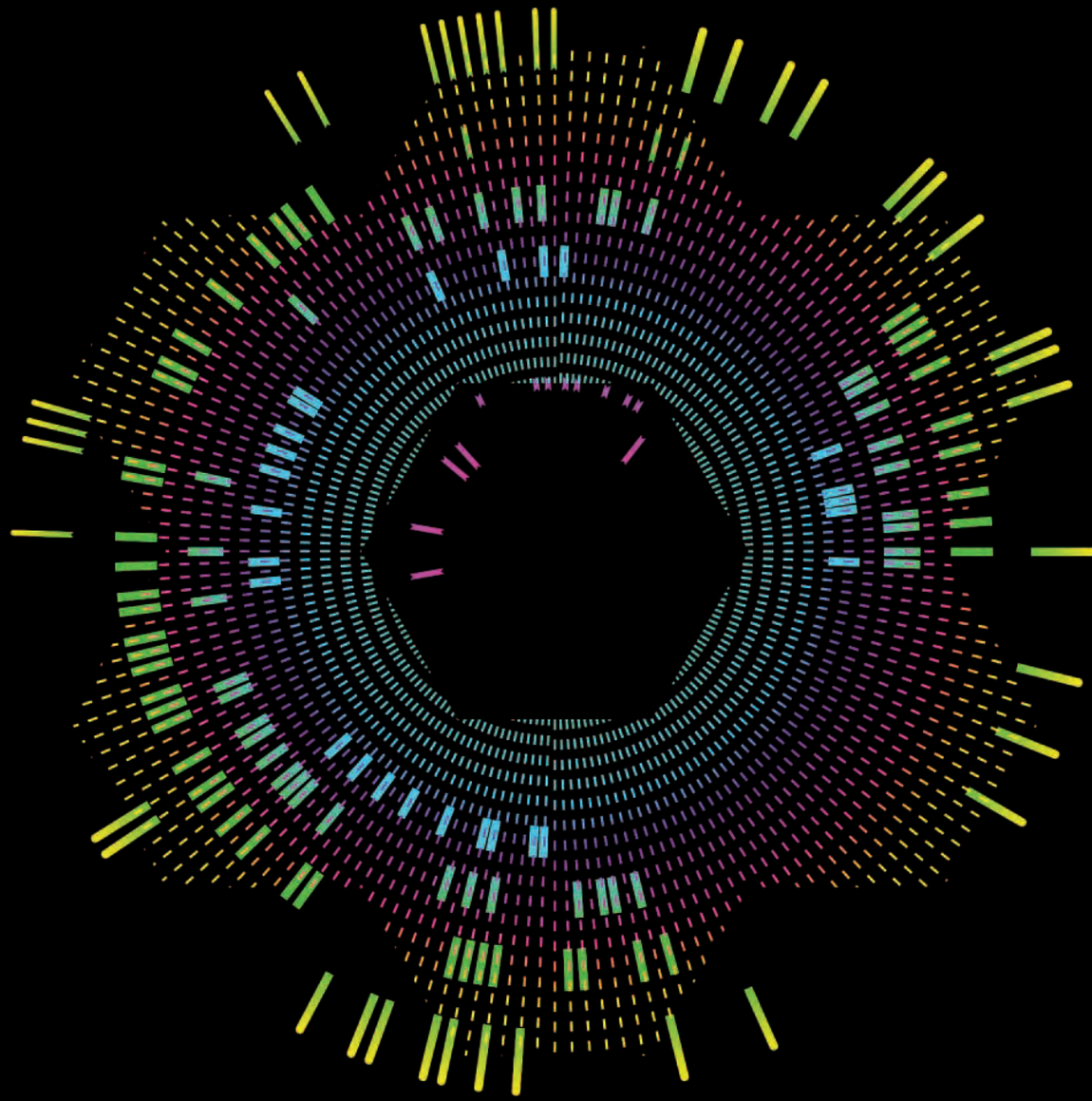
UNIVERSITY ALLIANCE



Problem solved: university research answering today's challenges

UNIVERSITY ALLIANCE

www.unialliance.ac.uk

World-leading research at the heart of universities, making an impact on people,communities, business, society and the economy.

Contents

Around the world, policy-makers agree on the big issues that need tackling by our finest minds. Universities, through their world-leading research, advance our knowledge and understanding of these issues and solve many of the problems that drive them. Businesses big and small, charities and governments also have their own sets of challenges that universities are uniquely able to answer. Alliance universities work with partners from across this continuum around the world on research and innovation that is making a difference today.

One such big issue is **environmental change**; something that affects everyone, which is why resources from all corners of the global research community are working to develop **cleaner energy** sources, adapting our lives and economies to place us on a sounder footing, so that future generations will not need to pay the price for today's excesses. Not only are Alliance universities working on these big issues by collaborating with businesses developing sustainable technology, they are ensuring that the changes we need to make can start today.

The University of Salford's unique interdisciplinary work through their Energy Hub has advanced our understanding about energy use in the home and how we might adapt existing buildings for a greener future. It has also brought many organisations together, such as small and medium sized enterprises (SMEs) that rely on the work of the Hub to develop and bring to market energy efficient products that people are using in their homes.

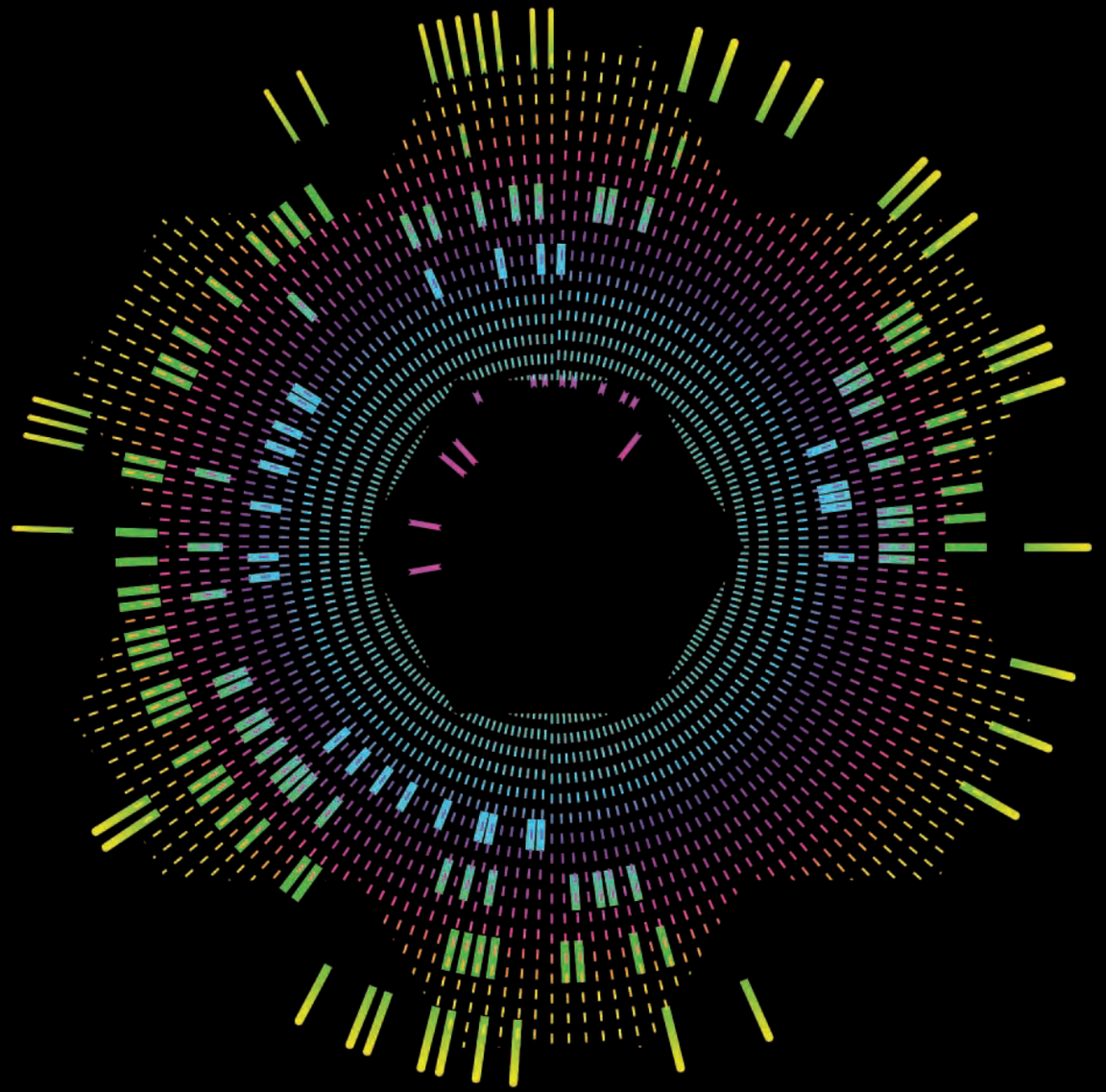
In an uncertain world, **safety and security** matters ever more to individuals, businesses, communities and even nations. From ensuring that the quality of the air we breathe is safe, to knowing that governments are equipped to tackle difficult social issues, universities are playing a vital role in shaping and driving policy across government on a local, national and international level.

The **health and wellbeing** of individuals matters not just to our every day lives, but to our society and economy that depend on citizens leading a healthy and productive life. From developing new techniques to train surgeons carrying out complicated operations, to ensuring that people get the right care, universities are working with doctors, hospitals and local communities to improve the health of the nation. It is this form of partnership working that brings expertise in universities together with health practitioners across discipline boundaries that makes Alliance research stand out. At Bournemouth University, computer scientists are working with NHS surgeons to develop the next generation of digital surgical training, a model of interdisciplinary work and a testament to the power of universities and their diverse but open approach to innovation.

A core part of the UK economy now exists in the **digital** world, which is why businesses depend on cutting-edge research in this area that will enable them to compete and deliver the products that their customers need. Drawing on significant strengths in areas from design to programming expertise, businesses large and small are working with Alliance universities to develop products that will enable them to compete in this increasingly important area. Universities also play a vital role in our **cultural life** with research across the arts and humanities. From conserving our art heritage, to exploring different aspects of our identity, this important work secures the foundations of knowledge about our lives today.

It is exciting to witness the power of research that universities are able to carry out. Supported by significant investment from both public and private sources, universities know that they have a responsibility to ensure that their work responds to the needs of society and the economy. And being world-leaders across different fields enables them to use science, innovation, creativity and intellectual strength to solve the big problems of the day. This is why universities play a critical role; their research touches everyone, whether they know about it or not.

Join us as we explore this research. We'll learn what it is doing, why it matters and why this is a story that could only be about universities and their part in ensuring that we all benefit from excellent research and innovation.



The cutting edge of cleaner energy

Towards an alternative nuclear future

The capacity to consume energy in both industrialised and non-industrialised nations is growing, and will continue to grow, at an unprecedented rate.

It is increasingly apparent that any strategy that attempts to satisfy global demand for energy, whilst also attempting to avert damage to the planet through conventional means of energy production, must include low carbon nuclear power.

However, despite its benefits, nuclear power has a number of drawbacks: high relative costs; perceived adverse safety, environmental and health effects; potential security risks stemming from proliferation; and unresolved challenges in the long-term management of nuclear wastes.

It is against this background that researchers at the University of Huddersfield are leading the way in looking at 'clean' nuclear. Building an innovative low carbon nuclear technology that is inherently safer than conventional systems; that is low waste; that does not include plutonium as part of its fuel cycle, that is intrinsically proliferation resistant; that is both sustainable and cost effective; and that can effectively burn legacy waste from conventional systems. This nuclear technology is the Accelerator Driven Subcritical Reactor, or ADSR.

Conventional nuclear reactors are powered by uranium, but the ADSR can be fuelled with the element thorium. Thorium is far more abundant than uranium and there are sufficient known reserves to power the planet for 10,000 years. Moreover the ADSR produces relatively small amounts of radiotoxic waste. Indeed, ADSR technology can be used to burn existing nuclear waste, considerably reducing the time needed for safe storage.

The ADSR technology couples a proton accelerator with a reactor core containing thorium. The high energy proton beam impacts a molten lead target inside the core, chipping or ''spallating'' neutrons from the lead nuclei. These spallation neutrons convert fertile thorium to fissile uranium-233 and drive the fission reaction in the uranium. This process has

Researchers at the University of Huddersfield are leading the way in building an innovative low carbon nuclear technology.

numerous safety benefits. Not only can the fission process be stopped by switching off the proton beam, but also only microscopic quantities of plutonium are produced.

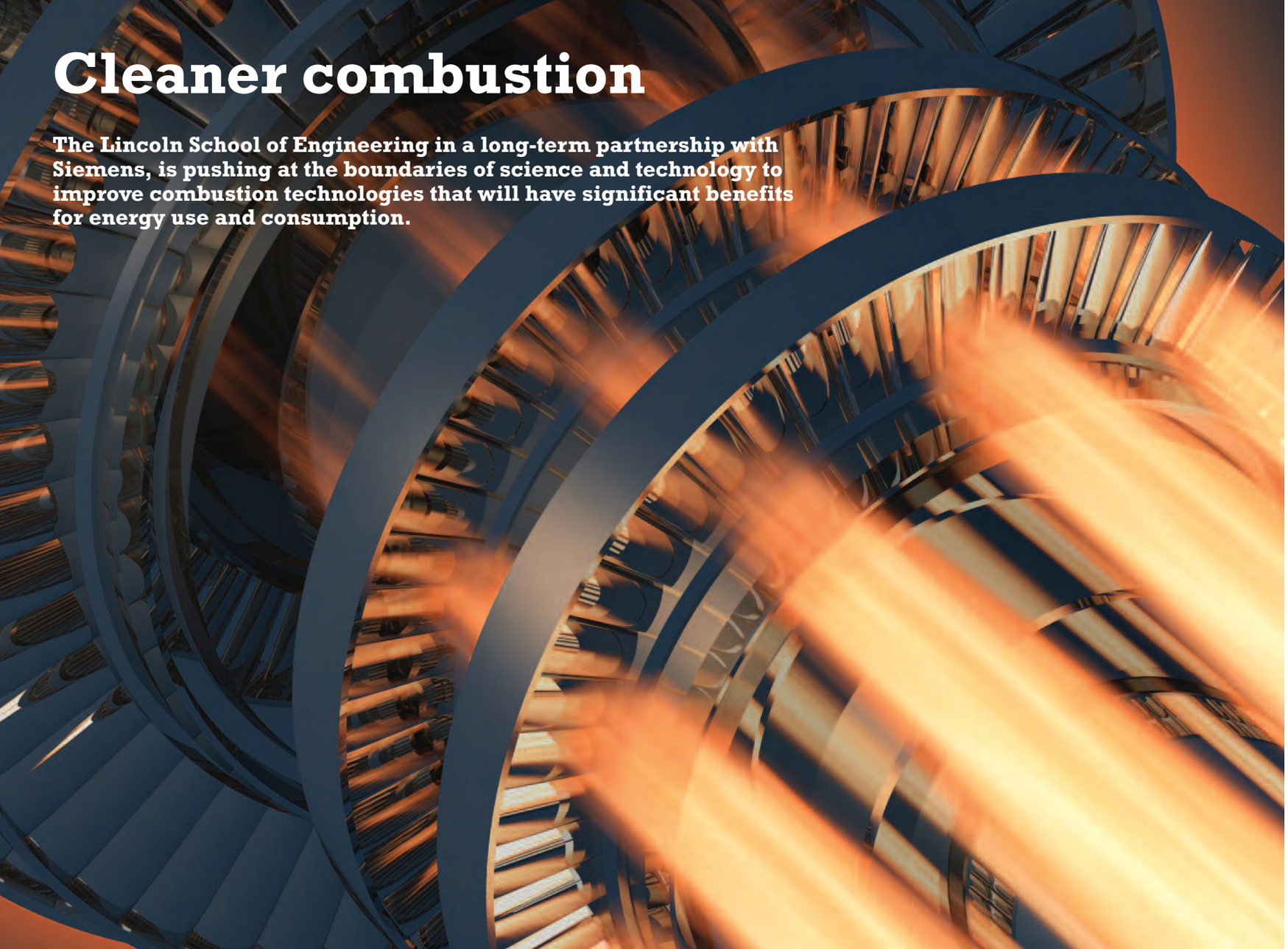
Researchers at the University of Huddersfield, led by Professors Bob Cywinski and Roger Barlow, lead the UK in thorium fuelled ADSR research, particularly through the development of an entirely new class of compact and reliable particle accelerators. Not only are these the crucial component to make ADSR technology feasible, they also have implications for the treatment of cancer, production of radiopharmaceuticals, and for other scientific, medical and industrial applications.

Bob, Roger and colleagues at the University of Cambridge and University of Manchester have founded ThorEA, the leading academic group in the UK investigating the possibilities of thorium power. The group also includes representation from Brookhaven National Laboratory in the United States. Through this research, they have shown that thorium can provide an alternative form of nuclear energy that needs to be taken seriously by governments, politicians and policy-makers around the world as they consider their future nuclear policies. The researchers believe that after further development, a fully functioning power station based on their technology could be supplying power to the UK's power grid in 2025.

Through this research, they have shown that thorium can provide an alternative form of nuclear energy that needs to be taken seriously by governments, politicians and policymakers around the world.

Cleaner combustion

The Lincoln School of Engineering in a long-term partnership with Siemens, is pushing at the boundaries of science and technology to improve combustion technologies that will have significant benefits for energy use and consumption.



The latest advances in scientific knowledge of lasers and combustion are being combined with state-of-the-art equipment to produce a cleaner and more reliable technology for the ignition of both gaseous and liquid fuels for the gas turbines produced by Siemens Industrial Turbomachinery Ltd.

The current ignition system in gas turbines uses conventional flame ignitors to ignite fuels. Unfortunately these systems are plagued by repeated failures and unreliable performance. The inherent characteristics of robustness, reliable performance and high levels of control associated with lasers and laser ignition mean that a laser ignition system will be less prone to failure and will give more reliable performance. Laser ignition also offers the potential to ignite leaner air fuel mixtures, thereby reducing harmful emissions. With the importance of gas turbines to power generation, this research represents a significant leap forward that could result in generating cleaner, safer and more reliable power in the future.

A great deal of new knowledge about lasers, ignition and combustion has been generated from the first phase of this research. The fact that it was conducted using existing gas turbine components demonstrates the laser ignition system's capability for operating within the constraints of existing hardware.

The next stages of this research will use this knowledge to develop a prototype laser ignition system. A key focus of this further development will be the method for delivery of the spark from the remote laser source to the ignition location within the combustion chamber of the gas turbine. The method employed will be delivery of the laser beam to the combustion chamber via an optical fibre.

A fully functional prototype will be further developed through field trials conducted on actual Siemens gas turbines in industry before full production for new gas turbines and retro-fitting in existing gas turbines. This will mean that new scientific and technical knowledge will give Siemens Industrial Turbomachinery a long-term and sustainable technological advantage in the area of ignition and combustion.

Dealing with environmental change today

Making our homes sustainable

There are few greater challenges that face our planet than how we consume energy in a more sustainable way, and how we make this a reality of our daily lives.

Universities are meeting this challenge by developing the underpinning research that enables businesses to bring more energy efficient products to market that consumers can use to improve the energy efficiency of their homes.

The Government's carbon reduction targets mean we need to retrofit 1,500 homes a day, every day, until 2050 to ensure they meet the energy standards. Given our ageing housing stock this is a particularly complicated task. Through their Energy Hub, the University of Salford have reconstructed the world's first terraced house inside a fully climate-controlled lab where new technologies and tests can be run in exacting conditions – such as wind, rain and varying temperatures.

The Hub brings together academics from varying disciplines; physicists, psychologists, engineers, designers and built environment experts all collaborating with a huge range of organisations to find energy efficiency solutions for our homes.

One such organisation is Dyer Environmental Controls who, working in collaboration with the team at Salford, have developed and brought to market 'Solis', a wireless, solar powered chain actuator for opening high level windows and rooflights. This new product facilitates a simple and efficient way to release heat and provide natural clean air into a house. Dyer's Managing Director, John Crossley, knows it couldn't be done without Salford's Energy House project.

"The Energy Hub's support has not only given us the opportunity to exchange innovative thinking and bring new products to market but, more importantly, it has been the catalyst for a new innovation culture within our Company. From supporting us through factory visits in the Far East, to facilitating Innovation Days within our business, the Energy Hub's refreshingly open communication approach has allowed us to develop from a construction-based subcontractor, to an innovative environmental technology provider."

John Crossley,
Managing Director
Dyer Environmental Controls

The future of green transport

Sustainable methods of travel will also help us work towards lowering our energy consumption. Electric vehicles may be one answer to this and BMW have been developing an electric version of its popular Mini, the MINI E. Throughout this complex project, and supported by a £6m fund from TSB, BMW's principal academic partner has been Oxford Brookes University.

The MINI E project required a multi-disciplinary approach to research, to interrogate the technical issues as well as to fully understand the social and psychological aspects of driving electric cars. Oxford Brookes was well placed to carry out this work due to its strengths across a range of disciplines.
As part of this work, BMW and the University conducted a trial of 40 vehicles with 138 private and fleet drivers and combined objective data logger information with subjective driver data.

The early project findings informed development of the 2011 BMW Active E, an electric derivative of the BMW 1 Series Coupé in preparation for the 2013 version of the car. The University's research was extended substantially across the whole of the TSB's 'low carbon vehicle demonstration' programme. This research also provided the first insight into the expectations and experiences of private and fleet drivers of electric vehicles, which posed many questions; How would private and company motorists and fleet managers get on living with a different type of car? What were their preconceptions, their real experiences and their attitudes towards a different style of motoring? Might there be unexpected benefits from having an electric car? What are potential barriers to the uptake of this type of car? What type of support is needed for drivers?

"For such an important task, BMW Group sought a research partner who could complement interpretation of behavioural metrics and engineering data with strong psychological analysis. The multi-disciplinary offering that a university could bring to the table was a more diverse and holistic one than the commercial sector alone can typically produce. The combined strengths of Oxford Brookes University's Sustainable Vehicle Engineering Centre (part of the School of Technology) and of its School of Psychology led to its selection. In particular methodological expertise in research construction, selection, delivery and analysis, as well as proven competence in the psychological interpretation of data were seen as key contributory areas of expertise."

Suzanne Gray, BMW

Saving lives at sea

Our physical environment matters to everyone and understanding it better could save the many lives lost each year in difficult environmental conditions.

Rip currents are responsible for hundreds of drownings and more than 100,000 lifeguard rescues on beaches around the world every year. The presence of rip currents are often associated with beaches along the coasts of Australia and the United States, but they are very common in the UK too. Plymouth University, in partnership with the Royal National Lifeboat Institution (RNLI) and funded by the Natural Environment Research Council (NERC), are undertaking research to improve understanding of these hazardous rip currents.

RNLI lifeguards, who patrol beaches throughout the UK, report that rip currents are responsible for 70% of all surf related incidents that they respond to. This amounted to more than 1,000 rip current incidents during 2009.

Previous research at Plymouth University has identified the complex nature of rip current behaviour at UK beaches. Rip current systems are influenced by constantly varying wave and tide conditions, and beaches that change shape throughout the year. The current research project has been designed to improve our scientific understanding of these rip current systems and how they affect beach hazards. This improved knowledge is then passed on to the RNLI in a form that can have a significant impact on public safety.

Impact-led, academic research can provide groundbreaking science that save lives through a well-structured working partnership.

A better understanding of these relationships will mean that the RNLI will be able to provide their lifeguards with tools and additional training to help keep beaches safe when rip current hazards are high. In addition, the project findings will support public rip awareness programs.

The strong partnership between RNLI and Plymouth University has been developed over time with the RNLI providing field support and input on dissemination strategies. As well as driving the research, the University will incorporate its findings into the RNLI's lifeguard training, public education programs, risk assessment procedures and resource management tools through a carefully researched and comprehensive impact plan.

This project provides an example of how impact-led, academic research can provide ground-breaking science that save lives through a well-structured working partnership.

Plymouth University, in partnership with the Royal National Lifeboat Institution (RNLI) and funded by the Natural Environment Research Council (NERC), are undertaking research to improve understanding of these hazardous rip currents.

"The expertise at Plymouth University made this partnership essential. Their strengths in the marine science department made them an ideal partner. Not only has this research project advanced our knowledge about rip currents which will help us save lives, it has given our organisation international credibility in both academic and practice-based circles."

Adam Wooler,
Head of Research for RNLI

A more sustainable future for the aviation industry

As well as adapting our economies and living arrangements to benefit the environment, universities are working with different industries that may be having an adverse effect on climate change.

The aviation industry is having a significant impact on the world's carbon emissions and this trend is set to increase as more and more people travel by air.

With the industry growing, researchers at Manchester Metropolitan University's Centre for Air Transport and Environment (CATE) are investigating how existing airport infrastructure can be used in a smarter way through better environmental management. The aim is to enable the industry to grow, but in a sustainable way, meeting UK Government and EU targets. CATE's longstanding research in this area has developed alongside a partnership with Manchester Airport which has been able to put much of CATE's research into practice subsequently leading the way for sustainable aviation.

Effective environmental management requires the collaboration of the many stakeholders in the air transport industry: aerospace manufacturers, airlines, air traffic management providers, airports and, of course, the travelling public. The environmental management systems used at airports are unique, involving sometimes hundreds of different companies, all of different sizes and all with different and sometimes conflicting interests. CATE's work has investigated how all these partners work together to find the appropriate balance between operating capacity, operating costs and environmental protection. From leading in this research, CATE have been able to advise airports, airlines and air traffic management organisations in the UK and around the world on how to change their operations to reduce their environmental impacts.

Professor Callum Thomas, one of CATE's leading researchers said "The flight path into and out of an airport can affect the daily lives of tens of thousands of people. The air quality around an airport is influenced by millions of cars, tens of thousands of aircraft movements, generation of energy and handling of aircraft on the ramp. For climate change, while aviation is responsible for 2-3% of CO2 emissions each year from human activities, the proportion of people around the world who fly is tiny."

Successive governments have consulted CATE on air transport policy as world leaders in their field.

The disturbance caused by aircraft noise is the single most significant environmental impact associated with airport operations and has given rise to significant capacity constraints and operating restrictions at airports worldwide. New research by CATE, working with noise experts from across the world, has developed and trialled a new "community friendly" noise measure that local people understand and engage with. It is anticipated that this will be used by increasing numbers of airports across the UK and internationally.

With UK public interest in the aviation industry and its growth being such a highly-charged political issue, successive governments have consulted CATE on air transport policy as world leaders in their field. With many important decisions needing to be taken by the UK Government about the future of the UK's air transport infrastructure over the next few years, CATE's work has never been more relevant or imperative.

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Making a valuable cultural impact

Understanding our identities

Universities play a vital role in our cultural life through their world-leading research in the arts and humanities.

Research into the human experience gives us an invaluable insight into different cultures, as well as art and history. These form the foundations of our understanding of today's world, which is why they remain an important part of our universities' research focus. Researchers at Northumbria University, funded by the AHRC for the next three years, are working to understand how the English saw themselves throughout history, a project that has far-reaching implications for our lives and identities today.

'Locating the Hidden Diaspora' is a ground-breaking project to explore why ''Englishness'' has been overlooked in America, while other ethnic groups are more celebrated and widely known. While people often think of Scots and Irish exerting a sense of their own ethnicity, particularly as migrants to America, there has been relatively little investigation into what the English thought about themselves.

The researchers believe that Englishness has been overlooked by historians because, as the founding colonists, the English were the benchmark against which all other ethnic groups measured themselves. Ironically, England's relatively recent decline in global influence and the cultural changes produced by mass immigration and regional devolution has sparked increasing attempts to rediscover and define Englishness.

The project also has implications for the other side of the Atlantic. Recognising the English as a distinct diaspora gives us a clearer picture of the development of an American identity in that it complicates the idea of a coherent 'Anglo' cultural mainstream and indicates the fluid and adaptable nature of what it meant and means to be an American or Canadian.

An understanding of what constituted Englishness historically in the US and how the English migrants expressed that will contribute to today's debates on national identity that are happening across the UK. The growing movement for an independent Scotland has raised the issue of ''Britishness'' and ''Englishness'' in the wider society and influenced national debate about identity. Professor MacRaild, the project's leader argues, "Today, Englishness in England is bedevilled with fears about right-wing extremists, football hooligans and the uses and abuses of the now prevalent St George's flag. We hope a project that will demonstrate the vibrancy of Englishness beyond England's shores will contribute to debates about how Englishness fits into today's multi-ethnic and increasingly federal political culture."

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Professor MacRaild

Conserving our art heritage

Researchers at Nottingham Trent University are developing a new generation of technology that will become a tool for use by galleries and art conservators around the world.

Projects funded by the AHRC, the EPSRC, and the Leverhulme Trust will result in a vital new instrument that will enable smarter conservation of some of our most priceless and important works of art.

All of this can help art conservators and curators to better understand the historical significance and what is required to preserve priceless artefacts.

Since 2004, Dr Haida Liang from the University's School of Science and Technology has led research into the application of Optical Coherence Tomography (OCT) which provides a badly needed non-invasive method for the examination of paintings. Originally developed as a medical imaging tool, OCT uses infrared light to penetrate biological tissue which scatters the light back. This scattered light is then detected by the device, allowing it to measure the distance it has travelled and produce a three-dimensional image of the inner structures of the tissue.

Since realising the potential for OCT to be applied in the examination of works of art, Dr Liang and her team have spent the past six years pioneering various applications for work in art history, archaeology and art conservation.

In the case of paintings, the depth and distribution of paint and varnish layers, and even artist's preparatory drawings, can be made visible. All of this can help art conservators and curators to better understand the historical significance and what is required to preserve priceless artefacts. The team at Nottingham Trent University now hope that a variety of improvements can be made to the effectiveness of current OCT systems, all of which will be of enormous benefit to its users. Researchers are developing a system that uses a broader band and longer wavelength of light to improve the resolution and depth of penetration achievable.

These improvements will allow OCT users to collect a level of detailed information which is currently only possible by physically removing samples from artefacts and examining them with a microscope. This work will also help to establish a reputation for OCT as a tool for non-invasive imaging in the heritage field, highlighting the benefits it has as an early warning tool for detecting deterioration and problems for conservation.

These research projects are being carried out in partnership with the National Gallery, English Heritage and the British Museum, which have allowed the researchers to apply their techniques to the examination of paintings, enamels, glass and ceramics. Teams from English Heritage and the National Gallery have been able to test the instrument, and work with the Nottingham Trent researchers to continually improve its effectiveness. Once fully developed, it will form a critical part of conservator's tools ensuring that art is conserved and protected for future generations without suffering any damage in the process.

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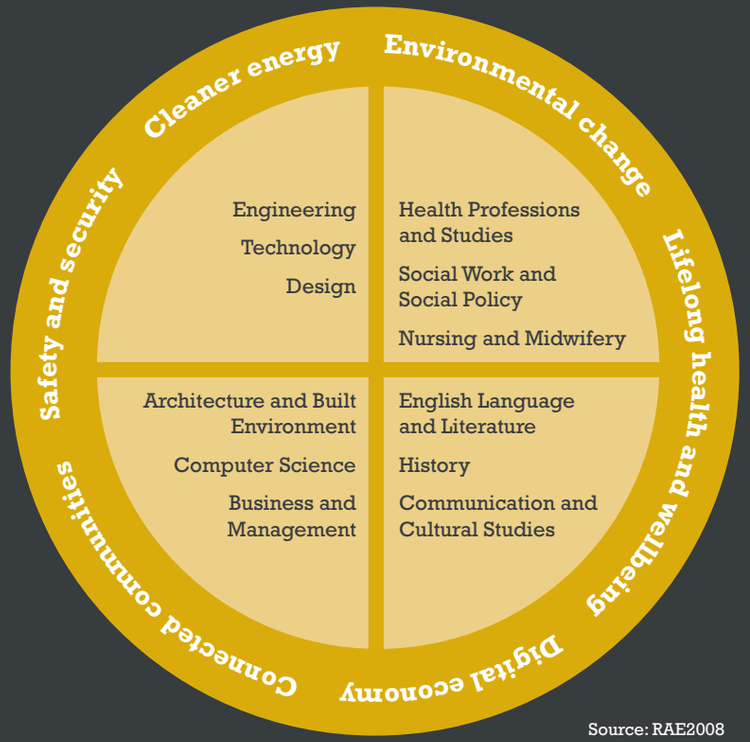
Alliance research

Alliance universities have significant strengths across a broad range of disciplines, which are contributing to the challenges posed by governments and funding bodies to today's research community.

These strengths represent the top areas excellence in research across Alliance universities that have been given the highest rating of 4* or 'world leading'.



Source: RAE2008

Alliance research is supported by significant investment from public and private sources in the UK and internationally.

In 2010-11, this amounted to:

£317m

Source: HESA

Research councils
Quality related funding
Business and industry
Charities
International governments
Innovation funding
Collaborative research
National Health Service
UK Government bodies
Local authorities

Driving policy to create real and lasting change

Tackling child abuse

Research carried out by Alliance universities frequently influences policy on a local, national and international level.

Alliance universities work with policy-makers across a spectrum of issues that affect communities and individuals on a daily basis. Researchers at Kingston University through The Centre for Abuse and Trauma Studies (CATS) are investigating the online grooming behaviours of sexual offenders.

The research project, run with partners in Italy, Belgium and Norway, is attracting interest worldwide and will inform internet safety legislation and policy across Europe, as well as law enforcement agencies and providers of treatment services for sexual offenders.

Working with police and prison services throughout Europe, the project explores motivation and victim selection practices among internet sexual offenders. The breadth of expertise within CATS allows its researchers to cross traditional disciplinary boundaries when working with victims and perpetrators. In the project's first phase, which began in 2009, they found similarities in the behaviour of sexual offenders, regardless of their country of origin. Previous research had revealed that abusers earn the trust of their victims through a variety of socialisation processes that often last several months. CATS researchers have shown that abusers have become increasingly competent with new technologies, fast-tracking the grooming process through social networking sites such as Facebook.

They work rapidly through lists of hundreds of youngsters until someone agrees to meet with them. Researchers believe that, by talking to convicted offenders about how they selected and prepared their victims, they will be better able to warn of the potential dangers. In addition, by talking to young people, parents and teachers, they aim to identify the most effective ways of promoting safer internet practices. CATS will also work with social networking sites to improve internet safety and is currently collaborating with Facebook to disseminate preliminary findings.

Findings from the first phase of the research are now being disseminated to the police, social and health services, NGOs, children's charities and others that may be able to use the findings to make positive steps in the fight against child abuse.

Peter Spindler, Commander at the Metropolitan Police said: ''There has never been a more important time for the academic community to step forward and provide their perspective on the challenging world of child abuse. Professionals are so immersed in addressing the symptoms and manifestations of abuse, they rarely have the time or resources to analyse the issues and tailor their response accordingly.''

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Commander Peter Spindler, Metropolitan Police

Driving down unemployment

Another important policy agenda being shaped by Alliance research is hidden unemployment.

Researchers at Sheffield Hallam University have undertaken numerous research projects over the years quantifying hidden unemployment and identifying the extent to which unemployment has been diverted into incapacity benefits.

The research has been at the forefront of academic and policy debates and highlights the importance of recognising geography. This is essential if the much-debated rise in incapacity benefits is to be fully understood. The research undertaken at Sheffield Hallam has informed national policy debates by advancing methodologies, creating analytical tools and generating a substantial evidence base to inform the policy-making process. Traditionally, the 'claimant count' was the preferred measure of unemployment in Britain. However, new research identified that this measure underestimated the real level of unemployment and that the diversion of claimants onto incapacity benefits meant that unemployment had become hidden within national statistics, and therefore to government, the policy research community, policy makers and the public.

The researchers collaborated with the Department for Work and Pensions which supported the project throughout from the application, to access data to form the basis of the sampling for the primary research, as well as active engagement on the steering group and at dissemination events. This research project has led to greater recognition of the true scale and spatial concentration of unemployment in the older industrial parts of Britain which is essential when planning policy across government that could have some impact on employment rates.

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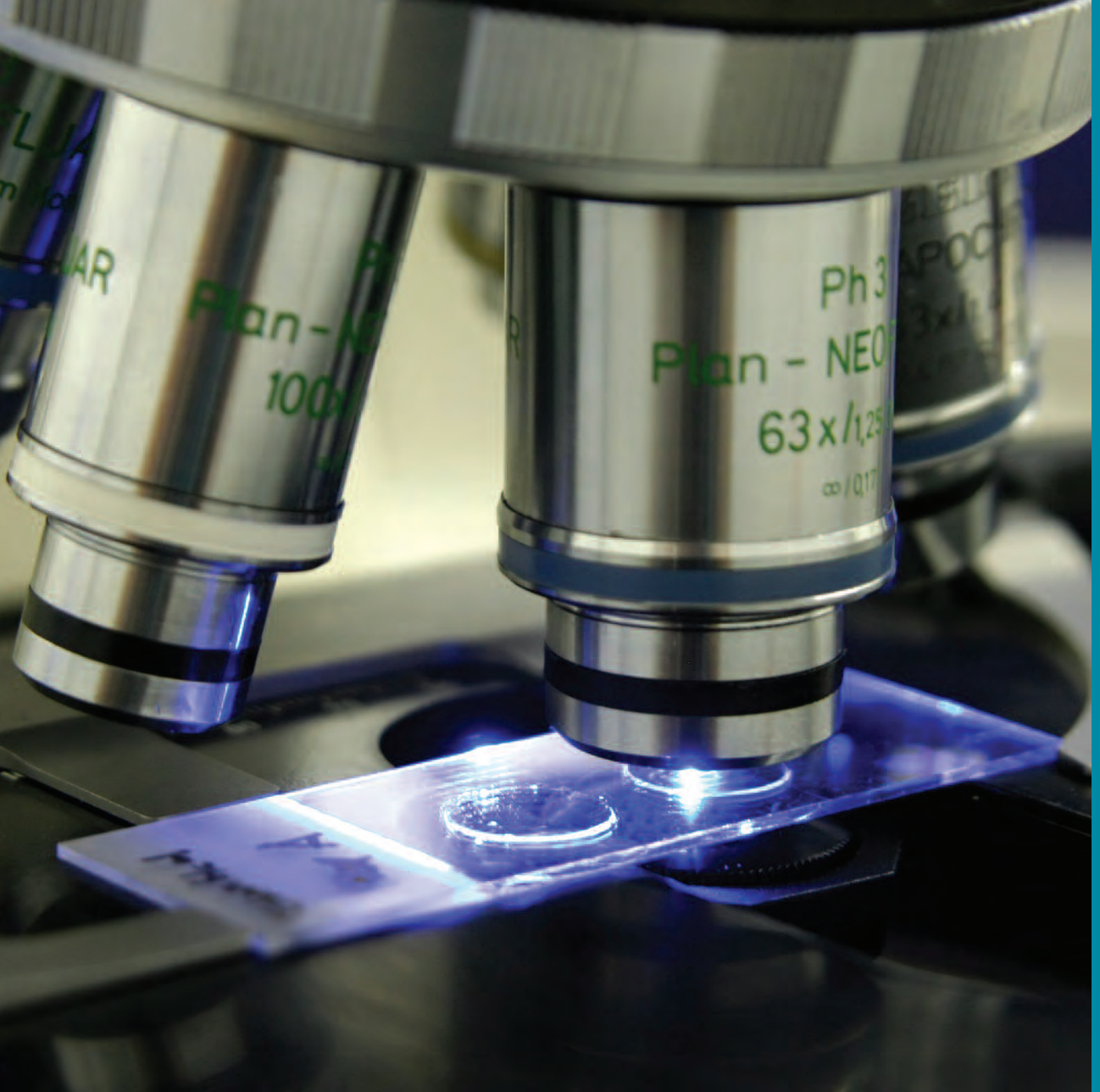

Researching across boundaries to ensure our health and wellbeing

Adding computer science to surgical training

Alliance universities make a significant contribution to research that affects our health and wellbeing.

Researchers in computer graphical simulation at Bournemouth University who, in partnership with consultant surgeons from Bournemouth and Poole hospitals, are developing a virtual reality based simulator that allows trainee doctors to learn their techniques by operating on a virtual patient.

Given the tremendous diversity of expertise that exists in any university, many of them are able to conduct groundbreaking research that spans a range of disciplines and techniques. And with a consistently open approach, they ensure that research is conducted in partnership with practitioners and experts from outside of university life.

This open approach is apparent when you talk to researchers in computer graphical simulation at Bournemouth University who, in partnership with consultant surgeons from Bournemouth and Poole hospitals, are developing a virtual reality based simulator that allows trainee doctors to learn their techniques by operating on a virtual patient.

Colorectal cancer is a life threatening disease and one of the most common cancers. Surgery remains the most common treatment option with 80% of patients undergoing an invasive procedure. Due to the complexity of the anatomy and the delicate structure of the bowel, removing the cancerous tissue fully and cleanly is a very skilful job. Recent research into relapse rates highlights the importance of a specialist colorectal surgeon in effective treatment. However, such skills are born of experience. The reality is that many new doctors gain these skills, in this country, by operating directly on patients which presents both a risk to the patient and inevitably prolongs the training period for capable surgeons.

There are already some computer assisted surgery simulators available. However these have primarily been for operations where there are only small movements and small deformations of soft tissue. Bowel cancer surgery is very different and a lot more complicated. To be effective as a training tool, the graphical representation, the sensation of force (haptic feedback) the trainee experiences and the deformation response of the soft tissue need to be realistic. Accurate representation of these elements is incredibly complex. This is why no such other simulators currently exist and why the system that has been developed through this research is one of a kind.

Dr Taz Quershi spoke passionately about his involvement with this research project: "I was appointed as a Consultant Laparoscopic (keyhole) Surgeon at Poole Hospital NHS Foundation Trust, tasked with introducing new laparoscopic techniques to the hospital. I now train other surgeons, both junior and established Consultant Surgeons on how to perform Laparoscopic surgery.

The collaborative project started in 2009 with Bournemouth University and their national centre for computer animation at the media school. This has enabled surgeons to be involved at the very beginning of its development.

The collaboration has meant that we have addressed the difficult challenges posed by this research together as clinicians and computer specialists, which has been really illuminating and a real privilege.

Once completed, we would hope our simulator will be attractive to the surgical profession not just in this country but internationally."

Improving the air we breathe

The quality of the air we breathe has a serious impact on our health and it is often the case that we have no guarantee that our air is always of an acceptable and safe quality.

Indoor environments, damp conditions, industrial processes and ventilation systems can all pose health risks. Exposure to some types of particles can lead to people suffering from a host of life-threatening conditions.

Researchers at the University of Hertfordshire's Centre for Atmospheric and Instrumentation Research (CAIR) have, after years of research and development, made a breakthrough in the development of a low-cost particle counter that allows for continuous monitoring of indoor air quality. Thanks to the advances made in particle characterisation by spatial light scattering and in-instrument design, the team have been able to develop a new reliable sensor with a wide range of important applications.

This technology is being used in a number of different applications, however real-time airborne asbestos detection is one of the most significant advances that it will now bring. Millions of buildings in the UK and Europe, including schools, hospitals, public and commercial buildings, still contain asbestos. Whilst untouched, the asbestos is fairly harmless, but with age and degeneration, asbestos fibres can be released into the atmosphere.

Researchers at the University of Hertfordshire have, after years of research and development, made a breakthrough in the development of a low-cost particle counter that allows for continuous monitoring of indoor air quality.

An asbestos detector based on the technology developed at the University of Hertfordshire is being manufactured by Select Group Ltd for use by trades-people across Europe.

Although development of the world's first real-time asbestos detector is of extreme importance within the construction industry sector, exposure to toxic asbestos is a global problem which reaches far outside the construction trade. Two million people are predicted to die from asbestos-related diseases by 2030, 250,000 of which are in Europe. In the UK over 4,000 people a year now die from asbestos-related diseases with only half of those being tradesmen, the other half consist of their families, teachers, emergency services, military, ship repairers, demolition workers and many other industrial sector workers and building occupiers. The 'Alert Detector' will provide an invaluable tool to Fire and Emergency Rescue services who face possible exposure to airborne asbestos, on a daily basis, through destruction caused by fire, collapsed buildings and other natural disasters.

Alan Archer, the Managing Director of the Select Group has been working closely with the University to develop this product and bring it to market.

''Whilst our business has many commercial strengths and business experience, we lack the in-house research and development, facilities and skills needed to develop highly technical products. Our company is never short on good ideas but we needed the scientific expertise of the University of Hertfordshire to make our vision a reality. Hertfordshire have brought amazing technical skills to the project and an excellent understanding of how to interact with the private sector. Without their expertise and scientific knowledge, our vision of a real-time asbestos detector would have been near impossible.

The level of knowledge and the necessary equipment to develop such a sensitive piece of equipment would have made it financially unviable for Select to have pursued this work on its own.

The technology behind the Alert Detector will provide millions of people who are currently at risk, with a means of personal protection. Alert will warn them of the potential presence of airborne asbestos fibres offering them the vital opportunity to stop, secure the area and have the asbestos treated professionally, minimizing exposure to these lethal airborne fibres.

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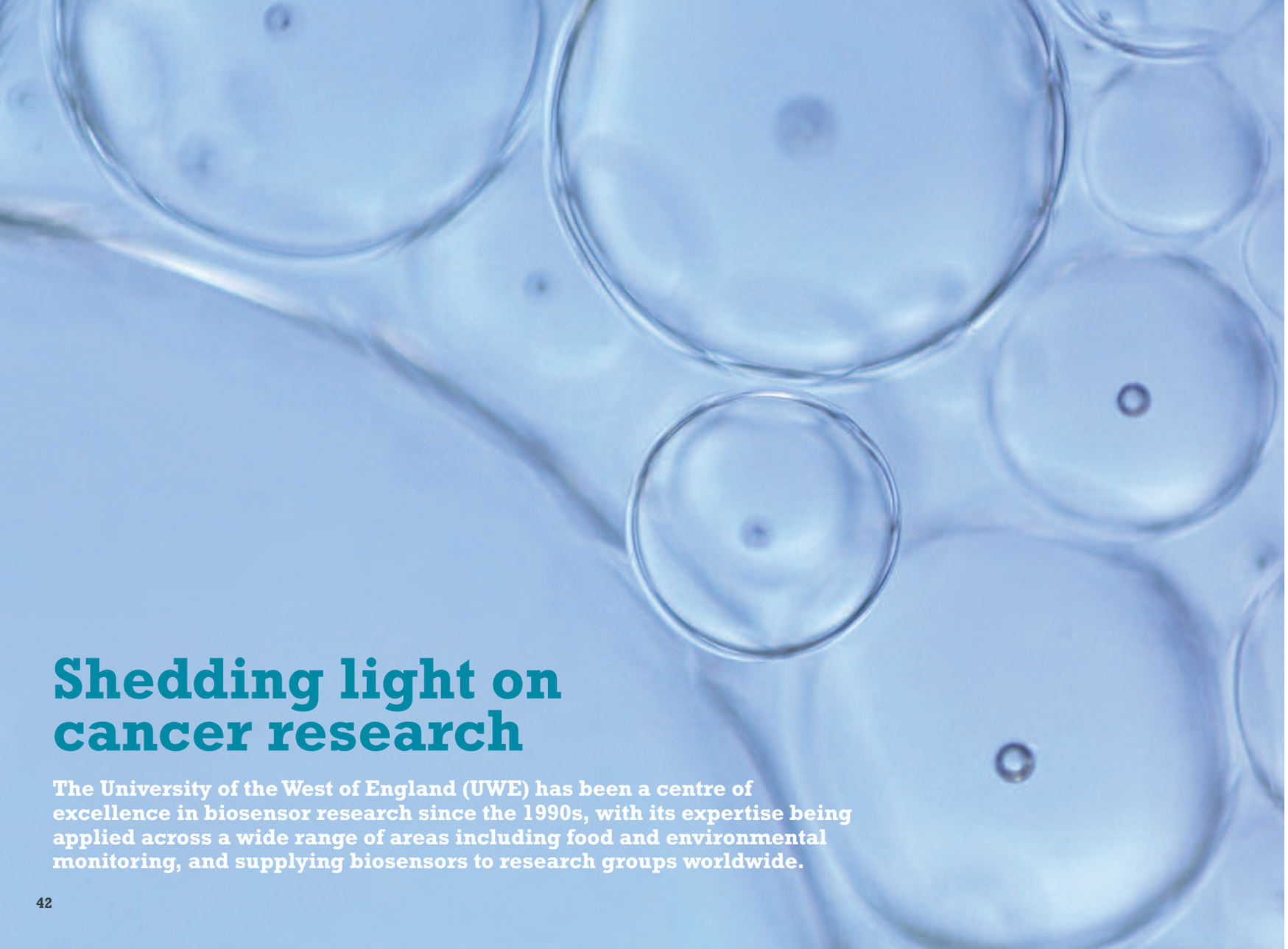


Shedding light on cancer research

The University of the West of England (UWE) has been a centre of excellence in biosensor research since the 1990s, with its expertise being applied across a wide range of areas including food and environmental monitoring, and supplying biosensors to research groups worldwide.

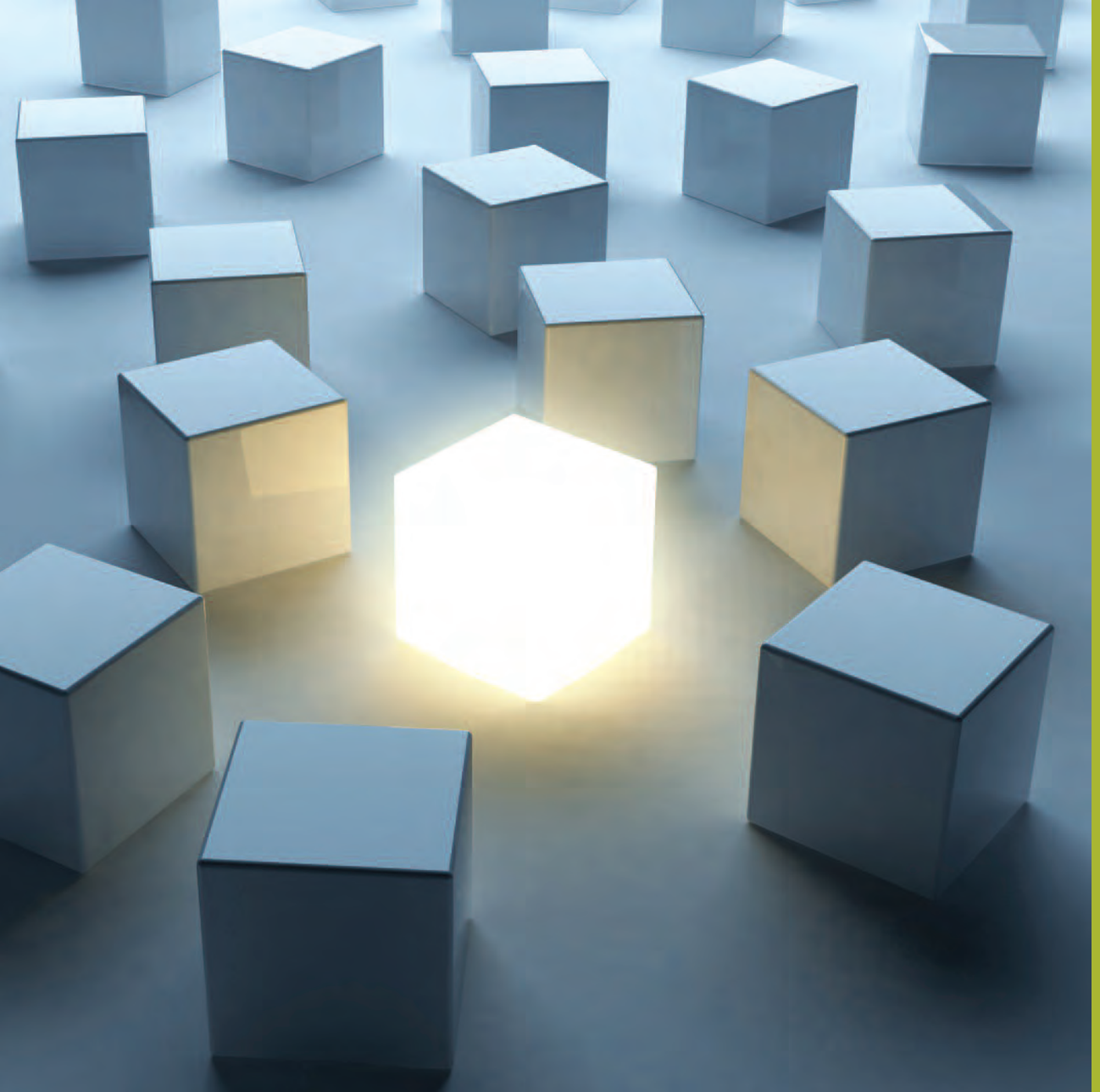
Professor Vyv Salisbury of UWE's Centre for Research in Biosciences, is using gene technology to develop a rapid predictive test to enable tailored chemotherapy for leukaemia patients.

These biosensors use genetically modified bacteria that emit light when alive. They can be used to monitor the effectiveness of drugs and to rapidly predict the effects of cancer chemotherapy on leukemic cells.

The biosensor has been patented and is being used in a rapid assay that will be marketed by Randox Laboratories. Its application will enable patient specific chemotherapy, initially for one drug used in the treatment of Acute Myeloid Leukaemia, but in future it could be used for combinations of drugs used in chemotherapy for a range of malignancies, including solid tumours.

''It is this area that excites me the most,'' says Vyv, ''I am very keen to try and extend the research to see if we can design biosensors for predictive testing of chemotherapy for solid tumours such as breast and bowel cancer."

The development of bioluminescent bacterial biosensors requires multidisciplinary expertise and collaboration with a wide range of partners. Vyv appreciates that ''the research programme has been helped immensely by being at UWE, and particularly having colleagues with expertise in optics, analytical chemistry, genetic engineering and haematology. The importance of good relationships with the health service and a strong commercial partner are also crucial for the successful development of new healthcare devices.



Innovating through design, laying the foundations of our digital future

Placing design at the heart of innovation

Design plays an important role for business and industry by adding value to products or by helping the innovation of completely new ideas and ventures. De Montfort University's 'Improving Business by Design' project has enabled SMEs to put design at the heart of their research and development so that they can bring outstanding and popular products to market.

De Montfort University is well positioned to lead this project, having significant academic design expertise. This has enabled them to link with design and manufacturing companies, a process of knowledge exchange that benefits researchers at the university, the business partners and of course the customers that use the resulting products.

When the innovators behind 'Walkodile' approached De Montfort University, it was clear that this expertise was needed to make their ideas a reality. Walkodile is an innovative children's safety device that links children together in groups of two or four. Elaine Stephen who developed the original concept of the Walkodile said ''It's not easy taking a large group of young children out on a walk outside school or nursery... ask any childcare professional. Young children are very unpredictable and no matter how careful you are and how much adult supervision you have with you, there's always the chance an accident could happen. I wanted to create something which would make the children safer and make this task more manageable.''

The design challenges for this product were very complex; it had to be lightweight, safe and reliable, fun and attractive for children to use and ultimately cost effective for parents and nurseries that would need to buy it. For a company with limited resources, these development challenges would normally be insurmountable.

The product has won several prestigious design awards and Dame Elaine Stephen herself was awarded an MBE for services to Child Safety in the Queen's 2011 New Year's Honours List because of tremendous safety benefits that the Walkodile has brought families and nurseries.

However, researchers at De Montfort along with their rapid prototyping facilities were able to provide the research, development and design infrastructure needed to bring Walkodile to market. The researchers took a Computer Aided Design (CAD) approach to the process as traditional techniques would have been too resource and time intensive for a small company to sustain. A carefully managed experimental research programme was undertaken using three dimensional CAD design and advanced prototyping development. Research was embedded within the whole design process, including in the evolution of the design to produce the final product.

The researcher's efforts were rewarded as the product itself proved to be a huge success. Elaine Stephen said that "Walkodile has received extremely positive feedback from children, parents and childcare staff. It has also received widespread acclaim from many other communities and interested stakeholders. I know it will give me, my colleagues and all other education professionals significant improvements in outdoor education for us and the children under our care".

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Apps that matter

Mobile technologies and in particular mobile applications or 'apps' have become an important part of the increasingly digitised UK and global economy.

The Centre of Excellence in Mobile Applications and Services (CEMAS) at the University of Glamorgan, partly funded by the European Regional Development fund, is providing research and development for SMEs in Wales to increase their competitiveness. The Centre has a primary responsibility to work with SMEs in the convergence area of Wales by helping them develop, test and find a route to market for their mobile application product.

The University of Glamorgan, partly funded by the European Regional Development fund, is providing research and development for SMEs in Wales to increase their competitiveness.

CEMAS is unique in the way that they are able to minimise the initial risks to businesses that are associated with developing a mobile application. This is done through a fully funded app development programme available to eligible SMEs in Wales. The CEMAS team can help Welsh SMEs and start-up companies develop their app idea on a number of platforms including iOS, Android, Blackberry and Windows Phone.

Underpinning this work is research which has broken new ground in many different areas. One research project led by Professor Al-Begain has been working on queuing models to assess the survivability of systems that face failure. The team introduced a new concept in the form of "propagated failures". They developed a model that is capable of capturing system behaviour providing insight into its ability to continue to provide an acceptable level of service in case of disasters. This work has wide applications for organisations, big or small, that depend on complicated systems to underpin their operation.

We all know about popular apps built for entertainment, but CEMAS's research is enabling businesses to develop apps that are mission-critical to important and often dangerous work. An example of such a business is C-ToolZ, a start-up that produces and sells specialist software to the power industry. The software is designed to assist the commissioning of high voltage substation protection systems.

It replaces most of the complex manual calculations performed by engineers which increases efficiency, saves time and increases accuracy and confidence in test results, which is of critical importance when commissioning substations given the dangers and risks associated with their failure. The increased portability of having an app means an engineer can have access to the software wherever they are. It is also much quicker and easier to open an app than to boot a laptop and load the software.

The power industry itself will ultimately be affected by the release of this app as laptops will be replaced by smartphones, engineers will be able to be more responsive and accurate in ensuring that a critical part of the UK's infrastructure continues to work as it should.

The Managing Director of C-ToolZ, David Messruther, spoke about working with CEMAS: "CEMAS has supported the project with their friendly, professional support, guidance and expertise throughout. My description and rough sketch of what I wanted was quickly transformed into a professional and sleek design. The app is very technical and the designer spent a lot of time and effort getting it perfect. I was given great legal and financial advice from the project manager."

Facts and figures

University Alliance is a group of 23 universities offering a distinct student experience shaped by a commitment to delivering world-class research and a culture of enterprise and innovation built on close partnerships with business, the professions and their communities.

De Montfort University's KTP with Nottingham Scientific lead to their involvement in a **£60 million** Euro European Space Agency grant.

Research by Manchester Metropolitan University's Centre for Air Transport is influencing global aviation policy with their work on including aviation in any international emissions trading scheme debated by the UN.

The John van Geest Cancer Research Centre at Nottingham Trent University leads on interdisciplinary **research into cancer detection,** monitoring and immunotherapy.

Built and Natural Environment, at Glasgow Caledonian University, has been placed as the **top department for research in Scotland** and in the top quartile in the UK, with 60% of its research internationally excellent or world-leading.

Kingston has significant strengths in nursing, where **15%** of the research submitted was judged to have reached **4* level**.

In the past five years, Plymouth University's Centre for Robotics and Neural Systems has won over **£20 million** in grant funding for projects which include the use of robots to work with children in hospitals.

University of Huddersfield researchers are developing unique high power beams from simple compact accelerators for **safer nuclear power and improved radiotherapy**.

Liverpool John Moores University's National Schools Observatory (NSO) has successfully delivered around 30,000 observations to over 1,000 schools from the Liverpool Telescope.

Virtual reality technologies have allowed Northumbria University to create a living 3D model of Newcastle and Gateshead which is used by architects and town planners.

The University of Bradford typically runs over **150 research projects** with over 100 organisations per year.

Cardiff Metropolitan University's **SESAME** (Sensing for Sport and Managed Exercise) Project is set to provide elite athletes and coaches with a competitive edge in the run up to 2012.

Sheffield Hallam University are one of the **largest providers** of nursing education in the UK delivering specialist teaching in areas such as acute and critical care, and palliative care.

Inter-disciplinary research at Teesside University across health, social sciences, computing, engineering and sport science has led to an 'exergaming' product that that will enter the global market in partnership with a major Australian sports company.

The University of Lincoln's new multi-million pound School of Engineering reflects the scope of research where the University is engaged with external collaborators in industry, government and social enterprises.

Bournemouth University is home to the world **number one research centre** for fish biology, investigating the biological risks threatening freshwater fish that are relied on by millions world-wide for food, business and leisure.

The University of Salford is in the **top 20 UK Universities** for KTPs, primarily working with SMEs to integrate them into the university's knowledge base.

Professor Rajat Gupta of the School of Architecture at Oxford Brookes University has been awarded **£1.4 million** to carry out research into low carbon communities.

The Genomics Policy Unit (GPU) at the University of Glamorgan is one of the longest established research groups studying the **"new genetics"** in existence in the UK.

UWE is home to the largest Robotics lab in the UK.

The University of Portsmouth has one of the leading groups in **the next generation of cosmology experiments**, which aims to uncover the mysterious nature of dark energy and dark matter.

The University of Hertfordshire is developing a new atmospheric remote sensing station to observe and monitor aerosols, clouds and any future volcanic ash plumes.

Researchers from the University of Wales, Newport are developing 'robot skin' which will improve the ability of robots to operate effectively and safely in unconstrained environments.