College of Science & Engineering

Working together

Innovative partnerships
We are working with existing partners and developing new relationships to tackle global challenges.
The College of Science and Engineering

We encourage excellence in our staff and students, who work to understand the world we live in, undertake research of global impact and create new technologies.

The College of Science and Engineering is home to wide ranging and high quality research. We have over 30 years’ experience in nanoscience and a world-leading nanofabrication centre. Our research makes a positive difference to society and informs academic endeavour and innovation.

Sharing our expertise is a priority
This brochure has been designed to provide you with an introduction to the breadth of our activities and to illustrate just how important collaboration is to us. There are always new challenges and we hope that this will help inspire you to work with us.

Our areas of expertise

Our Institute of Neuroscience and Psychology (a joint Research Institute with the College of Medical, Veterinary and Life Sciences) strives to understand the brain at multiple levels of function, from cells to cognition. The College also hosts a collaborative facility, the Scottish Universities Environmental Research Centre (SUERC), operated jointly under a Consortium agreement between the University of Glasgow and Edinburgh University.

Tackling global challenges
Our researchers work in collaborative teams to tackle global challenges. Examples of our research themes are:
- Electronics and Photonics
- Energy and Sustainability
- Healthcare and Diagnostic
- Imaging
- Materials and Nanotechnologies
- Modelling and Simulation
- Security, Defence and Aerospace
- Sensor Systems
- Space
- Synthetic Biology

The University recently led the bid that secured £10m to create a new Innovation Centre in Sensing & Imaging Systems. This flagship project will combine academic innovation capabilities with local industry. There are around 130 companies in Scotland working with sensors and imaging, and the new centre could increase that number, to the benefit of Scotland’s economy.
The College of Science and Engineering has a strong track record of collaborating with industry and other research institutions. We have successfully helped many organisations to strengthen their capabilities and competitiveness and we are highly experienced in working with partners.

There are many ways we can work together and we can discuss your requirements to find the best mechanism for collaboration.

Research collaborations and strategic partnerships
Our College has a wide range of expertise and facilities which allows us to offer you unique solutions and long-term partnership opportunities. By collaborating with us on a research project which is of mutual interest, your company can benefit from extensive and ongoing input to the research process. There are a number of grants and funding sources available and jointly we can seek external research funding. Our Business Development Team will be able to provide advice on the different funding sources available, their suitability and provide support to the team throughout the application process.

Consultancy
Our research experts can help you address specific issues quickly and effectively. Some examples of consultancy work could include expert advice and opinion; expert witness; customised training; and strategic planning.

Student projects and industrial studentships
Student projects are an excellent way to engage with the University to gain access to new ideas, expertise, and capability via the student and their academic supervisor. This approach has the added benefit of allowing the student and the company to consider if there may be future employment opportunities. By sponsoring a studentship you can specify a PhD topic and work with the student and academic supervisor to access basic research outcomes relevant to your business.

Knowledge Transfer Partnerships (KTPs)
KTPs enable businesses to work with the University, bringing knowledge and expertise into your organisation to help solve important technical or business problems. A KTP Associate, e.g. a recently qualified graduate specifically recruited to the project, will work within your business to manage the project, apply their own knowledge, and ensure that University expertise is available to your company. KTPs can vary in length depending on the needs of your business and the desired outcome.

Licensing technology
One of the core missions of the University is the creation, advancement and sharing of knowledge and we aim to transfer as much Intellectual Property into commercial use as we can. As well as our range of commercial licensing deals, we have launched a range of Intellectual Property that is available free of charge to businesses and individuals who think they can exploit the technology and are interested in working with the University. Easy Access IP offers cutting edge innovation and patents to those who can make best use of the research.

Technology services and facilities
We offer a wide range of high technology services, supported by our research facilities. These services are available to industry at commercially competitive rates, enabling companies to address and solve key technical challenges, increase product performance and improve business operations. To find out more, visit www.glasgow.ac.uk/technologyservices.
A model partnership

A collaborative project with Scottish software firm, Sciencesoft, leads to the development of new modelling software which has the potential to improve recovery from mature oil fields.

The oil and gas sector continues to play a crucial role in Scotland’s economic landscape. Although production in the North Sea has passed its peak, the sector is, and will remain, one of the most important to the Scottish and UK economies for decades to come.

It has been estimated that in most oil fields, over two-thirds of the oil is left behind as extraction becomes more difficult and costly. However, a sustained oil price of $100 per barrel means that alternative strategies for enhancing production are economically viable, which could yield an additional 15% to 20% of the original oil in the field.

Currently the main barrier is the labour intensive task of building accurate computer models of the field. Simulations run by hand can take weeks for a single well, which makes the evaluation of a field a costly and time-consuming exercise.

Partnering for a solution

Sciencesoft is an award winning Scottish company specialising in 3D visualisation and analysis software for the international oil and gas industry. The company has established a long-term working relationship with the University of Glasgow which was strengthened when both parties agreed to collaborate on a seven month project to investigate new methods that would simplify the evaluation of oil recovery schemes for mature oil fields in the North Sea.

The short timescale of the project, which was led by Professor Chris Pearce of the University’s School of Engineering, meant that the technical expertise of the participants had to be tightly managed. This led to a successful project outcome and the results are being fast tracked through commercialisation by Sciencesoft for inclusion in their ‘S3sector’ software tool. This will enable engineers to create models of advanced production processes for each well in a field in a matter of minutes instead of months leading to exceptional improvements in productivity.

Lindsay Wood, Sciencesoft’s Director of Research and Development, said: ‘We believe that we can automate 99% of this task and get people to where they want to be in minutes as opposed to weeks. Each additional 1% recovered of the original oil in place is worth several hundreds of millions of pounds, which represents billions if the correct recovery strategy is found.’

Professor Chris Pearce added: ‘This project represented an exciting challenge for us. Working with Sciencesoft enabled us to apply our research expertise into a new and industrially relevant application and provided one of our research students a great opportunity to gain some practical industrial experience.’

The project was funded by a grant from the Technology Strategy Board, developed jointly between Sciencesoft and researchers in the School of Engineering and Geography and Earth Sciences at the University of Glasgow.
Sciencesoft competes in a global market with 90% of their sales in more than 80 countries worldwide.

‘Working with Sciencesoft enabled us to apply our research expertise into a new and industrially relevant application.’
Professor Chris Pearce, University of Glasgow

Find out more at:
www.glasgow.ac.uk/engineering
www.sciencesoft.com
A fresh approach to food safety

Scientists at the University of Glasgow have developed a new method which makes packaged food safer and extends the shelf-life by harnessing the germ-killing power of ozone.

Dr Declan Diver and Dr Hugh Potts from the School of Physics & Astronomy have devised a way to reduce food-spoilage organisms such as mould and germs by temporarily rearranging the molecular bonds of the oxygen inside food packaging.

The power of ozone
The revolutionary product takes the form of a portable device which is applied to the outside surface of plastic or glass food packaging. ‘The device generates a plasma, which splits the bonds between oxygen molecules, or O\textsubscript{2}, inside the packaging,’ explains Dr Diver. ‘The oxygen reforms as ozone, or O\textsubscript{3}, which is a powerful germicide, even more powerful than chlorine. It’s very effective in getting rid of any mould, fungi or bacteria which may be lingering on the food surface. Our testing has shown the ozone treatment produces a major reduction in the presence of many pathogens and spoilage organisms in poultry including Campylobacter, Pseudomonas, and E.coli. The ozone naturally decays back to its original state after just a couple of hours, leaving the contents with a much lower bacterial count, making it safer to eat.’

Reducing waste
But the system isn’t just very efficient at killing germs – it could also have a positive impact on the environment. ‘The ozone treatment extends the shelf life of many foods by at least one day, and significantly more than that in some types of food, such as bread and muffins,’ says Dr Potts. ‘Households and businesses across the UK create more than seven million tonnes of food waste each year, much of it because the food has passed its use-by date. ‘Making food last longer on the shelf and in the home could help reduce the amount of waste we create.’

A safe solution
The company’s push into commercialisation is being led by Dr Ian Muirhead. ‘It’s easy to use and very safe. It works with today’s food packaging, so most companies would need to make only limited changes to their production line. Perhaps most importantly, it doesn’t require any chemical additives – the sterilisation effect comes directly from oxygen already in the package.’

Other applications
Although the team are initially focusing on promoting their product to the food industry, it also has potential applications for other sectors which require sterilised equipment. Dr Ian Muirhead, CEO of Anacail explains: ‘The process could easily be adapted to allow manufacturers of dental or medical equipment to sterilise their products, and we’ll be looking more closely at expanding into those areas in the future. It’s possible to imagine handheld versions of the device becoming available for home use, too.’
Encouraging enterprise
The University of Glasgow is committed to delivering economic benefits in Scotland via the creation of spin-out companies. The University works in partnership with the IP Group plc, a venture capital investor, to identify and create high growth companies developing products for international markets. Over the last five years our portfolio of companies have collectively raised in excess of £25M in funding, with a growing number of high value jobs being created.
Sustainable energy supply is a global technological challenge. The demands of a growing global population and the difficulty in locating precious oil and gas resources have increased the need for new technologies and alternative energy sources. However, in the short to medium term, hydrocarbons are set to remain fundamental to our energy provision. Hydrocarbon discoveries are becoming increasingly rare and situated in remote, inaccessible places. This is reflected by an increase in exploration costs of over 50% from 2009.

The greatest financial risks faced by oil and gas companies occur during frontier exploration when crucial licensing and development decisions have to be made on the basis of limited and often unreliable data.

LightTouch™, a novel, ultra-sensitive gas detector, was developed by Shell Global Solutions working in collaboration with scientists from the Optics Group at the University of Glasgow. The technology is helping to find oil and gas reserves by measuring trace gases escaping from the ground.

A more sensitive approach
The University of Glasgow Optics Group has developed the gas detection system and established a data processing algorithm that allows the gas concentration and wind-field data to be combined to infer the seepage locations and emission flux rates.

LightTouch™ measures the atmospheric concentrations of trace gases that leak from hydrocarbon systems and disperse into the atmosphere. These concentration data are combined with meteorological data and an understanding of the gas dispersion process to produce maps of gas emission rates from the ground’s surface. Early surveys were ground-based from 4-wheel drive vehicles but now the technique is deployed from specialist aircraft carrying gas detectors and meteorological sensors. These methods help to guide decisions on whether to drill and where.
‘We see this technology as a fast and inexpensive way of screening large areas for oil and gas...it allows you to make decisions more quickly and identify where money would best be invested.’

Bill Hirst, Shell Global Solutions

Estimates show that the cost of a LightTouch™ survey is only about 10% of a traditional seismic survey.

Financial gains
Initial estimates show that the cost of a LightTouch™ survey is only about 10% compared with a traditional seismic survey over a similar area. In addition, the results are available immediately so exploration resources can be focused on areas where hydrocarbons are present.

Bill Hirst, Principal Scientist of Measurement and Instrumentation at Shell Global Solutions, said: ‘We see this technology as a fast and inexpensive way of screening large areas for oil and gas, and you get the results the same day.

‘It allows you to make decisions more quickly and identify where money would best be invested in further exploration. We also expect LightTouch™ to provide useful additional input to ranking prospects for drilling.’

Find out more about the Optics Group at www.glasgow.ac.uk/optics
For people with end-stage renal failure, the most effective form of treatment is transplantation. Computing scientist Dr David Manlove is helping these patients who require a kidney transplant, and who have a willing but incompatible donor, to find an appropriate match by ‘swapping’ their donor with that of another patient in a similar position. Dr Manlove has been working with NHS Blood & Transplant since July 2008 on their kidney exchange matching scheme.

In collaboration with Dr Gregg O’Malley at the University of Glasgow, and colleagues at NHS Blood and Transplant, Dr Manlove has designed an algorithm that can search out options for kidney exchanges from anonymous patient data covering the whole of the UK.

Living donors
Until 2006, transplants from living donors were only possible where there was a genetic or emotional relationship between the patient and the donor. This changed when the Human Tissue Act came into force. Now, as long as there is no financial inducement and the potential donor passes a thorough assessment, strangers can donate to someone in need.

‘Living kidney donations can be complicated by blood-type incompatibility, or a tissue-type incompatibility,’ explains Dr Manlove, ‘these can cause a patient’s body to reject a kidney. There is also a major shortage of donors – there are approximately 5,700 patients on the kidney transplant list, and the average waiting time for a kidney is around three years for adults and around ten months for children.’

Maintaining efficiency
The algorithm currently produces results within one second. However, the challenge for Dr Manlove and his colleagues is to ensure that they can anticipate the future needs of the matching scheme. This includes improving the algorithm so that the running time remains fast even as the input grows larger. It is likely that, as awareness of the kidney exchange matching scheme grows, more patients and donors will join, leading to richer input datasets and in turn a greater quantity and quality of potential transplants that can be identified by the software in the future.

‘We are dealing with a computational problem that is inherently difficult technically,’ Dr Manlove says. ‘It’s called an “NP hard problem”. What that means is that no “efficient” algorithm exists to solve the problem. It is important to avoid the possibility of a “combinatorial explosion”, where just a small increase in the size of the data being fed into the algorithm could cause the running time to rocket to many hours or even days.’

Development plans
Recently, Dr O’Malley has been working on a major redesign of the algorithm to deliver a stand-alone software product that NHS Blood & Transplant can use in-house. This will also allow ‘chains’ of transplants to be found, involving altruistic (non-directed) donors and couples, each comprising a patient and their willing but incompatible donor.

A long-term goal is to establish a European-wide collaboration involving countries that are actively practising kidney exchange, with the aim of sharing best practice, developing common data formats and models, and possibly even sharing patient-donor pools.

Between 2008 and 2013, the number of transplants has increased by 40%, in comparison with the number of transplants possible with the previous pairing technique.
Working with NHS Blood & Transplant, scientists at the University of Glasgow have designed an algorithm which constructs a set of exchanges that consider a range of factors to maximise the overall suitability of transplants.

Find out more about the School of Computing Science at www.glasgow.ac.uk/computing

Other applications
‘Even beyond the medical sphere there are commodities that can be exchanged,’ explains Dr Manlove. ‘Local government housing in China can be exchanged using matching schemes, for example. Previously, residence exchange fairs have attracted up to 80,000 people. At one fair in Beijing in 1991, nine families formed a chain and exchanged houses. So I expect that in the future, with more people engaging with forms of electronic communication and more processes being centralised, we will only see an increase in the need for matching schemes of this type.’
‘Easy Access IP is a simple and straight-forward approach that focuses on establishing and supporting a relationship to commercialise university developed technology’

Mark Tanner, Vice-President, Boulder Non-Linear Systems
Making it easier to manipulate the micro world

Researchers at the University of Glasgow have developed a holographic optical tweezers system which is compatible with a wide range of microscopy techniques.

The Optics research group are now working closely with Colorado-based Boulder Non-Linear Systems, who specialise in custom light control systems, and have licensed the technology free of charge, as part of the University’s Easy Access IP initiative.

Optical tweezers are an established tool for the trapping, manipulation and force measurement of micron sized objects. Holographic optical tweezers have a number of applications including the construction of 3D structures using micron sized dielectric spheres or living cells.

This new system is compact, transportable and designed around a custom inverted microscope. The research team, led by Professor Miles Padgett, designed it to be accessible for non-specialist users, and have further improved its ease of use with a multi-touch iPad interface.

The Cube
Boulder Non-Linear Systems have licensed the technology to use in their Portable Optical Trapping System, known as the ‘Cube’. Having met the research team at a conference, the University offered an Easy Access IP license for the design rights and a non-exclusive license for the software. The deal was completed within eight weeks and the product has now successfully launched.

One application of the ‘Cube’ includes biological research; it enables the measurement of cell properties and controlled studies of how cells interact with foreign objects. Another example is the trapping of metallic objects and carbon nanotubes for engineering materials with unique thermal and electrical properties.

Mark Tanner, Vice-President of Boulder Non-Linear Systems, is full of praise for Easy Access IP. He said, ‘Easy Access IP is a simple and straight-forward approach that focuses on establishing and supporting a relationship to commercialise university developed technology.’

Professor Miles Padgett, leads the Optics research group. He said, ‘The University recognises the benefits of the Easy Access IP initiative as a means of building long term partnerships with industry. I have long realised the importance of getting research out of the lab and into use and I look forward to continuing to work with Boulder Non-Linear Systems.’

Find out more at: www.glasgow.ac.uk/optics www.bnonlinear.com

Making it easy with free IP
In 2010 we started marketing technology opportunities free of charge through our Easy Access IP initiative. Easy Access IP helps us get early stage technology into the hands of innovators who can then explore, develop and exploit it quickly. Sharing our expertise is a priority and Easy Access IP reflects our commitment to making it easier for industry to engage with us. Find out more at www.glasgow.ac.uk/easyaccessip.
‘The project achieved several world firsts and also led to Wellcome Trust funding for the development of magnetic sensors for brain imaging and European Space Agency funding for the development of atomic clock technology.’

Professor Charlie Ironside, School of Engineering, University of Glasgow

More about KTPs

• KTPs help businesses to improve competitiveness, productivity and performance through collaboration with universities, colleges and research organisations.
• It is one of the most successful programmes of its kind with over 800 projects in the UK.
• Business benefits include: an increase of over £240,000 in annual profits and the creation of two new jobs.
• Find out more: www.ktponline.org.uk
A partnership between the University and micro-chip laser manufacturer, CSTG, has led to new fabrication processes and enabled the company to tap into new markets.

Researchers from the University and Compound Semiconductor Technology Global (CSTG), worked together on a radically new mid-infra red laser called a Quantum Cascade Laser (QCL), an emerging technology, in its infancy in terms of commercial applications. This technology has the potential to enable the displacement of traditional sensing technology with high resolution optical techniques.

Continued expansion of CSTG’s business relied critically on their ability to offer ‘high-value add’ device technology and chip fabrication processes. CSTG was aware of the commercial potential of Quantum Cascade Lasers as an emerging technology, but they had very limited knowledge of their design and optical characterisation. Nor were there any commercially available modelling packages or turn-key equipment to address this gap in their capability.

Knowledge Transfer Partnership
Together with Professor Charlie Ironside of the University’s School of Engineering, the company applied for Knowledge Transfer Partnership (KTP) funding. Thomas Slight, the associate employed on the project, was instrumental in initiating the partnership and set about embedding aspects of QCL technology into the company’s fabrication and device portfolio. This knowledge enabled CSTG to address new markets in life sciences, defence and industrial applications.

The KTP project has produced world-leading advances in semiconductor laser engineering, contributing to driving turnover growth of 40% in the business and yielding top-tier research publications and expert recognition for the University and CSTG. In 2012 the project was awarded best KTP project in Scotland and was shortlisted by the Technology Strategy Board for the best KTP project in the UK.

Global leaders
Dr Wyn Meredith, Commercial Director, CSTG describes how the project has benefited the business. ‘KTP has opened up a new spectrum for us as a business, taking us into radically new applications and markets. We have increased our order pipeline – especially in the defence and industrial markets – and rapidly established a thought leadership position in the area of mid-infrared laser technology.

‘By extending the collaboration already in place with the University of Glasgow, we wanted to embed several aspects of the technology into our fabrication and device portfolio to allow us to address multiple new markets in life sciences, defence and industrial applications.

‘The partnership has established CSTG’s reputation for QCL manufacture and has addressed a market need for semiconductor foundry processes for the realisation of compact, mid-IR laser chip sources. We have developed various fabrication processes and several novel laser chip designs.’

Professor Charlie Ironside said: ‘The collaboration with CSTG has helped to establish our group’s reputation for QCL chip, design fabrication and characterisation.

‘The net result is a benefit to the reputation of UK Plc as a driver of high technology innovation and the potential for export revenue driven by high-value add manufacturing.’

Find out more at:
www.glasgow.ac.uk/engineering
www.compoundsemi.co.uk
Gold Standard Simulations Ltd (GSS) was formed to commercialise the advanced simulation tools developed in the School of Engineering’s Device Modelling Group. The technology the company is developing could predict how silicon chip performance will be affected in future generations of miniature transistors. Intel founder Gordon Moore correctly predicted in the mid-1960s that increasing miniaturisation would make it possible to double the number of transistors on a microchip every two years, leading to a phenomenal increase in computing power. A typical silicon chip contains one billion transistors – electrical switches at the heart of microchip complementary metal oxide semiconductor (CMOS) circuits - that have led to an explosion in the capability of devices such as iPods, mobile phones, computers and games. However, as the demands of the global semiconductor industry have pushed the continual scaling of transistors to truly nano-scale dimensions, their performance started to vary due to atomic imperfections in their structure – a phenomenon known as ‘statistical variability’.

This has led to decreasing yield, increasing manufacturing cost and increasing rates of chip failure for the $300 billion a year semiconductor industry. It currently takes companies 18 months, on average, to bring a new product to market and delays caused by chip failures close to product release can lead to businesses losing millions of dollars and significant market share.

Predicting performance
Gold Standard Simulations Ltd (GSS) is leading the world in predicting the impact of ‘statistical variability’ on microchip performance. It now produces and sells software and services for 3D ‘atomistic’ Technology Computer Aided Design (TCAD) simulation of devices, advanced variability compact modelling and statistical circuit simulation.

GSS uses these tools to predict variations in the performance of next generation transistors up to two years before they come to market, allowing the semiconductor manufacturers who produce them to optimise their designs in order to improve performance and yield.

Professor Asenov, Head of the Device Modelling Group and Chief Executive Officer of GSS, believes that these techniques could save the semiconductor industry up to $2 billion a year, rising to $4 billion in the next five years, and Gold Standard Simulations is aiming to be the first to market with these tools.

GSS supplies simulation software and services to some of the largest semiconductor companies in the world. Find out more at www.goldstandardsimulations.com
‘This project brings together industry and academics to give Scotland an edge in developing tools for the design of the next generation of electronic circuits and systems.’

Professor Asen Asenov, University of Glasgow

Knowledge exchange to give Scotland’s semiconductor industry the edge

The advances made by the Device Modelling Group and other researchers to model transistor performance will have a direct benefit for the Scottish electronics design industry. A knowledge exchange project supported by the Scottish Funding Council has enabled the sharing of research and tools with industry partners. These partners can use this insight to optimise the design and performance of their products.

Derek Boyd, Chief Executive of the National Microelectronics Institute said: ‘Accurate simulation, modelling and verification are more critical than ever. Increasing costs of production, and the need to hit market windows with new product information, means there is no margin for error. Getting things wrong can wipe out profits.’

The project ‘Statistical Design & Verification of Analogue Systems’ (StatDes) is a partnership between the Universities of Glasgow and Edinburgh and 14 industry collaborators. It transfers knowledge gained in the NanoCMOS project - an initiative funded by the Engineering & Physical Sciences Research Council which tackled variability in digital systems.

Professor Asen Asenov, James Watt Chair in Electrical Engineering said: ‘This brings together industry and academics to tackle the issue and to give Scotland an edge in developing tools for the design of next generation of electronic circuits and systems.’

Engineers from two of the collaborators (Wolfson Microelectronics and IBM) are working with the StatDes academic team to develop tools for analysing analogue systems. These tools will use advanced simulation technology provided by Gold Standard Simulations Ltd (GSS).

The first phase of the project has transferred the knowledge gained by the academics to two companies - Wolfson Microelectronics and Gold Standard Simulations. Later phases will see information being disseminated to other electronics manufacturers including Freescale, Elonics, Inside, Ateeda and Dukosi.

At the end of the project, the partners hope that an industry-focused research centre can be established to sustain the partnership in the future.
Where do missing people go?

University of Glasgow researchers are investigating the journeys of missing people. It is hoped that this work will help support organisations to improve their services.

An estimated 250,000 people go missing in the UK each year and little is known about where they go and what happens to them. Researchers are working closely with the UK Missing Persons Bureau, the Scottish Institute for Policing Research, the Metropolitan Police and Police Scotland to develop training and help staff involved in missing person cases.

The £435K Economic & Social Research Council (ESRC) funded project, led by Dr Hester Parr and undertaken in collaboration with the University of Dundee, recruited returned missing people via the police partner database in order to gain qualitative information about where people go when they go missing.

Traditionally, police had quantitative information about distance travelled by missing persons but no qualitative information. The project is the first in-depth study into the reasons people go missing, by interviewing those who return to understand more about why, how and where people journey to when they are reported missing.

Increasing understanding

The results of the research carried out at the University is contributing to multiple police evidence based forums, international meetings and workshops alongside face-to-face training courses for specialist search officers connected to the Police National Search Centre.

The project has also recruited families of missing people and interviewed them about the search strategies used by them and the police. This information is being fed back to the Missing People charity for use in their guidance and support services.

The University is working with the support of the UK’s Missing Persons Bureau to develop training materials that contribute to developing the skills of both general and specialist officers involved in missing persons investigations. Using funding from the University of Glasgow Knowledge Exchange Fund, the team will adapt their face-to-face training material for use in the College of Policing e-learning programme.
‘These are stories that we have to hear. We must learn from them. All our current and new staff and volunteers will hear these recordings and read the transcripts, and they will bring their training to life.’

Lucy Holmes, Research Manager of the UK Missing Persons Bureau

‘Our hope is that research such as this will help broaden public and professional understanding of people reported as missing and lessen the stigma attached to the experience, and that our recommendations can be taken on board across the country.’

Lucy Holmes, Research Manager of the UK Missing Persons Bureau is in full support of the research. ‘These are stories that we have to hear, and we have to share. We must learn from them. We must allow these stories to affect us, to ground us, to help us empathise with adults who go missing as we seek to find and support them. And we owe this team our thanks for bringing us these stories. All our current and new staff and volunteers will hear these recordings and read the transcripts, and they will bring their training to life. We will pore over the full report and its recommendations and we’ll think about how it can help us to improve our services to vulnerable adults.’

Key Facts
• 51% of missing people are male, 49% are female.
• An estimated 140,000 young people under the age of 18 go missing each year.*
• 99% of all missing cases are solved within one year.

* The Home Office, 2010:5
Radiocarbon (14C) is produced at a relatively constant rate in the atmosphere and is taken up by all living organisms. When an organism dies the 14C decays over time - radiocarbon dating uses this decay to estimate the age of carbon-containing materials.

Built on many years researching techniques to improve the reliability of radiocarbon (14C) measurements, the SUERC Laboratory is one of the leading 14C labs in the world. Scientists at SUERC analyse and report on more than 3,000 samples per year - three times the number of samples dealt with by any other UK lab.

Led by Professor Gordon Cook, 14C research at SUERC has had significant impact on a number of sectors. The capabilities of 14C analysis were introduced to police and customs authorities, forensic science companies, commercial archaeology companies, local authorities, national and regional museums, English Heritage and Historic Scotland. These organisations have all adopted new practices involving 14C analysis to improve their decision making processes.

Criminal investigations
The laboratory works with UK police forces and forensic science companies to accurately date human remains. Prof Cook has been commissioned to carry out 14C analysis and provide expert reports to both the police authorities and forensic science companies on more than 30 cases involving human skeletal and dental remains. This work has resulted in the closure of a number of high profile legal cases.

Renewable energy
SUERC developed a novel bio-carbon analysis technique for Shell Research’s Amsterdam facility where scientists are working to introduce modern biomaterial into a conventional crude oil refining process. The drivers for this research have been the government’s obligations for reporting and reducing carbon emissions. Shell needed help in understanding the chemical processes that went on during the bio-refining process, and in measuring the bio-carbon content of the resulting bio-fuels. The company continues to collaborate with SUERC and regards the work as vital to its long-term plans to develop more economical, environmentally-friendly fuels.

‘We work closely with the team on developing strategies for more complex cases, which has introduced new evidence into police inquiries’

Linda Ainscough
Forensic Anthropologist & Archaeologist
Cellmark Forensic Services

Understanding our cultural heritage
In 2011 Historic Scotland needed a chronology for the formation of the Ring of Brodgar. Analysis determined that the standing stones pre-dated Stonehenge. The importance of this and other findings have been recognised by the Scottish Parliament.
New techniques for old mysteries

With the addition of Bayesian statistical capabilities to the SUERC laboratory in 2011, commercial archaeology companies throughout the UK and abroad have benefitted from an improved approach. The Bayesian techniques mean the lab provides a complete analytical approach from advice on the best number and type of samples for a particular study, actual ¹⁴C analyses and a highly detailed Bayesian report. Historic Scotland, Field Archaeology Services, West Coast Archaeological Services, Clwyd-Powys Archaeological Trust and Gwynedd Archaeological Trust have all benefitted from improved results.

Most recently, Professor Cook, Dr Hamilton and Oxford University were asked by the University of Leicester to analyse bones excavated from a car park which were believed to be those of Richard III. Standard radiocarbon analysis alone did not provide the correct timeframe to confirm his identity, however, taking data on his diet and the marine reservoir effect into account, and bringing Bayesian techniques to bear meant that it was possible to pinpoint the time of death to prove that the remains were potentially Richard III (later absolutely confirmed by DNA analysis).

SUERC has extensive analytical capabilities and regularly supplies analyses on a commercial basis to public and private sector organisations, visit their website to find out more about their services at www.glasgow.ac.uk/suerc