)

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Zenotech provides online, on-demand simulation services using high-performance graphical processing units (GPUs) now available in the cloud, with consequent reduced cost and increased speed. Users can easily customise the application without loss of performance and can interact using an iPad.

What was the business need that motivated the project?

High-fidelity computational fluid dynamics (CFD) simulation is used to measure the performance of products and components in almost every manufacturing sector, from aircraft and power stations to replacement heart valves and air-conditioners. Now an essential tool in the design process it reduces or eliminates expensive physical testing, increases confidence in product performance and reduces financial and safety risks. But it is very expensive.

What approach did you take to address the challenge?

There are three barriers for companies (and especially smaller companies) looking to fully exploit CFD in their design processes. Typical CFD applications demand large amounts of computer hardware and expensive software licences. They take hours (and sometimes days) to deliver results. Thirdly, high levels of expertise are required to configure the inputs and interpret the outputs. Our service delivery model, many-core architecture and API interface address all three barriers.

What are the potential benefits?

The direct economic impact is the establishment of an IT ecosystem in the UK that serves a global world market. We will start by addressing the £50m market within the UK for automotive, buildings, transport and renewable energy. Companies without in-house HPC will be able to compete for new work while existing users can augment their in-house capability with extra cloud capacity. zCFD consumes 75% less energy per simulation.

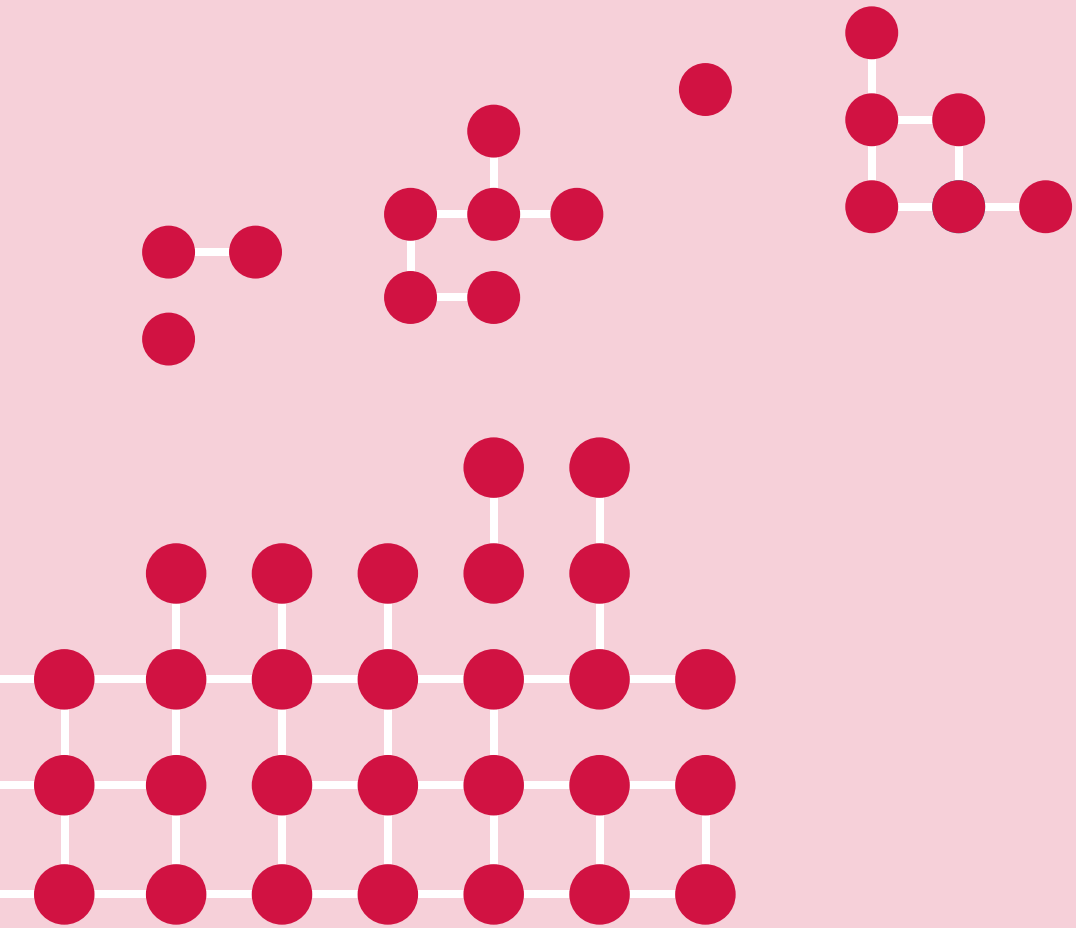
What are the next steps?

We are looking to academia and other SMEs for potential future product lines and for aligned R&T; we are part of the Connected Digital Economy Catapult Special Interest Group (SIG). Following this project, we will launch the prototype commercial online system. We are seeking aligned investment.

Collaboration Nation

Technology-inspired feasibility studies

Nutrition for Life



Advanced Microwave Technologies (AMT) Ltd

Partner: Moredun Research Institute

Assessment of the use of microwave volumetric heating to inactivate mycobacterium avium paratuberculosis (MAP)

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Microwave volumetric heating (MVH), a unique technology developed by AMT Ltd for heating liquids, has significant technical advantages, including the efficient killing of micro-organisms. We have worked with Moredun Research Institute to assess the inactivation of MAP.

What was the business need that motivated the project?

Some 35% of the national dairy herd – and the milk supply – is infected with MAP, a micro-organism causing Johne's disease in cattle. MAP's resistance to standard pasteurisation is a concern because of controversy over whether it can be transmitted to humans. The dairy industry can benefit from a robust means of pasteurising milk without compromising nutritional content.

What approach did you take to address the challenge?

MAP is difficult to grow in culture and we overcame significant technical challenges, including quantification of the micro-organism and preventing clumping of the organism. Using a solution of MAP in UHT milk (to create a milk-based sterile environment) and in PBS (phosphate buffered saline), we compared the inactivation curve using MVH and conventional thermal treatment. The promising outcome was complete inactivation of MAP (6-log reduction) by MVH at 73-79 degrees Celsius.

What are the potential benefits?

A major benefit would be the ongoing biosecurity of the UK's £3bn dairy industry. Protection from existing and emerging pathogens would support the diversification of the industry through scalable pasteurisation technology at farm level and the prevention of medical costs resulting from zoonoses (transmission of disease from animals to humans). For instance, the total annual cost of treating 125,000 Crohn's sufferers in UK is estimated at £950m.

What are the next steps?

Although immediate deployment of the MVH for the pasteurisation of dairy products is possible, we need to undertake further work. That includes assessing pasteurisation of 'difficult' dairy products, such as flavoured milks and milk from different species, the preservation of nutritional and organoleptic properties and developing a 'UHT equivalent' product.

Advanced Microwave Technologies (AMT) Ltd

Partner: Queen Margaret University (QMU)

Does processing by microwave volumetric heating (MVH) enable the reduction of salt in ready meals, without losing flavour/shelf-life

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AMT has developed a method of delivering microwave energy into flowing materials on a continuous basis and on industrial scale. It has been adopted for food and drink pasteurisation; now we are working with QMU on validating its role in salt reduction.

What was the business need that motivated the project?

Reducing the salt level of food is desirable, but complex, since salt plays a key role in the development of the texture and flavour of food, as well as prolonging its shelf-life. In order to make the next 'step-change' in salt reduction, the food industry will rely on innovative ingredients and processing technologies to deliver further reductions.

What approach did you take to address the challenge?

Food cooked using MVH has been observed to be 'saltier' than that cooked by conventional means. Our key objectives were to compare for taste recipes cooked by both methods and to reformulate lower salt products using MVH. We discovered that for cheese sauce, haggis and black pudding produced using MVH, salt can be reduced by at least 10% without significant loss of flavour, texture or shelf life.

What are the potential benefits?

Most UK adults exceed the daily recommended intake of salt; reducing the salt content of convenience foods is likely to have a positive impact on salt consumption and public health. There is therefore an existing and growing market opportunity, particularly within the ready meals sector (worth over £3bn), for innovative processing technology that can deliver low-salt products without loss of quality, flavour and shelf-life.

What are the next steps?

Our MVH technology is commercially available and can be immediately deployed for the production of low-salt products, providing they are liquids or semi-solids that can be pumped. If the industry requires an understanding of the mechanism of action or further validation, we may have to undertake additional studies.

Advanced Pest Solutions Ltd

Novel bactericides for the management of soft rots of leafy salads

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Advanced Pest Solutions Ltd (APS) is an innovative SME, trading since 2004. Our platform technology is based on developing bacteriophage as novel biocides for food production and processing. Our lead product is Biolyse®, a processing aid for the potato-production industry.

What was the business need that motivated the project?

Rots of bagged salads represent 79% of customer complaints to supermarkets at a cost of £544k a year. Existing processing methods, typically washing in chlorinated water, can actually increase the levels of bacterial surface contamination. We investigated whether a novel biocide treatment, based upon naturally-occurring, highly specific, safe and easily applied bacteriophage, could be developed to address this market opportunity.

What approach did you take to address the challenge?

We isolated and quantified bacteria from salad samples collected at various points during processing. Using selective microbiological media and molecular methods we identified rot-causing species. We isolated bacteriophage capable of lysing these bacteria and, when applied to inoculated lettuce leaves, they prevented rot formation. These promising results indicate that a bacteriophage-based biocide product could be developed to prevent rots on processed salads – a world first.

What are the potential benefits?

We estimate product sales within five years of around £300k annually, creating the equivalent of 2.5 jobs. We also envisage reduced waste for salad processors (typically 10%), increased food quality and extended shelf life for retailers and consumers, with typically a 1% rejection rate. Environmentally, it will lead to reduced use of chemical bactericides. We have agreed to collaborate with a major salad processor for future roll-out.

What are the next steps?

The partners have submitted an application for additional funding from the Technology Strategy Board, aiming to further develop and test bacteriophage product(s) at various stages of salad processing. If the funding application and subsequent trials are successful, we would launch a bacteriophage-based biocide treatment for bagged salads within five years.

Applied Nanodetectors Ltd

Detection of Campylobacter infection in chickens by monitoring volatile organics in faeces

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Applied Nanodetectors Ltd is a leading supplier of nanosensors for the healthcare and medical markets. Our main focus is to develop point-of-care diagnostics for respiratory disease, based on breath analysis.

What was the business need that motivated the project?

Chickens are a significant source of Campylobacter infection in humans and chicken meat accounts for 20-30% of total human cases. Rapid detection of Campylobacter in chicken flocks on farms would help identify infected chicken before slaughter and thereby reduce human infection.

What approach did you take to address the challenge?

Volatile organic compounds (VOCs) from human faeces have been used to identify specific bacteria pathogens and there is evidence that chickens have a similar emission process. We identified a number of VOCs that could be used as a marker of infection. We then designed and fabricated a sensor array to successfully detect these types of VOCs associated with Campylobacter infection.

What are the potential benefits?

A rapid test for identifying Campylobacter infection would improve food safety and reduce the risk of infection being transferred to humans. Deploying and utilising such a rapid test system would lead to a direct reduction in the cost of this infection to the UK and EU economy. A handheld device could be used by farm workers as an early warning detection system on the outbreak of infections.

What are the next steps?

We are planning to look for further grant funding to develop the sensor prototypes and to collaborate with other partners to create the manufacturing supply chain. We have also engaged with poultry companies and other parts of the food supply chain to understand their market requirements.

AvantiCell Science Ltd

Food safety monitoring using animal cell-based analysis

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AvantiCell Science is a biotechnology company which provides cell-based services and products to customers in the pharmaceutical, food, healthcare and nanotechnology industries. AvantiCell specialises in human primary cells, in advanced culture formats, and in the evaluation of natural product therapeutics.

What was the business need that motivated the project?

Our project addressed an unmet need for efficient, cost-effective methods to evaluate new feed supplements for their effect on livestock metabolism and productivity. Testing the metabolic impact of feed components on meat or milk composition is presently impeded by lack of realistic in vitro models, which makes expensive, difficult large animal trials the only option.

What approach did you take to address the challenge?

We developed bovine cell cultures which reproduced the function of key tissues involved in meat and milk production. These cell culture models are capable of testing consumer health-benefit or risk from introduction of new feed components into the animal's diet. By combining cells from different organs in co-cultures, the systems also offer a convenient way to evaluate the impact of production conditions, whether accidental or imposed, on product quality.

What are the potential benefits?

The technology we have developed offers the prospect of streamlined testing of animal feed components for their metabolic effect and biosafety in dairy and meat livestock. This will benefit producers by informing the design of expensive and time-consuming animal trials. Societal benefit will come from ability to measure at an early stage the biosafety or health benefit of new feedstuffs intended to improve human food quality.

What are the next steps?

We are using a successful project outcome to promote constructive dialogue with technology end-users, all with the intention of building a customised, industry-responsive service, and thereafter a set of products in the form of customer-friendly cell-based analysis tools.

AvantiCell Science Ltd

Cell-based screening for nutraceuticals with anti-osteoporotic activity

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AvantiCell Science is a biotechnology company which provides cell-based services and products to customers in the pharmaceutical, food, healthcare and nanotechnology industries. AvantiCell specialises in human primary cells, in advanced culture formats, and in the evaluation of natural product therapeutics.

What was the business need that motivated the project?

Osteoporosis is a disease of low bone mass affecting 200 million women worldwide, and accounting for a significant proportion of the nutraceuticals market. Its development is strongly influenced by diet. Our project tested the concept that personalised screening of known anti-osteoporotic nutraceuticals in bone-degrading cells derived from the blood of susceptible individuals offers a personalised approach to prevention or treatment.

What approach did you take to address the challenge?

Our objective was to develop personalised cell-based analysis to screen individuals pre-disposed to osteoporosis and to enable customised dietary intervention that could assist prevention or support treatment of the disease. The analysis system uses human cells displaying bone-degrading activity and measures cellular functions that, in certain individuals, are linked to disease susceptibility. Using donor-specific cells, our system should allow personalised screening of nutritional candidates for preventive or therapeutic value.

What are the potential benefits?

We have identified market opportunities to screen natural products for anti-osteoporotic activity and to validate anti-osteoporotic health claims for existing nutraceuticals and foodstuffs. These opportunities lie in fast-moving, growing markets, including south-east Asia, where the company is already exploring commercial opportunities. The societal benefits of effective osteoporosis treatment and prevention by nutritional means will be substantial, improving quality of life for affected individuals and reducing healthcare costs.

What are the next steps?

We are intent on finding follow-up support to consolidate the project's technology output, which has significant potential. The objective shall be to extend demonstration of utility to the extent that we can market a commercially-robust service to organisations engaged in providing health-promoting advice.

Gee Lawson

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Seaweed as a salt replacer in ready meals

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Gee Lawson is the global distributor for Seagreens®, a dried and milled seaweed with patent-pending methods of production. Seagreens® has multiple attributes, including salt replacement in foods. Meals containing Seagreens were successfully developed and tested by Teesside University.

What was the business need that motivated the project?

Reducing salt in the diet is a critical public health concern, especially in processed foods such as ready meals. Seagreens® has been successfully used as a salt replacer in breads, so this application could be extended to ready meals and sauces. Not only does Seagreens® significantly reduce sodium in the food, it enhances flavour and nutritional profiles.

What approach did you take to address the challenge?

In partnership with Teesside University, we developed a series of recipes, which reflected market conditions and specific challenges of achieving salt reductions. We tested meals on trained taste panels and as part of consumer testing to ascertain what would be acceptable.

What are the potential benefits?

The market potential of ready meals was expected to reach £2.7bn in 2010, with 16% growth to £3.1bn forecast by 2015. This assumes approximately one billion ready meals, with a potential 4,500 tonnes of salt – a proportion of which could be replaced with Seagreens®. Applying Seagreens® as a salt replacer, and providing other benefits, also has potential for wider impact across multiple application areas

What are the next steps?

Our recipes are already with manufacturers and end users to further develop Seagreens® as a natural, organic and sustainable ingredient for: salt replacement / flavour enhancement; nutritional enhancement; shelf-life enhancements; weight management (increased satiety).

SERE-Tech Innovation Ltd

Novel sterilisation process to enable dairy by-product recovery and utilisation as a high value nutritional food product

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We are a science and engineering services provider to the food, agriculture, wastewater treatment sectors. We have been established since 2008 and fully operational since 2010. We have been successful in securing two Technology Strategy Board-funded feasibility studies.

What was the business need that motivated the project?

We identified a clear market requirement for a technology to recover and stabilise dairy, food and drink by-products that were otherwise being disposed of at high cost to producers. Our technology would not only stabilise the by-product but do so at lower energy input requirements and at the same time generate higher value product streams.

What approach did you take to address the challenge?

We adopted a low-cost, low energy consumption process methodology in order to maintain low carbon principles in the technology development. Hence we developed an innovative low temperature and short time process to achieve high bacteria kill levels in order to stabilise the dairy by-products. Our challenge was to achieve stabilisation without loss or degradation of the by-product and to prevent thermally induced solidification. This was achieved successfully.

What are the potential benefits?

Benefits from the technology and processes include greater product recovery, higher value products (such as animal feed supplement or sources of energy), reduced waste disposal and reduced processing energy consumption. We foresee additional sales from dairy food and drink product sales, technology sales and licensing and also broader applications in juices, brewing and other food related applications.

what are the next steps?

Our project has been proven in concept through the feasibility study. The next step will be to undertake in-depth R&D studies to improve the process while broadening its applicability and to develop the technology on a pilot plant and prototype basis for scale-up demonstration.

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