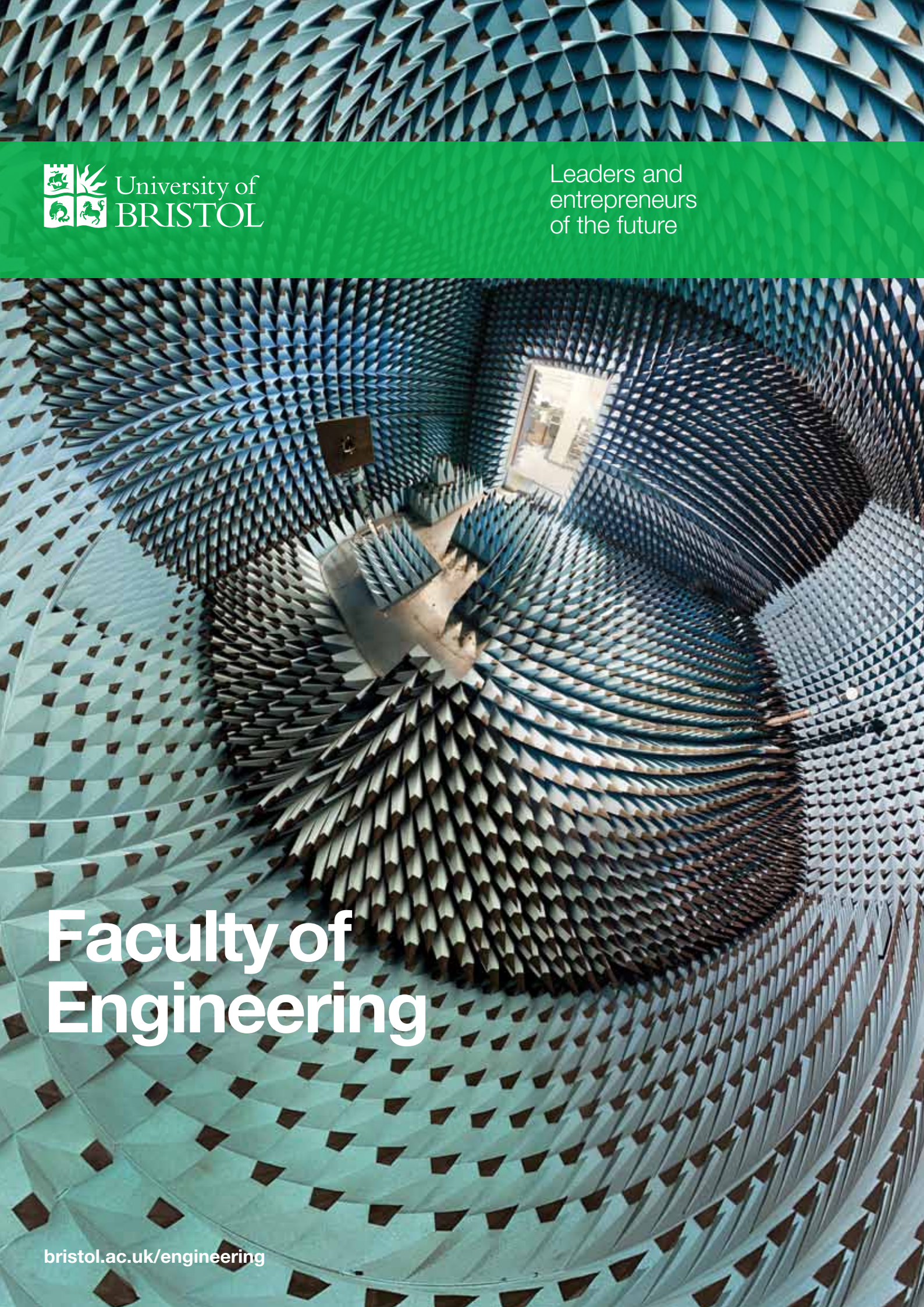
University of BRISTOL

Leaders and entrepreneurs of the future



Faculty of Engineering

bristol.ac.uk/engineering

Introducing the faculty

Engineering at the University of Bristol is committed to producing leaders and entrepreneurs of the future and to advancing the knowledge and technological innovations required to address global challenges.

Our academics are internationally recognised research leaders who have led the way in some of the most ground-breaking developments – from establishing the equation for the wing design on the Spitfire in the 1930s, to inventing the technology that led to the first mobile phone in the late 1970s. Today, our exceptional research continues and we maintain our international standing as leaders in engineering research and education.

Bristol is proud of its interdisciplinary culture where our academics have established lasting global partnerships with other leading universities and industry. We apply our research through successful technology and knowledge transfer, and our work is always engaged with industry, allowing us to add value to the national and global economy.

The engineering disciplines at Bristol empower our students to think creatively and challenge existing practice. This nurtures a culture of enterprise, providing the world with graduates who are best equipped to succeed in a career of their choice. I am privileged to have the opportunity to work with some of the world's most talented students and staff and be the Dean of such a successful faculty.

Professor Nishan Canagarajah
Dean of the Faculty of Engineering

History

Gordon H. Rawcliffe, appointed Professor of Electrical Engineering in 1944, developed the principle of pole amplitude modulation, enabling induction motors to run at different speeds

I have always believed that Pugsley's contribution to winning the 1939-45 war was as significant as any non-military person.

Emeritus Professor Roy Severn

Academic schools

Merchant Venturers' School of Engineering

Queen's School of Engineering

Graduate School of Engineering

Departments
- Aerospace Engineering
- Civil Engineering
- Computer Science
- Electrical and Electronic Engineering
- Engineering Mathematics
- Mechanical Engineering

How it all began

Education for engineering began in Bristol in the early 18th century under the sponsorship of the Society of Merchant Venturers in its Technical College. In 1876 University College Bristol was founded, with a Department of Civil and Mechanical Engineering, which was eventually to become the University of Bristol in 1909.

Between 1924 and 1950, the Dean Andrew Robertson, Professor of Mechanical Engineering, recruited seven professors whose reputations were to give the faculty an international significance. These were, in the order in which they arrived: Alfred J. Sutton-Pippard, John F. Baker, John L.M. Morrison, William M. Shepherd, Gordon H. Rawcliffe, Alfred G. Pugsley and A. Roderick Collar.

Five of them became Fellows of the Royal Society, four were founder members of the Fellowship of Engineering and five became presidents of their professional institutions. Professor Robertson himself was a Fellow of the Royal Society and President of the Institution of Mechanical Engineers.

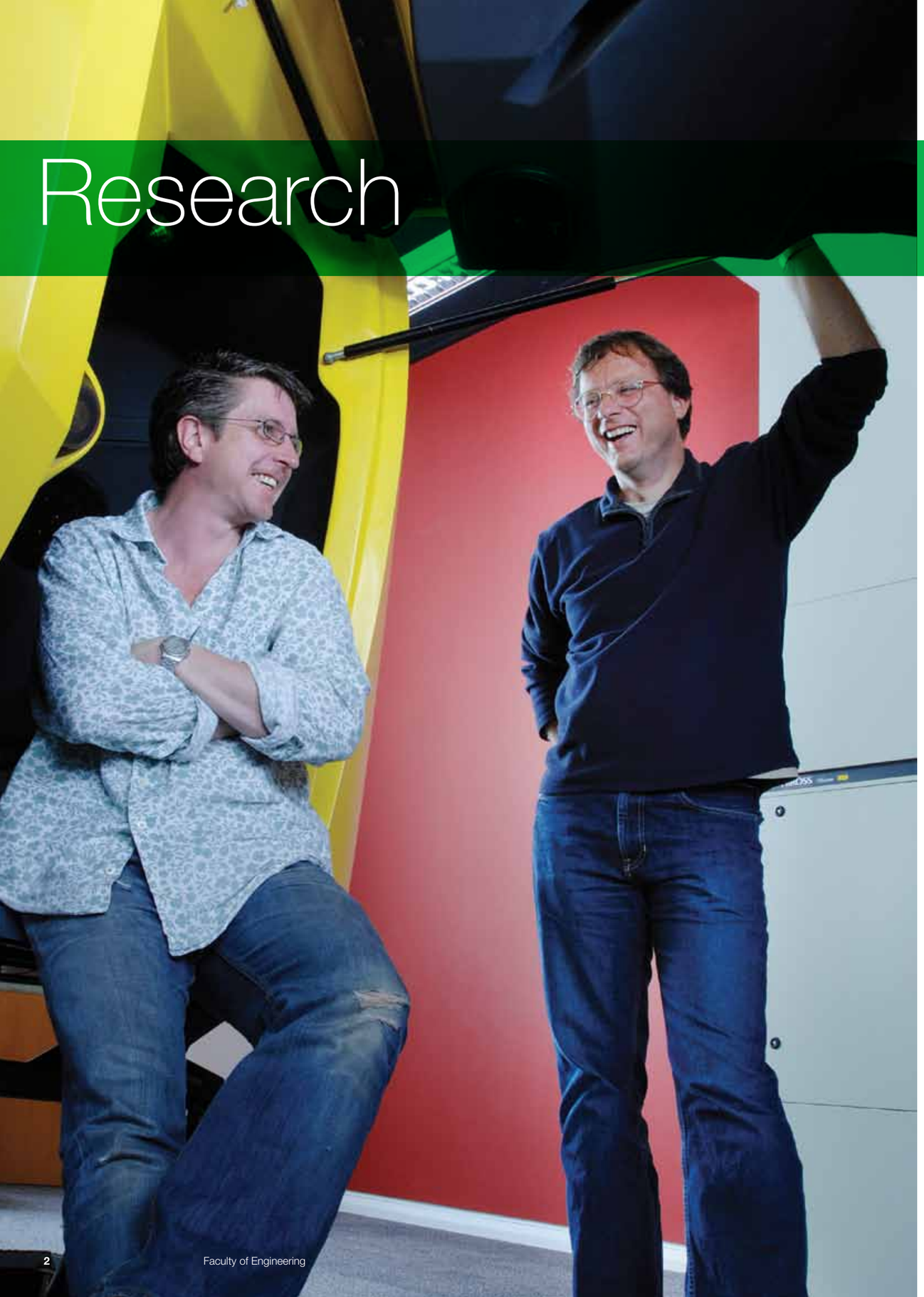
In 1946 the Department of Aeronautical Engineering was created through a large endowment from the Bristol Aeroplane Company. During the next 40 years the increasing government oversight of teaching practices and formal assessments of research output enabled the faculty to show during the ensuing years that both its teaching and research were at the highest level.

Case Study

Wings on Spitfire

Sir Alfred Pugsley was one of the leading structural engineering scientists of his generation. He brought new concepts of scientific understanding to important areas of structural engineering. His early work was of great importance to aeronautics when he was given the special responsibility of deciding the aero elastic properties required for new military aircraft. In the late 1930s he persuaded the designer of the Spitfire, R.J.Mitchell, to increase the stiffness of the aircraft's wings. Mitchell's final design was so sound that over 22,000 Spitfires and derivatives were built.

Research



40%

40% of employers value the analytical and problem solving skills of students who study engineering, science or IT. (Confederation of British Industry, CBI)

We thought it could clean up the problem of the discolouration of drinking water by getting rid of the sediment in the pipes. You can never mess up because the 'pig' just melts; it's as environmentally friendly as you can imagine.

Joe Quarini Professor of Process Engineering

Making a difference to society

Through collaboration and interdisciplinary work, our leading academics are addressing many of society's grand challenges in transport and the built environment, energy and advanced healthcare to name a few.

Since 2006, the faculty has attracted almost £30 million in funding to its four Doctoral Training Centres: Composites; Complexity Sciences; Communications and the Industrial Doctorate Centre in Systems. The faculty also hosts major research centres, including the Bristol Laboratory for Advanced Dynamics Engineering (BLADE), a £15 million investment that was opened by the Queen in 2005, and the Advanced Composites Centre for Innovation and Science, which has a £5.8 million new facility. Bristol is leading the National Composites Centre (NCC), a £16 million government-funded investment. The faculty is also home to 14 world-leading research groups which set the agenda across a range of subjects.

The following are examples of how engineering research at Bristol is cutting-edge and will shape our future.

Left: Professor Nigel Smart and Professor Dave Cliff

Sonotweezers

Ultrasonic manipulation of particles is an emerging and rapidly developing area. Various groups have demonstrated the basic principle and, like the work on optical tweezers in the 1980s and 90s, the race is on to develop devices to best exploit this phenomenon.

Professor Bruce Drinkwater is leading a team, from the engineering faculty's Department of Mechanical Engineering, in a £4.2 million EPSRC programme grant to develop new technology which ultrasonically manipulates microscopic particles such as cells. These new devices, called electronic sonotweezers, will be designed to complement the optical tweezers that already demonstrate the value of micro-particle manipulation.

Optical tweezers have become well-established in the past decade and, by using the momentum of laser photons to nudge molecules or single cells gently into place, researchers can use these extraordinary tools to perform previously unheard-of tasks, such as grabbing the ends of a DNA strand and stretching it to measure its stiffness

The electronic sonotweezers will allow very fine control of manipulation, involving no moving parts, scaling down to the micro-level, with the ability to produce forces over length scales from microns to millimetres. This capability opens up a range of interesting biological applications. For example in tissue engineering, researchers can potentially bring together small populations of cells for multi-layered structures that better replicate such things as the lining of the lung. So whilst optical tweezers offer the potential of doing this cell by cell, sonotweezers allow the user to operate on groups of cells and hence produce artificial tissue on a much larger scale. By bringing the two devices together, there is the opportunity to work across a very wide range of length scales.

The electronically controlled sonotweezers also have the potential to be used in forensic science, homeland security and applications such as cell-sorting and counting of micro, and potentially nano-composite materials.

Ice-pigging

The innovative *Ice-pigging* technique was developed to help clean food processing equipment effectively and could lead to a major change in the way that drinking-water pipes are maintained. Using a mass of crushed ice that is pumped into the piping, the ice 'pig' (pipeline inspection gauge) sweeps away debris and sediment.

Unlike the traditional pigs used for water lines, which can become inflexible when navigating some of the complicated internal workings of pipes, the ice pig forms a soft plug from its slushy consistency which pushes through the pipe scouring it effectively, adapting its shape to fill the most complex of pipes. This improves pipe flow and produces cleaner water, making it better for the consumer.

Research

Our research and teaching is often done in collaboration with industry; companies provide visiting lecturers and invest in teaching equipment

The Advanced Composites Centre for Innovation and Science (ACCIS) is at the heart of composites research regionally, nationally and internationally

The collaboration aims to build on our knowledge of advanced composites, set-up a staff and student exchange programme and break new ground in the development and application of advanced composites.

Michael Wisnom Director of ACCIS and Professor of Aerospace Structures

Bristol Water has trialled the process within its network around the city and all indications suggest the process is becoming the pipe cleaning technique of choice for the water industry.

Ice-pigging in the water supply industry won one of the *The Engineer* technology and innovation awards for the process and production sector.

Medical cancer imaging

A woman has a one-in-eight chance of developing breast cancer during her lifetime and it is a leading cause of death among women. Existing imaging methods can be expensive and may be uncomfortable. Despite having a high success rate of detecting abnormalities in older women they are not always reliable in younger women. It is for these reasons that national screening programmes only target women from around age 50 and in younger women the emphasis is on self-examination.

A team led by Professor Ian Craddock in the faculty's Communications Research Group has been developing radar technology to detect this potentially life-threatening disease. The group is a world leader in this field, being the first to use a radar-based device in a full clinical trial at Frenchay Hospital's Breast Care Centre. There, the research team sought to understand the numerous issues that arise when a prototype meets real clinical application for the first time. The system, called MARIA (Multistatic Array processing for Radiowave Image Acquisition), is a breast imaging technique that captures high-resolution, 3D images through the use of harmless radio waves. The signal is transmitted from each element in turn and is then received by all the other elements, effectively 'sweeping' across the breast, detecting tumours as small as five millimetres across. The smallest tumours detected by X-rays are equally as small but, unlike mammography, MARIA is comfortable and far below the safety limit for exposure to radio waves, making it intrinsically safe. Therefore, unlike X-rays, the test can be repeated as often as necessary in order to identify cancers, potentially saving many more lives. The experience of this trial led the team to produce a new prototype in early 2010. The previous prototype took 90 seconds to complete 465 swept frequency measurements of the breast and was itself regarded as a remarkable feat of engineering. The new design completes 1700 such measurements in an astonishing ten seconds. The implications of this cutting-edge imaging device are far-reaching. In particular, the compact size and low cost will make it ideal for use in numerous alternative locations such as GP surgeries, diagnostic centres and mobile screening units, as well as in developing countries where the cost of screening with X-rays is a major barrier to its widespread use.

Top: Antenna Array, **middle:** Clive Rendell and Tony Griffiths technicians in BLADE, **bottom:** mobile phones

Morphing composites

Our Composites Research Group has a truly leading international profile, particularly since the University was chosen to drive the National Composites Centre (NCC) in 2010. Critical mass in research has brought the best people in the world to work with us. Morphing structures is an especially significant area within this research and is attracting interest from many industry sectors, particularly aerospace and wind energy.

In the Advanced Composite Centre for Innovation and Science (ACCIS) morphing research is conducted at the 'blue sky' level and understanding of the fundamental science right through to application-focused projects. An example of significant focus is the application of morphing structures on wind turbine blades which are already a well-established technology, but further design and manufacturing improvements are essential in helping the industry meet its expected growth targets over the coming years. The Global Wind Energy Council (GWEC) has predicted that wind energy could provide as much as 13 per cent of global electricity demand in 2020 and as much as 25 per cent in 2030.

Modern wind turbine blades are generally made from a combination of glass and carbon fibre reinforced plastics. During manufacture, the plastic resin is heated and cooled in a controlled manner so that it bonds with the fibres and sets to form a rigid structure. The combination of very strong fibres surrounded by a lightweight plastic matrix enables a greater strength-to-weight ratio than is possible with conventional metallic materials. By carefully controlling the direction and tension of the fibres, it is also possible to create a bi-stable composite, which can snap between two distinct rigid shapes.

We are currently focused on producing morphing blades, which can rapidly change their aerodynamic profile to best suit the current wind conditions. This has the potential to relieve unwanted stresses in the blades, increasing their efficiency and helping to prolong their life. In addition to wind turbine and helicopter rotor blades, morphing composites are also being developed for aircraft wings.
Paul Weaver, Professor in Lightweight Structures

This research will lead to an increased efficiency and cost reduction for wind energy. For the aviation industry, it will lead to substantial cost and weight savings offering extended service lifetimes, less use of fuel and reducing CO_2 emissions. These advances are all positive for the environment, ensuring renewable energy becomes more commercially viable and making air travel greener.

Case Study

The Japanese Aerospace Exploration Agency

The Japanese Aerospace Exploration Agency (JAXA) is committed to engage in future research collaborations and cooperation in the field of Advanced Composites with our research centre, ACCIS, at the University of Bristol. This was marked by both parties signing a memorandum of understanding in July 2009, and was followed by a workshop at the University on Advanced Composites for Aerospace Applications, attended by JAXA and University academics in August 2009.

Partnerships

Between 2006 and 2011 the Faculty of Engineering has attracted over £80 million in industrial and governmental research awards

In 2010 we were jointly top in the Royal Academy of Engineering Leadership Advanced Awards, with six of our students winning these prestigious prizes

Our engineering research is world class, as is shown by the high scores in the 2008 RAE (Research Assessment Exercise)

The University of Bristol is the focal point of Rolls-Royce research into composite materials.

Rolls-Royce plc

Partnerships with industry

Bristol's ground-breaking research in engineering has led to strong partnerships and strategic alliances with local and global industry. Our taught programmes and research activity are shaped by the emerging needs of business. The faculty's industrial advisory board is responding to these needs and ensures that Bristol keeps at the forefront in providing industry relevant courses to future engineers.

Bristol is the first university to introduce an MSc in High-Performance Computing. Fundamental to many organisations undertaking research involving large amounts of data processing or complex calculations, this programme delivers the skills that employers need in this increasingly important area.

Cutting-edge scientific research is increasingly reliant on high-performance computing approaches alongside traditional theoretical and experimental approaches. The computational tools at our disposal are improving at an exponential rate, radically changing the possibilities of science. Technologies developed for 3D games, mobile phones and reprogrammable processors are being used to design future supercomputers capable of performance that will make today's computers look like yesterday's desktop calculators.

Simon McIntosh-Smith, senior lecturer in high-performance computing

Top: motion pod, **bottom:** high performance computer cluster

The faculty has developed many mutually beneficial links within industry, from research collaborations to studentship funding and industrial placements, our connections with industry are vital in allowing us to support outstanding research and excellent teaching at both undergraduate and postgraduate level.

Our exceptional composites research led to the launch of the Advanced Composites Centre for Innovation and Science (ACCIS), with a University Technology Centre (UTC), opened by Rolls-Royce, leading the way for other composites research activities. The centre also has strategic links with Airbus, which sponsors research work in ACCIS, and supports many of the faculty's PhD studentships.

Another key partnership includes a Research Alliance, through our Nuclear Systems Performance Centre (Nuclear-SPC), with British Energy. The centre includes a High Temperature Centre (HTC) that is supported by staff in the Department of Mechanical Engineering. The Nuclear-SPC provides systems-based solutions to help maintain safety, optimise operational performance of nuclear power plants and supports future nuclear generation initiatives.

The faculty enjoys a productive link with Toshiba; its Telecommunication Research Laboratory (TRL) was established as part of Toshiba's global research and development network in 1998. Professors, emeritus and current, from our Department of Electrical and Electronic Engineering head up this important research laboratory; with Toshiba collaborating on our research projects and supporting a number of our PhD students.

Our students also benefit from our links with Texas Instruments (TI), through our flagship MSc laboratory thanks to TI's £500,000 donation of state-of-the-art equipment including the latest Digital Signal Processing (DSP) hardware and software. This large corporation, which dominates the DSP market, provides us with a large portfolio of support ranging from donations to support teaching and research, student prizes and student placements.

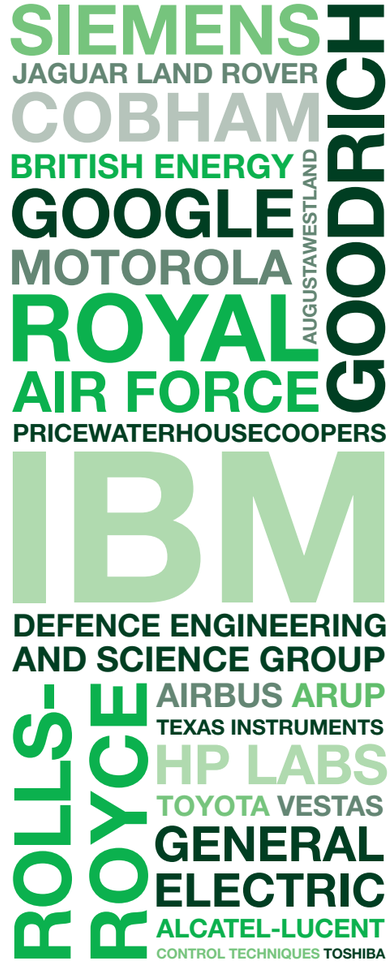
By working so closely with industry, our academics can deliver innovative teaching and first-class industrial training, giving students the collaborative problem-solving and leadership skills that today's competitive industry requires.

With 68 Engineering Doctorate (EngD) research projects, sponsored by 39 companies in the UK, from which 11 companies sponsor more than one EngD- project, the Industrial Doctorate Centre (IDC) in Systems has become one of the largest and the most successful doctoral training centres in the UK, funded by EPSRC. Our industrial partners represent various sectors in the UK: civil construction and design, defence and aerospace, energy and transport. Interdisciplinary research themes that span industry sectors include product and technology development, sustainability, decision support, process development and organisational change.

Oksana Kasyutich, Systems Centre Manager

Rolls-Royce derives considerable value from working with universities. The company's highly successful University Technology Centre (UTC) model, including the Composites UTC at the University of Bristol, offers the company efficient access to high-quality research and delivers significant technology advances. Composite materials and their resulting structures are becoming increasingly important to Rolls-Royce as we continue seeking to reduce the environmental impact of our products and improve their competitiveness in a global market.

Rolls-Royce plc



Teaching

The quality of teaching in Mechanical Engineering has been graded as 'excellent' by the Higher Education Funding Council (HEFCE)

I am using a great deal of the knowledge I gained from my structures modules in my current position. I am also using the valuable skills I have gained from working in various design projects at university. Bristol is highly regarded within the company.

Engineering graduate (MEng, Aeronautical Engineering, 2010) Aerospace Stress Engineer, Cabot Design Ltd

Learning from leading experts

The faculty offers outstanding teaching and a wide range of programmes delivered by our research-active staff. Along with the high standards of teaching, students also benefit from our state-of-the-art research centres.

Our commitment to providing research-informed education offers students an excellent opportunity to develop distinct advanced skills that will allow them to follow their chosen career.

The undergraduate programmes provide a technically excellent professional education. Teaching undergraduates is a central activity for the faculty, and the importance that it attaches to it is reflected in the National Student Survey where nearly all our departments regularly have an overall satisfaction rate of over ninety per cent. Most of the undergraduate education is clearly rooted in a particular discipline, enabling a student's education to be coherent and deep. For students wishing for more broadly-based studies, then a wide range of teaching is available that bridge several disciplines including a multi-disciplinary Engineering Design degree. This degree has been developed with the close involvement of industrial partners and a year in industry is integrated into the degree. Other multi-disciplinary opportunities exist for the study of computer science with either electronics or mathematics. In addition, every undergraduate programme offers a year of study at a university abroad.

We host a vibrant and diverse postgraduate community of over 700 students, from around the world, studying on programmes that evolve continuously to stay at the cutting edge of research and industrial advances. Since 2006 we have secured over £20 million of UK government funding to set up four new Doctoral Training Centres, and set up a new Graduate School to support the continuing rapid development in postgraduate education. We attract many applicants for our highly-regarded advanced taught courses in Communications and Signal Processing, Computing, Integrated Aerospace Systems Design, Mechanical Engineering, Microelectronic Systems, Robotics, Systems and Water and Environmental Management, and the conversion course in Computer Science. Many of our doctoral and masters projects run in close collaboration with industry, providing outstanding opportunities for our postgraduates to develop a wide range of high-level skills in addition to their specialised technical knowledge.

Doctoral Training Centres

The faculty plays a part in four doctoral training centres which is more than any other engineering faculty in the UK:

- Composite materials
- Complexity Sciences
- Systems
- Communications

The primary objective of our centres is to recruit and retain high calibre research engineers, providing them with an innovative and academically rigorous training experience of high industrial relevance. The UK Engineering Physical Sciences Research Council (EPSRC) has invested in these centres with the support of major companies and trade organisations. They provide doctoral-level training in areas identified by the Government as crucial for Britain's future competitiveness by addressing the skills shortage in the sector, equipping students with skills and knowledge to lead and forge lasting links with industry.

Employability

Engineering graduates are highly employable, with well-developed skills in numeracy, team working, report writing and creativity. These skills are easily transferable with eighty-six per cent of students gaining employment or continuing onto further postgraduate study. Of those who start work, fifty-five per cent typically embark on an engineering career. Others enter a huge range of occupations where their broad skills base is appreciated, applying their knowledge within the Civil Service, the armed forces, education, investment services, the media and a host of other fields.

Right: Dr Tony Horseman and student

Staff

Bristol receives the highest number of applications for engineering per place than any other UK University

The crochet design of the 'Lorenz Manifold', by Professor Hinke Osinga and Professor Bernd Krauskopf, gives us insight into how chaos arises

Alumni

The faculty is home to approximately 1400 undergraduates, 900 postgraduates and 350 members of staff

Innovators in engineering

Bristol's excellence in engineering research and teaching is a result of our outstanding staff, 13 of whom are Fellows of the Royal Academy of Engineering which brings together the country's most eminent engineers. Our academics are leading authorities in their field and have pioneered research that has paved the way for technology that we take for granted today.

Mobile phone

Professor Joe McGeehan is Director of the Centre for Communications Research which he established in Bristol in 1987. In 2004 silicon.com placed Professor McGeehan sixth in a list of global technology trendsetters for his ground-breaking work in mobile communications. He has a CBE for his services to the communications industry and is also managing director of the Toshiba Telecommunications Research Laboratory in Bristol. Professor McGeehan developed the technology and processes for wireless communication systems and that enabled the invention of the mobile phone.

Quantum computer

Jeremy O'Brien is Professorial Research Fellow in Physics and Electrical Engineering. Quantum computers have been the goal of worldwide efforts by scientists for several years as they hold the great promise of tremendous computational power for particular tasks. Professor O'Brien's research has demonstrated the quantum operation of new components that will enable compact circuits for future photonic quantum computers.

It is widely believed that a quantum computer will not become a reality for at least another 25 years. However, we believe, using our new technique, a quantum computer could, in less than ten years, be performing calculations that are outside the capabilities of conventional computers. **Professor Jeremy O'Brien**

Transputer

Professor David May was chief architect of the transputer architecture at Inmos Ltd between 1979 and the mid-1980s. The Transputer was a pioneering single-chip processor designed to support parallel processing. It was highly influential in provoking new ideas in computer architecture, several of which have re-emerged in modern designs. The transputer and Inmos left a legacy on the computing world and also established Bristol as a hub for microelectronic design and innovation.

Top: Professor Joe McGeehan, Electrical and Electronic Engineering, **bottom:** Dr Wendel Sebastian, Civil Engineering

Treatment for multiple sclerosis (MS)

Dr Laurence Ketteringham, a researcher from the Department of Mechanical Engineering, won the MS Society's MS Researcher of the Year award for his ground-breaking research into treatment for MS symptoms. Dr Ketteringham has been using his skills to reduce tremors for people with MS. Tremors are often a debilitating symptom and can affect up to seventy-five per cent of people with MS at some time in their lives.

Creative and challenging education

Bristol provides a creative and varied research-led education, from research projects devised by students and carried out in our extensive and unique engineering laboratories, to research and industry-led small-group seminar courses. The learning experience is simultaneously challenging and supportive.

We encourage innovation and enterprise in students' learning and professional development. They are encouraged to challenge existing practice, giving them the skills and confidence to become potential leaders in their chosen fields. Between 2006 and 2010, our students won more Royal Academy of Engineering Leadership Advanced awards than any other university in the UK. As a result, Bristol engineers are extremely employable and go on to excellent careers.

Enterprising and leading alumni

- **Steven Allpress** (PhD Electrical and Electronic Engineering 1994, Beng Electronic Engineering 1990) Founder of ICERA
- **The Rt Hon Lord Chilver** FRS FREng (BSc Mechanical Engineering 1947, PhD Civil Engineering 1951, DSc Civil Engineering 1962, Honorary DSc in Engineering 1983), Professor of Civil Engineering, Vice-Chancellor of Cranfield University (1970-1989), former Chairman of English China Clays and RJB Mining
- **Steve Coultate** (BSc Mechanical Engineering 1980), Vice President and General Manager of Brunswick European Boat Group
- **Professor Paul Dirac** (1902-1984), (BSc Engineering 1921), Scientist and Nobel Prize winner: described as 'one of the greatest scientists in the 20th century', he specialised in quantum mechanics. His famous wave equation introduced special relativity into Schrodinger's equation
- **Ali Dixon** (Meng Computer Science 2004), Founder of XMOS
- **Anton La Guardia** (BSc Aeronautical Engineering 1983), Defence and Security Correspondent for *The Economist*, and formerly Diplomatic Editor at *The Telegraph*, Anton is the author of *Holy Land, Unholy War: Israelis and Palestinians*
- **Colin Green** (BSc Mechanical Engineering 1971, Honorary DEng 1997), Former President – Defence Aerospace, Rolls Royce Plc. Colin is also a past President of the Society of British Aerospace Companies and a director of the UK Council for Electronic Business
- **Jenny Griffiths** (Meng Computer Science 2009), Founder of Snap Fashion, winner of The University Enterprise Competition and the Southwest Business Competition
- **Roger Holmes** (BSc Mechanical Engineering 1981), Managing Director of Change Capital Partners, Formerly Chief Executive of Marks and Spencer
- **Ben Morris** (Beng Mechanical Engineering 1993), VFX Supervisor, Framestore CFC. Ben won an Oscar and an Academy Award for his company's effects work on the Philip Pullman adaptation of The Golden Compass
- **Ed Strongman** (BSc Electrical Engineering 1971), Chief military test pilot for Airbus

Alumni case studies

Jenny Griffiths (Meng 2009), Founder of Snap Fashion

As a pioneering undergraduate from the Department of Computer Science, Jenny is set to make finding exclusive and elusive fashion items easier, thanks to her innovative new website, Snap-Fashion. Jenny won the University's annual New Enterprise Competition 2009 and the South West Enterprise Award when Snap was a prototype as part of her final year thesis.

Jenny is one of a long line of Bristol's Engineering students to take the content of their final year project and form a new company from it. Consumers can visit the website www.snap-fashion.co.uk and upload an image of an item of clothing or an accessory that they wish to find. They will define the region of the image that they are interested in and the website will apply a number of image processing techniques to the picture in order to find approximate matches for the item of clothing. The website will act as a pictorial search engine for the latest fashions on the Internet.

Alumni

Bristol has a venerable engineering heritage. Some of the most remarkable work of Isambard Kingdom Brunel, is centred in Bristol

When I was studying I was really excited to see my project materialise into such significant reality.

Ali Dixon Co-founder of XMOS

Ben Morris (Beng 1992), Visual Effects Engineer
After graduating in mechanical engineering, Ben immediately got a position in Jim Henson's Creature Shop where he created mechanical puppets for the Oscar award-winning film *Babe*. In 2000 he began working for Framestore, the largest visual effects and computer animation studio in Europe. During this time he developed in-house mechanical motion systems to allow real actors to ride on the back of computer generated characters. Ben has worked on the visual effects and camera systems for many famous films such as *Gladiator*, *Troy*, *The War Horse* and *Gravity*. His work on *The Golden Compass* between 2005 and 2007 earned him an Oscar in 2008 for Best Visual Effects.

I had a fantastic time studying Engineering at Bristol. The subjects I studied on my Mechanical Engineering course formed the perfect foundation for my career designing, animating and rendering what is often make believe. Aside from the academic studies, Bristol is a brilliant city to live in as a student.
Ben Morris, Framestore

Ali Dixon (Meng 2004), Co-founder of XMOS
Ali Dixon was a student doing a degree in computer science at the University and has seen his project form the basis of one of the University's most significant enterprises. What started as an undergraduate project is now a major semiconductor business that may revolutionise the consumer electronics market. Spun out of research from the Department of Computer Science, XMOS assembled a team of entrepreneurs and scientists led by CEO James Foster and Professor David May.

XMOS has created a new category of semiconductors called Software Designed Silicon (SDS). SDS is designed for high performance consumer electronics applications, requiring extreme design flexibility at low manufacturing cost.

The Bristol region contains the largest cluster of microelectronics design companies in Europe, so being based in the University's Department of Computer Science was the right place for me to be.
Ali Dixon, Co-founder of XMOS

Top: student in anechoic chamber, **bottom:** engineering UG student

Engineers without Borders (EWB)
In 2004, Bristol's Faculty of Engineering joined Engineers without Borders UK which is a research initiative that provides a bridge between universities, students, development NGOs and local communities with technical research requirements. Bristol's engineering students have the opportunity to work on projects at home or around the globe, learning about technology's role in tackling poverty and improving lives.

The Engineers without Borders Society at Bristol, which now has over 200 members, has taken part in projects that range from research in the UK to overseas projects, such as tackling water shortages in Cuba. Research projects are usually carried out in the UK, either as a project within a student's degree (for example, a 3rd or 4th year accredited degree project), or as an extra-curricular project run through the university EWB branch.

Top: Robert Cottrell and Hayley Sharp, members of the EWB-UK Bristol team that took part in the Havana project, which saw students from EWB-UK working to improve Havana's water supply, **bottom:** an inlet valve in Havana

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