Engineering
at the University of Bristol

Aerospace Engineering
Civil Engineering
Computer Science
Electrical and Electronic Engineering
Engineering Mathematics
Mechanical Engineering
We are committed to producing the innovators and leaders of the future and to advancing the knowledge and technology needed to address global challenges. Our academics are internationally recognised researchers who have led the way in some of engineering’s most ground breaking developments – from establishing the equation for the Spitfire’s wings in the 1930s, to inventing the technology that led to the first mobile phone in the 1970s. Today, our cutting-edge research covers the breadth of Engineering, from composite materials that can revolutionise what our world is made of, to exploring the potential of quantum computing.

We are proud of our interdisciplinary culture and our established global partnerships. We apply our research through technology and knowledge transfer, thanks to our strong relationships with industry which enable us to add value to the national and global economy.

At Bristol we empower our students to think creatively and challenge existing practice. This nurtures a culture of enterprise, turning out graduates who are equipped to succeed and lead in whatever careers they choose. I am privileged to have the opportunity to work with some of the world’s most talented students and staff.

Professor Andrew Nix
Dean of the Faculty of Engineering
The Future of Engineering

Our faculty is applying world-leading research to tackle the world’s grand challenges, from big data to green energy, digital health to composite materials. We believe that by partnering with industry as well as local and global innovators we can solve these challenges. We develop future leaders through challenging educational programmes, and we strive to create opportunities for anyone with the talent to study engineering at Bristol.

A collaborative approach
Collaboration is crucial to the way we work, from our partnerships with local and global innovators to our multidisciplinary degree programmes and Doctoral Centres. We work with other leading institutions, funding bodies and industry leaders such as Airbus, BT, FirstGroup and Google.

Workplace expertise
Our close ties with industry (through our Industrial Liaison Office) ensure that our students benefit from courses that are shaped by employers’ needs. Mentoring, seminars and the option of a year in industry mean that our students are well placed to decide where their course will take them in the future.

Investing in our future
Our interdisciplinary environment enables students and staff to move seamlessly from theory to experiment. Our world-class facilities are available to students, researchers and international industry.

We have invested £19 million in a new wing and refurbishment of the Queen’s Building. Our new, flexible spaces promote active learning and create exciting opportunities for research collaboration and co-delivery of teaching.

Growing with the city
The University is building a £300-million campus on a brownfield site near Temple Meads Station. The Temple Quarter Enterprise Campus will focus on the digital technologies of the future and the ethics, business models and infrastructure needed to turn digital opportunities into jobs, wealth and wellbeing for all. The Faculty of Engineering will be instrumental in the development of the campus and the work that goes on there.

We already work with partners across Bristol to ensure that our expertise brings benefits to the whole city. Our work attracts investment and brings jobs to the South West. Projects like ‘Bristol is Open’, trials of 5G technology and advances in digital health all help to bring the benefits of new technologies to everyone.

£19 million invested in new hi-spec labs and equipment.

New and renovated spaces

- Bigger and fully modernised electrical teaching laboratory
- Enlarged high-spec Engineering teaching laboratory
- Engines and propulsion laboratory that combines traditional and green technology
- New non-destructive testing laboratory
- New Faraday cage
- Pop-up computer laboratory and 200 seater design suite
- New café with social learning spaces
- Bookable rooms for group study
- Spaces to experiment and put teaching into practice
Research

Cutting-edge research solving global challenges

Our academics are addressing some of the world’s most pressing problems by collaborating across disciplines and borders. From the ageing population to sustainable building, cryptography to composites, our researchers are inspired by the challenges and opportunities the future offers.

Digital Health: Sensor Platform for Healthcare in a Residential Environment (SPHERE)

The UK’s ageing population is at risk from isolation, strokes and broken bones. Like many other countries, we face an explosion of long-term health conditions that need continuous management.

SPHERE uses a unique platform of sensors, along with data fusion and pattern recognition, to quantify behaviour and to diagnose and manage health conditions. The technology will aid early diagnosis and lifestyle change and will help patients to maintain their independence.

Professor Ian Craddock, Director of SPHERE, said: “The fastest-rising healthcare costs in the UK are associated with long-term health conditions such as diabetes, dementia and depression. Advanced sensing and artificial intelligence can reveal long-term behavioural patterns that help us understand the progression and

A vital part of SPHERE’s research is to test the system in real homes, and we are now asking people across Bristol to take part in this research.
management of illness, especially in ageing populations.”

SPHERE is working with doctors, designers, social care professionals and – importantly – members of the public to develop the SPHERE technology. This collaboration helps make sure that people will accept the sensors in their homes, that the platform will solve real healthcare problems cost-effectively, whilst giving us information to improve clinical practice.

SPHERE uses a two-bedroom house in Bristol as a ‘living lab’. Healthy participants and people with health conditions live in the house to investigate clinical hypotheses and learn how sensor data can be used to monitor quality of life, wellbeing and health conditions.

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Cryptography: Protecting the systems we rely on

Attacks on computer systems have increasingly been in the news, with a recent attack on the NHS causing chaos. Technologies to protect data and the systems the data resides on all use some form of cryptography. Traditionally, cryptography is about securing data while it is being sent, a famous example is the Enigma machine used in World War II. More recently, cryptography has been used to secure stored data, such as hard disk encryption. At Bristol we’re looking at a third area; securing data while it is being used for computation.

We’re approaching this entirely new field in two different ways. Professor Elisabeth Oswald has been given an ERC Consolidator Award to continue her groundbreaking work on side-channel protection. This research tries to stop attackers obtaining information by measuring emanations coming from a device. For example, by measuring the power consumed an attacker can work out what’s going on inside a computer. Sometimes even measuring the noise a computer makes can reveal secret information. Elisabeth’s cutting-edge work mixes deep statistical theory with practical experiments on real hardware to try to mitigate these types of attack.

Professor Nigel Smart is investigating how to let organisations compute on data without ever having access to it. Imagine a UK healthcare provider being able to place its data on a Google server in America, and allowing Google to perform computations on the provider’s behalf, without Google ever seeing any of the data. Nigel is supported by an ERC Advanced Grant (his second), funding from the US DARPA agency and a Fellowship from EPSRC. Nigel’s work in multi-party computation and fully homomorphic encryption has attracted much attention. He is a co-founder of a company in Israel (Dyadic Security) which examines applications of this technology in corporate risk mitigation. He is also working with a US company (Galais) on potential applications, such as processing census data.

Composites: Protecting premature babies from stress

If you’re familiar with composites, you probably associate them with large structures like aircraft wings and turbine blades, not new-born babies. But Professor Fabrizio Scarpa, a member of the Bristol Composites Institute (ACCIS), has been working on a new ‘metamaterial’ which could improve how premature and critically ill babies are transported for medical treatment.

There are 16,000 transfers of premature babies to medical facilities each year in the UK. Babies are often transported over large distances and significant periods of time. The ambulances or aircraft used are miniaturised intensive care units, containing all the equipment needed to keep the baby alive. But vibrations and noise from equipment and vehicles can cause considerable, even life-threatening stress to the most vulnerable human lives.

Professor Scarpa’s new ‘metamaterial’ is inspired by a nuclear reactor design that offers double protection by combining two unusual properties known to dampen vibrations to a much greater degree than other materials. Working with colleagues at Sheffield Hallam University, his team developed “double negative” mechanical metamaterials that combine both negative Poisson’s ratio and negative stiffness properties simultaneously.

The prototypes are exciting, and once the team has tested and adapted the material, it could be used to make safer neonatal transfer vehicles – as well as in larger applications like earthquake protection.
Earthquake proofing: Building our resilience to natural disasters

Building resilient civil infrastructure is vital to reducing vulnerability to natural hazards.

Research at Bristol is informing design which maximizes in-built protection. By strengthening structures’ ability to absorb shocks and recover, we enable effective local and national responses to emergencies. This multidisciplinary challenge involves engineers, scientists, infrastructure stakeholders, emergency responders, industry groups, regulators, and governments.

UK infrastructure is not exposed to significant seismic hazard, but our construction sector is highly involved in major technical projects in earthquake prone areas around the world. Oil and Gas industries have major financial and safety interests in their networks deployed in areas of seismic activity where the risk of a potential failure is enormous. The same applies to the UK Critical National Infrastructure (CNI) which is associated with considerable Seismic Risk (hazard likelihood being moderate but potential failure impact being substantial).

Bristol is a world class center for earthquake engineering teaching and research, with large investments in experimental and computational research. We conduct world class research in a wide range of earthquake and geotechnics applications. Our research addresses the global need for long-term, sustainable, performance of existing and new earthquake-proofing global infrastructure systems. We are leaders in modelling and managing the impact of natural and human hazards, such as earthquakes, human-structure interaction and soil-foundation-structure interaction. Bristol is one of 14 university partners in the UK Collaboratorium for Research in Infrastructure and Cities (UKCRIC) which has secured £138M to develop a world-class, UK-based national infrastructure research community.

From safety testing to tractor beams

Non-destructive testing is essential for the safety of structures we depend on every day, from power stations to jet engines. Our Ultrasonics and Non-Destructive Testing (UNDT) research group is working to improve the quality of information to find and characterise smaller flaws, defects or cracks in structures. This will lead to more accurate safety tests while avoiding unnecessary repairs and disruptive shutdowns.

The group’s work on post-processing-based imaging and characterisation using ultrasonic arrays has changed the architecture of commercial equipment. The group is progressing this cutting-edge technology from fundamental science to industrial application. This leads to cost savings for businesses, job creation and safer structures. The group’s spin-out company (Inductosense) uses embedded wireless sensors for both local and remote monitoring. These sensors reduce inspection costs and allow inaccessible areas of structures to be tested without removing insulation and other coatings.

The UNDT research group is also looking at the wider applications of ultrasonic technology. In 2016 the group developed an acoustic tractor beam capable of supporting small particles in air. Most people associate this technology with science fiction, but the process is so simple that the group posted a video on YouTube showing how it can be done at home for £70! This reduction in cost and complexity means acoustic tractor beams could be used as a tool in science and medicine, for example to examine blood samples or mix chemicals.

The next generation of digital infrastructure

Across the faculty we are investigating how digital innovation can improve everyday life, from trialling 5G to developing artificial intelligence. Bristol is Open is a prime example: researchers are ‘programming’ the city so we can use data sensors to respond in real time to everyday events including congestion, waste management and energy supply.

In 2016 our researchers developed an acoustic tractor beam for only £70!
Across the faculty we are investigating how digital innovation can improve everyday life.
Hands-on Learning from Experts

We are proud of our outstanding teaching and our wide range of programmes delivered by research-active staff. Our commitment to providing a research-informed education helps students to develop advanced skills and follow their chosen career.

Our students benefit from state-of-the-art research centres, modern facilities and a supportive learning environment. Our undergraduate programmes provide a technically excellent professional education. Teaching undergraduates is a central activity for the faculty; this is reflected in the annual National Student Survey where we regularly have an overall satisfaction rate of over 90 per cent.

Most undergraduate study is clearly rooted in one discipline, enabling a student’s education to be coherent and deep. We also offer teaching that bridges several disciplines, including a multidisciplinary Engineering Design degree and an MEng in Mechanical and Electrical Engineering, developed with our industrial partners.

All undergraduate Engineering courses now offer a year in industry as part of the degree and every undergraduate programme offers a year of study at a university abroad. Every first-year will have an industrial mentor and the opportunity to apply for internships.

Vibrant postgraduate community
The Faculty of Engineering is a dynamic environment with around 2,500 undergraduate and 700 postgraduate students. We have around 200 academics and over 350 research and teaching staff. Our staff and students come from every continent, and we actively support this diversity.

Our academics establish lasting global partnerships with other leading universities, government departments and industry. We apply our research through successful technology and knowledge transfer, and our work is always engaged with industry, which adds value to the economy and benefits society, as recognised in REF 2014.

Centres for Doctoral Training
With grants totalling over £30 million, Bristol leads seven Engineering and Physical Sciences Research Council (EPSRC) Centres for Doctoral Training, and partners in two more: Advanced Composites for Innovation and Science Centre (ACCIS), Complexity,

Group projects help Team GB bring home Cycling Gold
In 2016 Mechanical Engineering undergraduates worked with Professor Stuart Burgess to redesign and test the chain drive for Team GB’s Olympic Bikes. The group developed one of the world’s most accurate test rigs for measuring the efficiency of bicycle chain transmissions and their success was reflected in the cyclists’ record medal haul at the Rio Games.
Engineering with Innovation

Computer Science and Electrical and Electronic Engineering are now offering MEng courses with Innovation. These are the first of their kind in the UK and combine in-depth subject specialism with interdisciplinary breadth, creative teamwork on real world challenges and entrepreneurial skills.

“The Innovation courses inspire and encourage students to think new thoughts and to become the innovators of tomorrow with the creativity, resilience, entrepreneurial and interdisciplinary thinking that our 21st-century society and economy cries out for.” Dr Kirsten Cater, Centre for Innovation and Entrepreneurship.

Communications, Composites Manufacture, Robotics, Quantitative Non-destructive Evaluation, Quantum, Systems and Water Informatics.

The 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.

Engineering leads the National Composites Centre (NCC), a £44-million, government-funded capital investment in world-leading design and manufacture of composite materials for industrial application. We also work closely with the School of Physics for the world-leading Nuclear and Quantum hubs.

Employability

Engineering graduates are highly employable, with well-developed skills in numeracy, team working, report writing and creativity. These skills are easily transferable with 86.5 per cent of students gaining employment or continuing onto further postgraduate study. Of those who start work, 68 per cent typically go into an engineering career. Others enter a huge range of occupations where their broad skills base is appreciated.

Award-winning teaching

Dr Francesco Fornetti (Electrical and Electronic Engineering) won the Students’ Award for Outstanding Teaching in Engineering this year. Students describe Francesco as an ‘outstanding lecturer’ who engages all his students with ‘drive, dedication, knowledge and enthusiasm’. He has changed students’ perspectives by altering the lecture style to make a heavily theoretical unit accessible, relevant and thought-provoking. His ‘lab in a bag’ project has helped students to improve their practical skills at home and build their confidence.

Engineering / at the University of Bristol
Partnerships

The Faculty of Engineering has a dedicated Industrial Liaison Office (ILO) which creates opportunities for engagement and collaboration with industry, so our students can reach their full potential and our researchers can change the world.

Supporting Students

Explore:
Our Industry Insight programme features technical talks and workshops by engineers working in a variety of companies and sectors, from multinationals like Airbus, Dyson and Google to smaller organisations such as Nova Systems and university start-ups like Ultrahaptics.

Engage:
All first-year students have an industrial mentor. Students meet with their mentor in small groups during their first and second years, including a visit to the mentor’s company. In 2016/17, 167 mentors from 64 companies mentored over 600 students.

Experience:
The ILO internship scheme lets students get experience in an industrial environment, something that many employers now insist on. Research and teaching internships are also available to help students to explore their interest in further research or study. From 2018/19 MEng students will have the option of a year in industry as part of their degree. Students will get workplace experience, work on larger long-term projects, and gain valuable skills.

Events:
The ILO delivers one off activities in partnership with industry. In 2017 Airbus sponsored Outreach Days and Drone competition and Boeing sponsored a Hackathon. These events help students to develop skills like problem solving, project management and commercial awareness early on in their academic careers.
Space Universities Network (SUN)

Dr Lucy Berthoud is a Senior Teaching Fellow in Aerospace Engineering as well as chair and co-founder of SUN. She said: “The global space market is forecast to be worth at least £400 billion by 2030 and we want UK graduates to be able to compete.

We have members from over 20 UK universities and are supported by the UK Space Agency. It’s all about sharing best practice and preparing our students for working in the space field.”
Inclusivity

The Faculty of Engineering has a commitment to diversity and equality. As well as increasing diversity across the board, we want to have at least 30 per cent female representation by 2030. We believe that people with a wide range of backgrounds are best placed to solve the global challenges of the future, so we need to actively prioritise inclusion.

**Working with schools**
We work closely with schools in the South West to get young people interested in Engineering. We run outreach days, school visits and an annual work experience week to demonstrate the breadth of Engineering and to show the creative, exciting and sometimes lifesaving work that we do here.

**DigiMakers**
DigiMakers is inspiring the next generation of technical innovators, creatives and engineers by introducing them to ‘making’ in the digital world. DigiMakers runs hands-on workshops delivered by our students and industry professionals. From hacking hardware to programming software, the sessions demonstrate more ways to have fun with technology. DigiMakers promotes affordable, creative, open-source technologies like Raspberry Pi, Arduino, Python, and Unity 3D.

**Summer schools**
We run a range of summer schools to give young people an immersive engineering experience on campus. Groups spend a week staying on campus, attending lectures, taking part in hands-on challenges, meeting current students and finding out where an Engineering degree can take them. This unique experience gives students a flavour of our cutting-edge research and shows them how they can unlock their potential in engineering.

**RoboGals Bristol**
Robogals is a student-run organisation and part of a global initiative. Its goals are to promote Science, Technology, Engineering and Maths (STEM) within the local community and to engage more women in STEM. Robogals has been running workshops, STEM clubs and public events since 2011 and runs bi-weekly robotics workshops in Bristol primary schools. Robogals Bristol has a pool of 50 volunteers and has worked with more than 750 students around the South West.
Women in Engineering Day
This globally recognised day is a chance for us to celebrate our talented staff and students while breaking down stereotypes about who makes a top engineer. In 2017 we ran a space-themed day and invited 90 girls from local high schools to hear about how our female academics are helping humanity explore space.

Women in aerospace
We work with Airbus to offer scholarships to women with an interest in aerospace. Prospective students write about why they’re want to be an engineer and their vision for the future of aerospace. Winners receive a cash scholarship and get to give something back by supporting an Airbus-sponsored outreach day for Year 8 girls.

We have committed to at least 30% female representation by 2030
Student-led societies

Engineers without borders
Using Engineering to eliminate global poverty
This award-winning society gives student across the faculty the opportunity to embrace the humanitarian aspects of Engineering whilst developing technical and professional skills. Their programme of events include outreach, talks from experts, and hands on workshops. Last year a team of students travelled to Benin to construct a rainwater harvesting system for a health clinic.

Women in Engineering Society
Supporting and celebrating women
Women are massively underrepresented in Engineering disciplines and this society aims to remedy that. They run outreach activities encouraging girls to consider engineering. They also provide peer support, run social events and host talks from inspirational women engineers.

Bristol University Drone Society
The place for Drone enthusiasts
This vibrant new society is for all Bristol students interested in Drones. The group aims to bring drone racing to Bristol, whilst also embracing fixed wing flying, design challenges, autonomous control and RC truck and car racing. This year they worked with Airbus and AeroSoc to run ‘Drone Dash’ a two-day event where multidisciplinary teams built and flew drones from scratch.

Bristol University Industry Led Design (BUILD)
Hands on skills and practical experience
This community of creative, technology focused students work together to gain practical experience of design. They run lectures, workshops, collaborative design projects and challenging design competitions. They also cultivate links with industry to benefit members.

Bristol SEDS: Space Exploration Society
“Sending ‘stuff’ into the stratosphere and sometimes getting it back”
This multi-disciplinary group gives students with an interest in space the opportunity to send things into space! Part of a wider UK-based group, students compete in competitions, build satellites and launch rockets.

The Space Exploration Society (Bristol SEDS) group gives students the opportunity to send things into space!
Course Specific Societies

The University of Bristol Engineering Society (TUBES)
This society helps students meet their fellow engineers through intramural sports and social events. They also focus on professional development, helping members build their networks and connect with employers.

Computer Science Society (CSS)
CSS runs hackathons, socials, and panel discussions on issues affecting CS students. They also work to get more young people interested in Computer Science by collaborating with Digimakers, Student Robotics and Code Club.

Bristol Electrical & Electronic Engineering Society (BEEES)
Aimed at Electrical and Electronic Engineers, this society provides a support network for students as well as opportunities to hone their practical electronic skills. One of their most high-profile events is Robot Wars, where students design and build ‘ant-weight’ robots and battle them in a public arena.

Engineering Design Society
Eng Des Soc helps Engineering Design students to meet their peers in different year groups. They run a range of events, from industry visits to design competitions and socials. They also have a ‘family’ system where older students help first years to settle in.

Engineering Maths Society
From intramural sports teams to quizzes, EngMaths Soc helps students exercise their bodies and brains. As well as social events, they support their fellow students and help them connect with industry and think about where Eng Maths could take them in their careers.

Mech Soc (Mechanical Engineering)
This society gives each first-year student two older ‘parents’ to help them find their feet at Bristol. They also run social events and course-based activities, such as helping their members gain hands-on experience of kits like the Raspberry Pi.

Aero Soc
Links with industry, peer support and social events are just a few of the benefits offered by the Aerospace Engineering society. Events like ‘Drone Dash’ and an annual international trip give members unique opportunities.

Bristol Electric Racing
Formula Student is Europe’s most established educational motorsport competition, run by the Institution of Mechanical Engineers. The Faculty of Engineering supports students to enter a vehicle under the name Bristol Electric Racing. Multidisciplinary undergraduate teams work on the design of the car in their spare time, and as part of university credited research projects.
Reputation and ranking

Bristol consistently ranks in the world’s top 100 and the UK’s top 10 universities in league tables that draw on information about both research and teaching excellence.

We are one of the most popular UK universities, attracting an average of eight top-quality applicants for every place, and our graduates are among the most sought after by employers across the globe.