

A photograph of a modern building with a mix of materials: wood slats, stone tiles, and large glass panels. The sky is clear blue. The text is overlaid on the image.

UNIVERSITY OF
Southampton

ENGINEER
A NEW
WORLD

SCHOOL OF ENGINEERING

INTRODUCTION

The University of Southampton is a research intensive university with a distinctive, high quality educational offering.

It is a founding member of the Russell Group – an organisation of 24 top UK universities committed to maintaining the highest research and teaching standards. Southampton is ranked in the global top 100 universities in the QS World University Rankings and joint 17th in the UK's Complete University Guide 2021.

Southampton is ranked 8th in the UK for 'research intensity', according to Research Excellence Framework (REF) 2014, which assessed the quality of research in UK higher education institutions. The University is also a three-time winner of the Queen's Anniversary Prize, most recently for its expertise in photonics and fibre optic technology.

The University was awarded Silver in the Teaching Excellence and Student Outcomes Framework (TEF) for its quality teaching and learning. Southampton is also a founding signatory of the Athena Swan Charter and holds a silver-level Athena SWAN award.

The University's mission is to change the world for the better. Central to the success of this strategy and underpinning all of the University's activities are four principles:

Collegiality- one team working, planning and delivering together, toward our shared vision; Quality- always striving to achieve the highest quality in everything we do; Internationalisation - delivering across global markets and building strong partnerships with other leading organisations; and Sustainability- ensuring our actions lead to environmental, social and financial sustainability.

The University's Faculty of Engineering and Physical Sciences includes the Schools of Chemistry, Electronics and Computer Science, Engineering, Physics and Astronomy, and the Zepler Institute for Photonics and Nanoelectronics, together with the research-led Web Science and Southampton Marine and Maritime Institutes.

The Faculty's teaching and research laboratories and testing facilities, including one of the world's leading cleanroom complexes, are spread across the University's Highfield and Boldrewood Innovation Campuses. Southampton's Research Power was found to be the best in the UK for General Engineering in the 2014 Research Excellence Framework (REF).

Overall, it is home to over 4,400 undergraduate students, over 600 postgraduate taught students, 870 postgraduate research students and over 900 education, research and enterprise staff. This represents an annual research income of around £55 million.



Above: 138m towing tank: Hydraulics Laboratory, Boldrewood Campus

Front cover: National Infrastructure Laboratory, Boldrewood Campus

SCHOOL OF ENGINEERING

The School of Engineering represents one of the largest and most diverse engineering groupings in the UK, with expertise that looks deep below the Earth's crust, reaches into space, and encompasses everything in between.

The School comprises four departments and their constituent management groups:

- **Aeronautics, Astronautics and Computational Engineering (AACE):** Astronautics; Aerodynamics & Flight Mechanics; Computational Engineering & Design.
- **Civil, Maritime and Environmental Engineering (CMEE):** Energy and Climate Change; Maritime Engineering; Infrastructure; Transportation; Water and Environmental Engineering.
- **Mechanical Engineering (ME):** Bioengineering; Energy Technology; Engineering Materials; Mechatronics; National Centre for Advanced Tribology.
- **Institute for Sound and Vibration Research (ISVR):** Dynamics; Acoustics; Signal Processing, Audio and Hearing.

In addition to these established engineering areas, the School of Engineering works at the interfaces between engineering and complex biological systems; for example in environmental and ecosystem management, bioengineering, human factors, and performance sport. Our research addresses the key challenges facing society in areas including sustainable energy, green transport, resource efficiency, resilient infrastructure, and cities, mitigating and adapting to climate and environmental change. Research projects and teams are therefore organised more flexibly (as is our teaching), transcending the traditional disciplines of aeronautical, civil, environmental, maritime, and mechanical engineering, around the key themes of:

- Acoustics
- Autonomous Systems
- Bioengineering
- Computational Engineering
- Energy and Climate Change
- Fluid Dynamics
- Infrastructure
- Materials, Solid Mechanics and Surface Engineering
- Transportation
- Water and Environmental Engineering

These themes reflect and are supported by major laboratories and facilities. They have been developed and refined over the last ten years to enable us to respond to key international and UK research priorities. Our engineering facilities include:

The **Boldrewood Innovation Campus (BIC)**. This £170M investment in teaching space, staff/student offices, and laboratories was funded largely from sources external to the University, including Lloyds Register, South East England Development Agency, and UK Research Partner Investment Fund. The campus was officially opened in 2015 by HRH the Princess Royal and is home to the Southampton Marine and Maritime Institute (SMMI) and Lloyd's Register's Global Technology Centre. It is the UK's largest University-business partnership and represents the next stage of a >40 year partnership between the University and Lloyds Register in marine engineering research.

BIC encompasses state-of-the-art facilities for teaching, research and enterprise including a fluids laboratory, autonomous vehicle research laboratories, a driving simulator sponsored by Jaguar Land Rover, a performance sports laboratory, a large design studio, lecture and seminar spaces, and the new **UKCRIC National Infrastructure Laboratory (NIL)**, opened in 2019 by Andrew Haines, CEO of Network Rail.



The NIL represents a £48M investment as part of the UK's Collaboratorium for Research on Infrastructure and Cities (UKCRIC) including funding from the Department for Business, Energy and Industry Strategy (BEIS), the Engineering and Physical Sciences Research Council (EPSRC £26M EP/P013627) and project partners. Infrastructure engineering facilities include a 15m×30m strong floor and a materials testing laboratory equipped with a range of computer-controlled, servo-hydraulic testing machines ranging from 1kN to 2.5MN in capacity capable of reproducing complex dynamic loading signatures; a 100kN high strain rate test machine; and bi- and tri-axial loading machines supported by UKCRIC, UKRRIN and Structures 2025.

Facilities for stress analysis and crack/damage monitoring include ultrasonic scanning, and a suite of CCD and high-speed infrared cameras with associated image-based strain measurement software. Composite fabrication and processing facilities include vacuum assisted resin infusion and an autoclave (1m dia. x 1.5m long).

Our new geotechnical laboratory is equipped with resonant column, cyclic triaxial, hollow cylinder and cyclic simple shear apparatus; a low temperature/high pressure rig for testing gas hydrate bearing sediments; consolidating anaerobic reactors used to investigate waste compression and degradation, on which similar equipment around the world is based; in-house digital image analysis-based strain measurement equipment; and a 3m radius, 140g-tonne geotechnical centrifuge.

Energy and climate change facilities include: one stand-alone and two building-integrated instrumented photovoltaic arrays of 7.2 kW peak (kWp) and 12.5 kWp; laboratory testing of solar home systems (batteries, lighting, fans, TVs, fridges etc.); environmental monitoring systems; thermal cameras; and tidal/wave energy device testing facilities (housed in the Fluid Dynamics Research Laboratory).

The **Fluid Dynamics Research Laboratory** incorporates a 138m towing tank and advanced wind tunnels complementing existing large-scale facilities located on our Highfield campus. The towing tank is equipped with advanced instrumentation including a wave maker and is used to investigate the power requirements of high speed vessels, safe limits in extreme waves, marine renewables, fluid-structure interactions of moorings for offshore structures, and the energy efficiency of hull designs.

The facilities also houses a unique aeroacoustic wind tunnel used in our research on aircraft noise reduction. A recirculating wind tunnel is used for environmental research including atmospheric boundary layers. These facilities complement our established RJ Mitchell wind tunnel, used extensively for research into vehicle and Olympic-level cycling aerodynamics – including Chris Froome prior to his 2016 Tour de France victory, to perfect posture and maximise speed/performance.

Water and environmental engineering facilities comprise bioreactor laboratories used in the development of novel environmental technologies for water, waste and wastewater

treatment and bioenergy production from prototype to commercially viable application; an analytical suite (shared by all groups) housing a range of equipment including gas and ion chromatographs, atomic absorption and near infrared spectrophotometers, carbon and elemental analysers and calorimeters); 24m and 16m tilting flumes; 60m outdoor ecohydraulics flumes; 8m and 12.5m wave basins; a semi-anechoic ecosystem tank; and field equipment including boat-based acoustic Doppler current profilers and 3-D acoustic telemetry for ecohydraulics research.



Our new **Future Towns Innovation Hub** (above) is nearing completion at the University of Southampton Science Park where leading academics will collaborate with businesses and the region's towns to develop low-carbon and more sustainable engineering and technology innovations to create happier, healthier, and more prosperous places to live and work.

Enterprise M3 LEP is funding almost £3m from the government's Local Growth Fund and Research England are adding a further £1.5m to support the £14m project, which will focus on addressing challenges of energy efficient housing, water conservation, sustainable transport, carbon neutral waste management and recycling, and improving health outcomes.

The Hub will deliver a joint industry-academic Centre of Excellence bringing together expertise, skills and knowledge alongside state-of-the-art research laboratories that can be easily accessed by local businesses and enterprise to advance teaching, research and innovation.

Teaching

The School's teaching expertise is combined with a practical approach to offer students the best possible start to their career. All courses offer students the chance to put theory into practice at the School's state-of-the-art facilities, with many of the students' innovative engineering projects showcased at an annual Design Show. The School is home to approximately 2,250 undergraduates, 270 postgraduate taught and 300 postgraduate research students.

Southampton was ranked number one in the UK for Civil Engineering in the 2021 Guardian University Guide and sixth for Mechanical Engineering. The Times Good University Guide 2021 placed the University second for Civil Engineering, Aeronautical and Manufacturing Engineering, Aural and Oral Sciences, Civil Engineering and Mechanical Engineering were all ranked in the UK's top ten for the Complete University Guide 2021 – the third year in a row they have achieved this rating.

Taught programmes are variously accredited by Institute of Mechanical Engineers (IMechE), Institute of Marine Engineering, Science & Technology (IMarEst), Royal Institute

of Naval Architects (RINA), Royal Aeronautical Society (RAeS) and Joint Board of Moderators (JBM – which includes the Institution of Civil Engineers and the Institution of Structural Engineering).

The School of Engineering contributes to a large and vibrant enterprise community, providing consultancy and practical solutions to industry, locally, nationally and globally. Staff work closely with partners and tailor solutions to ensure that we provide the most beneficial service, enabling them to achieve their goals. It might be as simple as a day's consultancy or a longer-term joint research project.

Equality

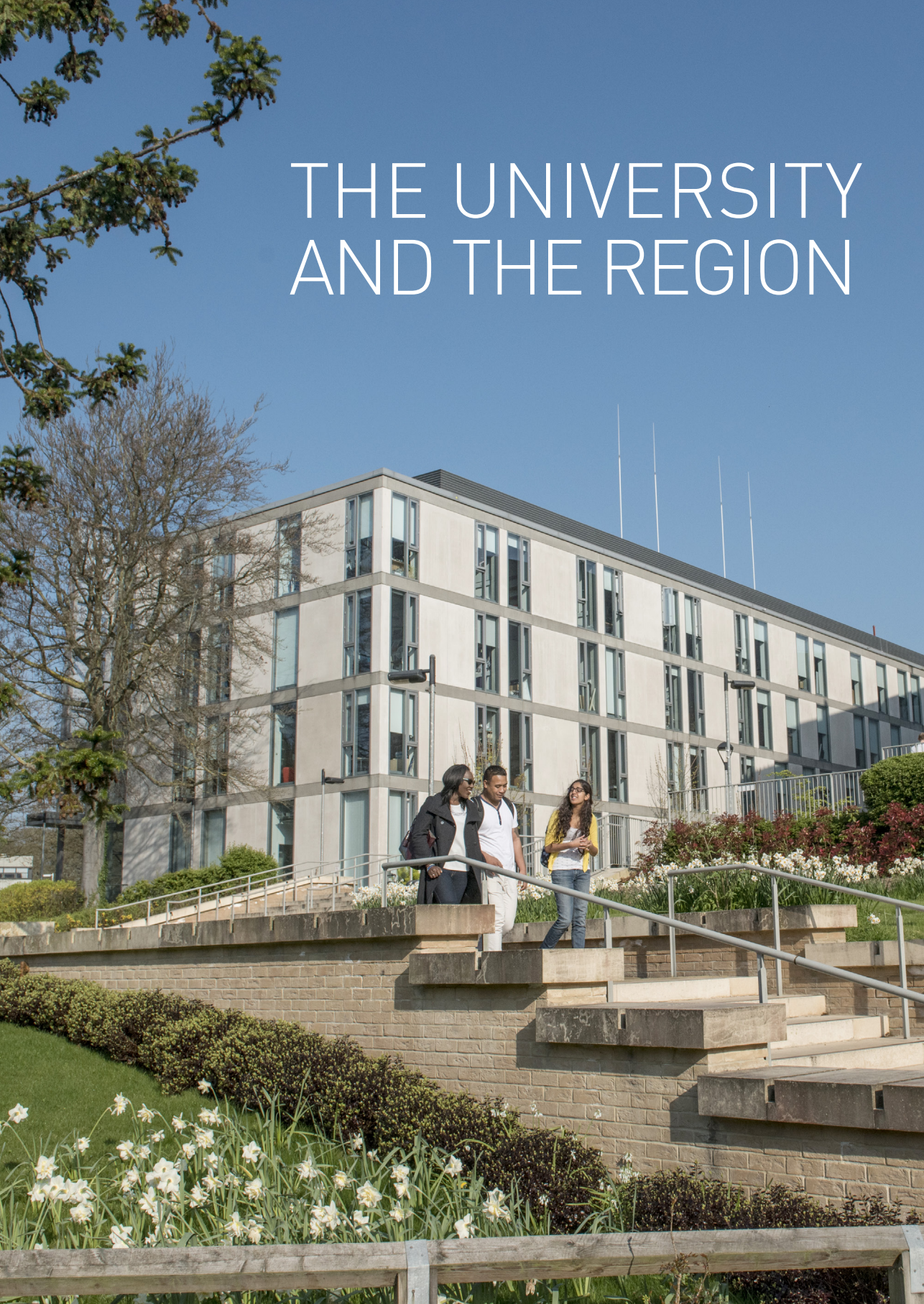
The School of Engineering is fully committed to the Athena SWAN Charter that recognises a commitment to addressing gender inequalities and holds an Athena SWAN Bronze Award.

Our involvement in the Athena SWAN project aims to tackle an uneven representation of women in science and as a result achieve a significant increase in the number of women recruited to top posts.



Above: Engineering students at Boldrewood Campus

THE UNIVERSITY AND THE REGION



Famous as a maritime city, Southampton sits right on the south coast and has some of the best weather in the UK. Rich in history, it's a safe, friendly and walkable place.

The University campuses

The University has seven lively and diverse campuses: Highfield, Avenue, Boldrewood and Waterfront in Southampton; Winchester, Malaysia; and Southampton General Hospital.

Highfield Campus is home to state-of-the-art teaching and research facilities. It is our oldest and largest campus, located close to Southampton Common. It's the academic heart of our University and home to social events, sports facilities and our Students' Union.

The Avenue Campus houses most of the humanities disciplines and the Centre for Language Study. It also has a purpose built £3 million archaeology building with state-of-the-art facilities for teaching and research.

The University's collaboration with Lloyd's Register, Boldrewood Innovation Campus, represents one of the largest business partnerships with any single university in the world. This new campus is the result of this partnership and is home to the Southampton Marine and Maritime Institute.

Situated on the City's waterfront, the National Oceanography Centre Southampton (NOCS) is one of the world's leading research centres for the study of ocean and Earth science.

Close to Winchester city centre, 12 miles north of Southampton, our internationally renowned Winchester School of Art provides studios and workshops, an extensive specialist library and a well-stocked art supplies shop.

Southampton

Southampton is a thriving modern city, steeped in history and culture, while less than an hour away, the New Forest National Park offers vast open heathland and beautiful forest. In 2016, it was rated by The Guardian as one of the top ten happiest cities to work in the UK.

A lively city

The City offers a vibrant mix of recreation, culture and entertainment – from restaurants, cafés, bars and nightclubs to cinemas, sports facilities and internationally acclaimed arts venues. Close to the city centre, the University forms an integral part of this dynamic, multicultural city.

A growing city

The City is benefiting from substantial, ongoing investment. Facilities include: the new £40 million cultural quarter and £90 million of investment in West Quay. The University is worth over £1 billion-a-year to the regional economy and is a key part in ensuring Southampton's thriving future.

A coastal location

Southampton has one of the biggest commercial ports in Europe, and the City is known across the world as the home of the prestigious cruise liners, Queen Elizabeth, Queen Mary 2 and Queen Victoria. With a coastal location, there is a vast range of opportunities for sport and leisure, with a major focus on water sports, sailing and ocean racing.

A gateway to the world

Just over an hour from central London, Southampton has excellent transport links with the rest of the UK and internationally, by road, rail, sea and air. Our award-winning unilink bus service connects all Southampton campuses and halls of residence, the city centre, the airport and railway stations.

Winchester

The historic city of Winchester has a rich cultural heritage, complemented by a lively atmosphere and a wide variety of pubs and restaurants, museums, theatres and galleries.

See for yourself what the University and surrounding area has to offer:



View our virtual tours