Engineering at Sheffield.
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Sheffield has been at the heart of engineering innovation since the industrial revolution and we are continuing to build on this proud heritage to match the ambitions of our 21st Century engineering students.

Sheffield Technical School, established in 1884, offered the first formal engineering education in the city. From our origins in this local College, the Faculty of Engineering has become renowned internationally for outstanding learning and teaching, underpinned by research excellence. Yet we have remained true to the aspirations of our founders; Sheffield is a University for the people and for the city.

As a member of the prestigious Russell Group of Universities, we have big ideas and even bigger ambitions.

We advance understanding, covering all the engineering disciplines and ensuring we have the world’s experts teaching our students in a research-led environment.

We are making a difference, delivering pioneering interdisciplinary research and working in specialist fields of engineering study distinctive to Sheffield.

We influence and shape policy - locally, nationally and globally - finding solutions to the world’s problems.

We power industry, working in partnership with global leaders such as Boeing and Siemens, through to collaborations with local enterprises.

As engineers, our motivation is to make the world a better place. We are committed to producing world-class engineers who will go on to tackle global challenges with confidence.

Our vision is to compete to be the best engineering faculty in the UK and to be amongst the best in the world, I hope through reading about some of our strengths and successes in the pages to follow, you will see that we are well on the way.

Professor M. J. Hounslow
Pro Vice-Chancellor for Engineering
5,000+ students \( \uparrow 64\% \) since 2008

900 staff \( \uparrow 36\% \) since 2008

£150m invested in new facilities

£77m research income \( \uparrow 105\% \) since 2009

7 academic departments

- Materials Science
- Civil & Structural
- Computer Science
- Electronic & Electrical
- Chemical & Biological
- Mechanical
- Automatic Control & Systems

3 interdisciplinary programmes

- MEng Engineering
- Bioengineering
- Aerospace

From 65 countries
Our students will become the next generation of world-class engineers and researchers who will go on to solve the grand challenges of the future.
"We now have the capacity to educate even more of the world-class engineers that the UK needs to address the skills shortage in the sector"

Professor Stephen Beck, Head of Multidisciplinary Engineering Education in The Diamond
The University’s biggest ever investment in learning and teaching, this world-class facility demonstrates our commitment to producing the best engineers. Students are not limited by traditional discipline boundaries, learning both advanced industrial practical skills focused on employability as well as core scientific principles.
The UK is facing a nationally recognised skills shortage in engineering, with the Royal Academy of Engineering reporting that we need a million more engineers by 2020 to meet industry demand. This is a problem that industry, funders, government and other stakeholders beyond academia are keen to address. At Sheffield, we are leading efforts to tackle this through outreach programmes, investment in new facilities to accommodate growth, offering innovative routes into engineering education and providing practical hands-on experience through both curricular and extra-curricular initiatives.

From first year undergraduate to masters level and beyond, students are taught by world-class academics who are active researchers in their fields.
In a week-long project, the Global Engineering Challenge (GEC) addresses this question by bringing together all first-year students from across the faculty to work in multidisciplinary teams and tackle real-world problems from a global perspective.

Previous project examples range from researching alternative fuel sources for a small community in India to the challenge of rhino tracking in Uganda.

Students research and present ideas, understanding how to work effectively in a team, improving communication and problem solving skills and thinking outside their specialism – just as they would in industry.

In their second year, students develop the skills learnt from GEC through our Engineering You’re Hired initiative, focusing on employability skills such as setting goals, project and time management and understanding the needs of industry. Recent graduates from industrial partners such as ARUP and Siemens offer their expertise and support to students throughout the week.

These initiatives create skilled and confident engineers that industry want to employ, helping them stand out from other candidates in the recruitment process. We are equipping our students for a career with impact – shaping and improving the world we live in.
ENGINEERS WITHOUT BORDERS

This extra-curricular student-led society supports the work of students of all disciplines who want to know more about how engineering can enhance human capacity and enrich lives. Members undertake projects working with non-governmental organisations in Sheffield and around the world, sharing their engineering expertise to make a difference.

Whether it’s installing wind power energy generation in Guatemala, building bicycle trailers for a local Sheffield bakery or helping farmers in Malawi irrigate their land, the programme connects Sheffield’s student engineers with those who need their help the most.

The partnership with voluntary group, Butterfly Space, in Malawi, initially involved building a pedal-powered pump to irrigate the land. The simple and portable pump was based on a design created in Sheffield, which has previously proved popular in Guatemala.

Through involvement in the Engineering Without Borders projects, the students learn valuable practical skills and gain an understanding of how important it is to develop engineering solutions whilst being sensitive to real-world constraints and cultural sensitivities.

"What makes Sheffield truly unique is not just the high academic standards or the great teaching staff, it’s the activities you can do outside the classroom."

Abdelkhafe Kawafi, Mechanical Engineering student.
Leaders of the Future

The Sheffield Engineering Leadership Academy (SELA) was the first extracurricular leadership scheme launched by a UK University to cover all the engineering disciplines.

It is an intensive, two-year programme, which runs alongside the students’ degree studies. In addition to working on group projects and completing a summer placement – either in industry or on a research project - the students benefit from mentoring, skills workshops and guest lectures, enabling them to network with a range of highly successful leaders from industry and academia.

Dr Richard France, SELA Manager, explains the thinking behind the programme: “SELA was created to fill the skills gap in engineering by equipping graduates, who often have masses of technical knowledge, with the real-world skills that employers desire, such as leadership, negotiating and project management.

"Industry involvement is central to the programme, we offer them access to some of the UK's brightest and most enterprising engineering students and at the same time, the students benefit from their experience and knowledge, gaining valuable employability skills."

Gaining valuable industry experience

All the engineering departments offer placement opportunities and industrial training initiatives, ranging from 12 weeks to a Year in Industry programme. Developed in partnership with industry, students gain valuable experience working in a professional environment and employers gain a highly-motivated student with excellent technical skills.

"I’ve been lucky to have been able to work on some really interesting projects at British Sugar and have learned a lot in a short space of time – definitely a year well spent"

Alice Campkin, Systems and Control Engineering MEng with a Year in Industry
We are committed to ensuring that we develop research leaders of the future who have enough time, space and freedom within our undergraduate and postgraduate programmes to demonstrate creativity and excel academically.

From research placements for undergraduates to our seven Engineering and Physical Sciences Research Council (EPSRC) Doctoral Training and Industrial Doctoral Centres, we are focused on finding solutions for the major engineering challenges.
A low carbon economy is a must for the future, but without efficient and cost-effective methods of energy storage, we will continue to rely on the planet’s ever-diminishing natural resources, all the while increasing our carbon footprint. Research into energy storage is vital in addressing and counteracting climate change.

The first ESA-CDT cohort at Sheffield are working on a wide range of PhD projects. Examples include looking into the feasibility of low carbon heat supply for homes and the sustainable use of energy resources and integration of sub-systems for city scale networks. The research projects are undertaken with industrial partners across the areas of energy generation, supply and technology development.

All of the research projects the PhD students are carrying out through the CDT have the potential to have huge societal impact, given the essential role of energy storage in moving to a low-carbon economy.
Postgraduate research is a life changing experience: intellectually, professionally and personally. Our postgraduates are supervised by experts and work with researchers who have an international reputation for excellence. Many of the projects also involve industrial interaction and supervision.

Mike Hounslow, Pro Vice-Chancellor for Engineering, said: “Our brilliant PhD students make Engineering at Sheffield what it is – a research powerhouse, a multidisciplinary community, a place where ideas matter. In return, we provide an all-round experience that enhances earning potential and inspires them to think big.”

Sheffield Undergraduate Research Experience (SURE) offers undergraduates the chance to be directly involved in our research. They take part in real life projects in subject areas that interest them. They experience what it’s like to work in partnership with academic staff or collaboratively in a research group.

The experience informs their studies. It’s also excellent preparation for life and work. They develop enhanced skills in research, transferable skills in areas such as project management, awareness of the academic research environment, including career options, and an enhanced CV and employability.
New discoveries enable new inventions and new inventions enable new discoveries. Engineering at Sheffield provides a home for researchers to do both and to push the boundaries for global benefit.
Can we create robot tutors that will teach and inspire young learners?

This is the question being asked in Sheffield Robotics’ latest project – Expressive Agents for Symbiotic Education and Learning (EASEL) – which aims to deliver a unique tutoring system in the form of a humanoid robot.

Despite advances in technology-enhanced teaching systems, current IT applications for teaching and tutoring are very limited. Led by cognitive neuroscientist, Professor Tony Prescott, the team of researchers on EASEL believe that unlike other technology available to the classroom, the humanoid robot embodies social interaction.

The robot tutor is not built with the intention of replacing its human counterparts but as a support to teaching through its clear communication, patience and the task repetition it can perform. This will help promote children’s inquiry learning, developing skills such as critical thinking.

The tutor will be piloted in local Sheffield schools over the coming year and the EASEL project is setting the foundation for robots as viable classroom tutors, which, once they become affordable, can make a valuable contribution to every child’s learning.

EASEL is a collaborative cross-faculty project involving researchers from our Departments of Psychology and Computer Science, and the School of Health and Related Research, as well as researchers in Spain, Hungary, the Netherlands and Italy.
Sheffield Robotics is an ambitious, socially responsible research institute that develops safe and verifiable robotic technologies, investigates robots that interact with humans and works with business and the public sector to power industry, drive economic growth and improve lives.

The institute is dedicated to maximizing the economic and social impact of robotics and autonomous systems across a range of sectors, from healthcare to meet the needs of an increasingly elderly population, through to the use of robotics in hostile and extreme environments and advanced manufacturing.

A partnership between Sheffield’s two universities, Sheffield Robotics is also developing indoor and outdoor testing facilities in order to address some major challenges in national infrastructure, resources and agriculture.
Patients with severe nerve damage can suffer a complete loss of movement and sensation of their limbs, which can be very debilitating. The traditional course of action is to surgically join or graft the nerve endings together but reconstructive surgery often does not result in complete recovery.

Academics in Sheffield, led by Professor John Haycock and Dr Fred Claeyssens (Bioengineering) and Professor Boissonade (Dentistry), have succeeded in using a 3D printed device, called a nerve guidance conduit (NGC), which guides the damaged nerve ends towards each other so that they can repair naturally.

Although NGCs are currently used in surgery, they can only be made using a limited range of materials and designs, making them suitable only for small injuries.

The new technique uses Computer Aided Design (CAD) to design the devices, which are then constructed using laser direct writing, a form of 3D printing. The advantage of this is that it can be adapted for any type of nerve damage or even tailored to an individual patient. Prototype devices are then tested using 3D nerve cell models before animal trials.

During animal trials, the results demonstrated successful repair over an injury gap of 3mm, in a 21-day period. The next step is to investigate the use of biodegradable materials and make devices that can work across much larger injuries, before progressing the technique towards clinical trials.

Many of the genes and proteins found in the human brain are also found in the fruit fly’s brain. A complete model of the fruit fly brain could provide insights that will help develop a better understanding of diseases such as Alzheimer’s or motor neurone disease, as well as help identify potential new drug targets.

A research team led by Professor Daniel Coca (Automatic Control and Systems Engineering) has launched the ambitious project to build a complete model of the adult fruit fly brain for the first time.

The fruit fly brain has just 135,000 neurons, compared to around 86 billion in the human brain. Although projects are underway to provide complete models of the human brain, these won’t be complete for many years to come and will benefit from an understanding of how smaller brains work.

The team will develop an open software platform that will enable researchers from around the world to contribute data, models and tools to construct a comprehensive model – this collaborative way of working will enable the model to be built rapidly and efficiently.

Funded jointly by the Biotechnology and Biological Sciences Research Council UK and the National Science Foundation in US, the £1.2 million project is a partnership between researchers at the University of Sheffield, Columbia University in the City of New York, research laboratories at Stanford, Washington, Oxford and National Tsing Hua Universities, as well as NVIDIA, the company that pioneered Graphics Processing Unit (GPU) computing. The team estimate that a first draft model of the brain could be built and simulated in the coming decade.
Building a rumour detector for Social Media

In our digital age, rumours – both true and false - spread fast, often with far-reaching consequences. An international group of researchers, led by Professor Kalina Bontcheva (Computer Science), is aiming to build a system, called Pheme, that will automatically verify online rumours as they spread around the globe.

Social networks have been used to spread accusations of vote-rigging in Kenyan elections and claim that the animals were set free from London Zoo during the 2011 riots. In both of these cases, an ability to quickly verify information and track its provenance would enable journalists, governments, emergency services and the private sector to respond more effectively.

The EU-funded project aims to classify online rumours to determine the type of rumour and the intent behind it, such as whether it’s being spread unwittingly or with malicious intent.

Pheme will also develop algorithms to categorise information sources and assess their authority, such as news outlets, journalists, experts, potential eye witnesses, or automated “bots”. It will also look for a history and background, to help spot where Twitter accounts have been created purely to spread false information.

The Pheme algorithms will search for sources that corroborate or deny the information, and plot how the conversations evolve on social networks, and use all of this information to assess whether a rumour is likely true or false. The results will be displayed in a visual dashboard for the user, to support near real-time rumour monitoring and decision making.

Kalina said: “Pheme is not about replacing journalists, nor about defining what matters: it is about getting better data ready to be analysed quickly, so journalists spend more time where it’s required.”

Structural dynamics is essentially gaining an understanding of how things move, for example, how buildings move during an earthquake or how much an aeroplane’s wings bend whilst it’s in the air.

In the 20th Century, we used to fix movements such as vibrations in structures by making things bigger and heavier, using strong materials like steel. In the 21st Century, the focus is on achieving optimal efficiency, both in terms of energy usage and operationally.

Professor David Wagg (Mechanical Engineering) is leading an Engineering and Physical Sciences Research Council (EPSRC) funded project to develop a new landscape of non-linearity (where the relationship between variables is not directly proportional), researching flexible, light structures and how much they bend or vibrate.

There are others researching niche issues in this area but the Sheffield-led team of five universities and nine industrial partners, including Airbus and EDF Energy, have been able to map out all of these areas of research into one to look at the bigger picture and have had their recent research published by the Royal Society.

Building on this fundamental research, the team will be able to more accurately predict the real-world behaviour of advanced industrial designs. The ultimate aim is to develop software to enable the most efficient and complete design and manufacture of the next generation of engineering structures – safer and more efficient systems that power the automotive, aerospace, wind power and civil engineering industries.
Our academics are working across discipline boundaries and collaborating with partners to tackle the biggest challenges facing the modern world.
CONTAINING THE TERRORIST THREAT

Engineers in our Department of Civil and Structural Engineering are part of an international team developing a new material that will significantly reduce terrorist threats to airline passengers from bombs smuggled into luggage holds.

Fly-Bag lines the luggage hold with multiple layers of novel fabrics and composites. "The key to the concept is that the lining is flexible and this adds to its resilience when containing the explosive force and any fragments produced," said Professor Andy Tyas, who leads the research at Sheffield.

This flexibility helps to ensure that the Fly-Bag acts as a membrane rather than a rigid-walled container that might shatter on impact. Fly-Bag prototypes were tested at our own blast-testing laboratory, before a series of controlled explosions in the luggage hold of a Boeing 747 and an Airbus 321. The results are extremely promising.

The Fly-Bag team includes Blastech, a spin-out company from the University of Sheffield, as well as partners from Greece, Spain, Italy, Germany, Sweden and the Netherlands.
Our Insigneo Institute for in silico Medicine brings together engineers, scientists and clinicians to develop technology that will revolutionise healthcare. It’s a huge challenge. One that calls for radical new ways of working. Like the MultiSim project.

MultiSim is an Engineering and Physical Sciences Research Council (EPSRC) Frontier Engineering Award, given to Insigneo. Its aim is simple: to develop technology that can simulate musculoskeletal diseases through the development of a virtual body that can predict the best treatment for a given patient. This would enable faster, more accurate diagnosis and personalised treatment.

If MultiSim works, it will change the way healthcare is provided in the world. But to achieve great things, we have to be faster, more flexible and more collaborative. So we invited more than 25 of the best young engineers from across Britain and Europe to take part in a three-day modelathon and breathe life into the project.

“The idea of the three-day event came from the hugely successful computer software hackathons,” says Professor Damien Lacroix, Director of MultiSim. “The future of medicine lies in personalised treatments, but this means we have to be able to solve complex problems in a timely manner and this challenge forced people to do that.”
Under the leadership of Professor Chee Hing Tan (Electronic and Electrical Engineering), the Advanced Detector Centre was established in 2015 to pull together Sheffield’s academic expertise in the field and encourage interdisciplinary working, offering customised solutions for industry.

The Centre focuses on projects involving optical light (such as UV or infrared) and translating fundamental research through to creating prototypes then manufacturing and industrial application - ranging from healthcare to renewable energy, advanced manufacturing, aerospace and defence.

Current industrial partners include the Ministry of Defence and the European Space Agency, with future potential partners including a company involved in nuclear monitoring.
PROJECT IN FOCUS: HIGH PERFORMANCE MANUFACTURING

A Knowledge Transfer Partnership (KTP) with LAND Instruments, now part of the global AMETEK Group, has proved beneficial for both ADC and the company.

LAND Instruments focus on the design and application of infrared temperature measurements for industries such as steel, glass, electronics and power generation. They required special detectors to measure and monitor their manufacturing processes and came to the ADC’s experts to collaborate on the project.

The ADC designed sensors to meet their specification, providing a customised solution that was more effective than any similar product they could have bought commercially. This has the potential to open up new markets for LAND and has led to another funded KTP which will adapt the sensor design for use in further products, as well as mapping out the global supply chain, assessing reliability and productivity to find ways to improve the manufacturing processes.
The UK market for coffee at home is growing and is now worth in excess of £1bn annually, with instant accounting for 77% of the coffee Brits buy to drink at home. The appeal? Convenience.

The speed of dissolution is important to consumers and research by the Sheffield University Granulation Centre (SUGaR) is leading the way on developing new techniques to improve it.

The team of researchers, led by Professor Agba Salman (Chemical & Biological Engineering), worked with Nestlé to improve the solubility of their coffee powders and stock cubes, carrying out tests to monitor how they dissolved and providing recommendations on what they could do to improve.

“Research collaboration with Granulation Group helped Nestlé to optimise the product qualities and production processes.” Professor Stefan Palzer, Global R&D Manager for Beverages at Nestlé.

The team is continuing to work on this project to understand how we can improve the dissolution process further and develop new products.

The groups’ success is down to their innate ability to translate research into applications – primarily in the food and pharmaceuticals industries – and their successful collaborations with global leaders in these industries.

"Granulation Group has a world-class reputation in the field"

Professor Gavin Reynolds, Principle Scientist at AstraZeneca
We value diversity in research, encouraging creativity and innovation in all disciplines, producing world-class research with real impact.
Cost-saving jet design

Significant cost savings have been made to one of Rolls-Royce’s flagship civil aviation jet engines, without compromising on quality and performance. This is the result of groundbreaking design work carried out by researchers in our Rolls-Royce University Technology Centre (UTC) and Department of Automatic Control and Systems Engineering.

Established in 1993, the UTC has a close working relationship with Rolls-Royce, whose Trent jet engines are used to power the Boeing 787 Dreamliner aircraft adopted by the world’s leading airlines.

“Our new design process achieves a tenfold reduction in the number of tuning parameters without detriment to control system performance,” says Professor Visakan Kadirkamanathan, Director of the UTC. “This has produced cost savings due to improved design practice, reduced development effort and streamlined verification requirements.”

In addition, Professor Kadirkamanathan says: “During the course of our research, besides demonstrating the enormous practical advantages of this new design, we were also able to overcome a number of difficult tuning and architectural problems.”

Additive manufacturing for high performance

When Sir Bradley Wiggins smashed the world record for distance cycled in an hour in June 2015, a team of engineers from our Mercury Centre were watching his performance closely.

They knew Sir Bradley’s fingers were gripping a set of titanium handlebars that they had created for the optimum riding position. “By using additive layer manufacturing we could adjust and refine the design right up until the final practice stages of the event,” says James Hunt, Technical Lead on the project.

“The key is to manage the airflow around the bike. Because the handlebars hit the airflow first it’s absolutely critical to perfect that part of the design – 3D printing allows us to make shapes that optimise this aspect and that it would be very hard to achieve using other manufacturing techniques” he added.

Based in the Department of Materials Science and Engineering, the Mercury Centre provides advanced manufacturing solutions, from design and modelling of components, through to manufacture and materials characterisation.
Our Energy 2050 initiative is tackling the world's biggest energy challenges. It brings together international scholars, industry experts and government to promote research and innovation that will make energy more affordable, secure and sustainable.

The initiative gives industrial partners and government departments access to the full range of Sheffield's energy expertise across areas including nuclear, renewables, storage and waste, buildings and transport. "Our aim is to increase our extensive links with industry to deliver commercial solutions to energy issues," says Matthew Billson, Energy 2050 Programme Director.
Cool solutions for a hot climate

We are also setting up our own projects to help find sustainable energy solutions. In the United Arab Emirates, for instance, Dr Ben Hughes (Mechanical Engineering), is providing a climate-friendly cooling system in one of the hottest countries on earth.

“Our innovation is that we use zero energy to produce 15 degrees of cooling,” says Dr Hughes.

The passive cooling system, modelled on technologies that have been used in the region for centuries, has been built in a new primary school in the Gulf state. Dr Hughes added: “We estimate a total of 45 per cent energy consumption saving in a school with close to 700 pupils. It’s a perfect example of ancient and modern technologies coming together.”

SAFE DISPOSAL OF NUCLEAR WASTE

Many of the UK’s nuclear reactors have been or are being taken off the grid in readiness for decommissioning and eventual dismantling.

The UK’s previous generations of nuclear power have left a legacy which requires managing over decades to come and Sheffield academics are leading the field in researching radioactive waste and its safe disposal.

Engineers in Sheffield’s Immobilisation Science Laboratory research group, led by Professor Neil Hyatt (Materials Science & Engineering), are focused on meeting both national and global demands. The team is working in collaboration with engineers from other universities and industrial partners to drive understanding of geological disposal and nuclear fuels in addition to delivering impact in changing nuclear waste policy.

The research group is currently working on an EPSRC-funded project to support research into the decommissioning and clean-up of the waste arising from the 2011 Fukushima nuclear accident in Japan. Since the accident, water has been used to cool the damaged cores and reactor buildings, resulting in the collection of 3760 tons of radioactively contaminated water per day.

Professor Hyatt and colleagues at Imperial College London and Kyushu and Tohoku Universities in Japan will work together, taking innovations in radioactive waste treatment developed in the UK and applying them to the challenge of decommissioning the Fukushima site safely and efficiently over the next few years.
Our engineers are leading a €5.4m Europe-wide research project to improve the efficiency and frequency of rail services on thousands of miles of rail infrastructure.

The three-year NeTIRail-INFRA project, funded under the European Union’s Horizon 2020 programme, involves a collaboration between 13 academic and industry partners across the continent. It will look at how advanced technologies could be applied to these train lines to make them more economically viable and productive.

“We will be conducting research to find technical solutions for track, power supply and the support of new smart services. This will address the growing demand for already busy services and ensure future growth of underutilised lines,” said Project Manager, Dr Jon Paragreen of our Department of Mechanical Engineering.

These technical developments will focus on modular infrastructure – standard designs with multiple applications that will reduce planning cycles and enable a lean design process for new installation and retrofit.

The project will also be carrying out economic and social impact research to develop decision support tools for the better management of the rail network. Dr David Fletcher (Mechanical Engineering), the Principal Investigator for the project commented “Our aim is to increase the attractiveness of rail for all passengers. This focus takes us beyond a purely technical development project and ensures our outputs have a real market and achieve genuine impact.”

Alongside its impact on transport, the skills developed in the project will allow European businesses and researchers to export their knowledge to wider markets, supporting EU competitiveness and growth.
The world is constantly evolving. Our investment in new areas of research reflects our understanding of these changes and the need for asking new questions and finding new solutions.
Biomanufacturing is the use of biological organisms, such as cells, to produce products that have applications in industries ranging from healthcare to food and even energy. Led by Professor David James (Chemical & Biological Engineering), the Advanced Biomanufacturing Centre (ABC) was formed in May 2014, to maximize the potential of Sheffield’s research in these areas.

With an industry advisory board comprising of some of the leading players in biopharmaceutics and biotechnology, the ABC wants to ensure that the progressive research it undertakes has real-world impact.

**CREATING NEW TREATMENTS FOR PATIENTS WORLDWIDE**

Biomanufacturing, using living cells to produce treatments or drugs (as opposed to drugs made from synthetic chemicals in a lab), has been used for many years to treat a variety of medical conditions. Using the biological processes in cells, it is possible to engineer new drugs to target and treat specific diseases— for example, to home in on precise targets in cancer cells. However, it is very costly and with an increasing and ageing population, more people than ever are requiring treatment.

The ABC has formed a five-year partnership with MedImmune, the global biologics research arm of AstraZeneca, to ‘train’ drugs to hit targets more accurately and in larger quantities so they become cheaper and quicker to produce.

MedImmune currently have numerous drugs in clinical trials to treat disorders such as cancer or neurological diseases, with the aim of treating more challenging problems and improving the quality of future treatment. This integrated team of researchers will develop new ways of effectively manufacturing these ‘smart missile’ treatments and the potential to produce life-changing therapies for patients worldwide.
In little more than a decade, the Advanced Manufacturing Research Centre (AMRC) with Boeing has gone from a drawing on a piece of paper to a global centre of excellence and a model for university and industry collaboration around the world.

With over 80 industrial partners, ranging from global giants such as Rolls-Royce and Airbus to local small-medium enterprises, the Centre specialises in carrying out world-leading research into advanced machining, manufacturing and materials. This research is of practical use to industry, helping manufacturers of any size to become more competitive by introducing advanced techniques, technologies and processes.

The AMRC with Boeing is a core part of the High Value Manufacturing Catapult, an alliance of seven leading manufacturing research centres backed by Innovate UK. It plays a core role in the revival of the national manufacturing sector, allowing partnering companies to tap into a national network of manufacturing research excellence.

As a result of ever-changing customer demands, the UK’s advanced manufacturing supply chain needs to tap into expertise to respond to the increasing demand for high levels of flexibility.

Factory 2050, which is home to the AMRC’s Integrated Manufacturing Group (IMG), has been designed for this purpose. The £43m development includes facilities such as advanced robotics, 3D printing, state of the art manufacturing and assembly technologies and new programming and training tools to drive its collaborative research programmes.

Initial projects include a programme to take aerospace manufacturing technology into the construction industry, explore future digital factory technologies for building commercial aeroplanes and investigate digitally assisted assembly technologies which could help to fill a looming skills gap in the aerospace sector.

Part funded by £10m each from the European Regional Development Fund and the Higher Education Funding Council for England, the factory will directly contribute almost £2m to the local economy every year and aims to excite young people about the prospects of a career in 21st Century engineering.
PUSHING THE LIMITS OF DESIGN

Small and medium-sized manufacturers are continually looking to develop new products and move into new markets.

In a project designed to showcase their skills and technological capabilities in this area, a team of engineers from the AMRC’s Design and Prototyping Group developed an unmanned aerial vehicle (UAV), an aircraft piloted by remote control, that pushes the boundaries of design and manufacturing in the aerospace industry.

Making the aircraft involved using 3D printed technology to reduce the time, amount of materials used and the cost of manufacturing components.

Having developed a UAV capable of cruising at around 45 miles an hour, the team’s next challenge will be to double the wingspan and use miniature gas turbine engines to power it.

Through pushing the limits of design, turning theory into reality, the Group is continually developing exciting, tangible products for industry and finding solutions for the big challenges in advanced manufacturing.
Feeling the pressure

Our research has led to new understanding of the processes and risks of potentially harmful contaminants entering the UK’s ageing water pipes through leaks.

“We have constructed and utilised a 140m long purpose built test facility that enables us to accurately simulate dynamic conditions of real world systems. Evidence from, and demonstrations of this, have been vital to the impact of the research” says the Sheffield Water Centre’s Professor Joby Boxall.

Joby and his team collaborate with leading figures in the water industry. With activities ranging from EPSRC sponsored fundamental research to industry-funded applied research, they are actively making water systems better for the future.

“This collaborative approach to working with industry enables our research expertise to be rapidly translated into real-world applications and solutions” Professor Boxall said.

“Our vision is that by 2065, collaborative innovation has generated a water sector that is delivering sustainable tailored water solutions that positively impact on public health, the environment, the economy and society.”

Water supply is the foundation of society but around the world, water resources are under pressure. Innovative approaches are needed to manage the challenges of ageing infrastructure, climate change, increasing population, the sustainable supply of safe, clean water and increasingly demanding customers.

Sheffield’s interdisciplinary water research centre, including researchers from engineering, physical and social sciences, is dedicated to continuing the University’s highly collaborative and innovative approach to solving these major challenges in the water sector.
# Contacts

For further information about Engineering at Sheffield, visit:  
[www.sheffield.ac.uk/engineering](http://www.sheffield.ac.uk/engineering)

## Academic Departments

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<td>Department of Materials Science and Engineering</td>
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<td>Department of Mechanical Engineering</td>
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<td>IPO Interdisciplinary Programmes Office</td>
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## Research Centres and Institutes

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<td>AMRC Group</td>
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<td>AMRC Knowledge Transfer Centre</td>
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<td>Advanced Additive Manufacturing (ADAM)</td>
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<td>Advanced Biomanufacturing Centre (ABC)</td>
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<td>Centre for Biomaterials and Tissue Engineering</td>
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<td>Centre for Cement and Concrete (CCC)</td>
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<td>Research Centre in Surface Engineering (RCSE)</td>
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