

IN BRIEF

SURFING IN BRISTOL



The Wave's 180 metre long surfing lake produces a range of wave heights from 50 centimetres to almost two metres © Global Shots

Opened in November 2019, a £25 million project in Bristol is providing surfers with up to a thousand waves an hour of varying sizes and shapes.

The Wave, an open-air surfing venue located three miles inland from the Severn Estuary, is a 200-metre-long cove-shaped lagoon that supplies whitewater waves for beginners and up to 1.8 metre high waves for elite surfers.

Wavegarden Cove uses a patented electro mechanical design consisting of 40 'paddles' set up along 80 metres of the lake. These slide backwards and forwards on a rack and pinion system coordinated by computer. The pulses of energy introduced at various points along a wave enable consistent power to be fed through to a wave until it dies out.

The advantage of this new modular system is that its working parts are out of the water, so if anything breaks or needs maintaining then this can be done while surfers are still using the facility.

It took Nick Hounsfield, a director of British Surfing and Surfing England, 10 years to find the financial backers and the right design to build the surfing set up.

Surfing will become part of the Olympics for the first time in 2020 and thousands of surfers visited the complex in its first three winter months of operation. The team is now developing a second 'Wave' in Lee Valley with several other potential sites across Europe and beyond.

Further inland surfing information can be read in *Ingenia* 69's article *How to create the perfect wave*.

A YEAR IN THE AIR

In February 2020, a solar-powered aircraft conducted its maiden flight.

The PHASA-35 (persistent high-altitude solar aircraft with 35 metre wingspan) unmanned aerial vehicle (UAV) flies in the stratosphere, above the weather and conventional air traffic, which makes it a cheaper alternative to satellites. It can remain in the air for a year and can be used for different types of surveillance, such as fire detection or maritime supervision.

The high-altitude, long-endurance plane was developed by BAE Systems together with another UK company, Prismatic Ltd. The 150-kilogram UAV has



PHASA-35 undertook flight trials at the Royal Australian Air Force Woomera Test Range in South Australia © BAE Systems

a monocoque structure made of carbon-fibre-composite materials. The ultra-lightweight plane is powered by the Sun

during the day via solar panels on its wing and by long-life lithium batteries at night. It can fly at a speed of between 50 to

78 knots at a height of more than 20,000 metres.

As well as its surveillance capabilities, the PHASA-35 could provide communications networks including 5G to remote areas, conduct polar summer operations and act as a supplement to, or replacement for, satellites. Whereas satellites have fixed orbits requiring long lead times for installation, this UAV is flexible and can be used for localised applications.

Further flights will be made during the year to test the UAV during taking off and climbing, when it is at its most vulnerable and susceptible to adverse weather conditions.

VIDEO GAME STAMPS

In January 2020, Royal Mail issued 12 stamps dedicated to UK-designed video games. Focusing on the early games launched in the 1980s and 1990s, the stamps show screenshots from the classics starting with *Elite* (1984) and ending with the *Tomb Raider* series, first seen in 1996.

Ian Bell and Dr David Braben OBE FREng were the game engineers and designers of *Elite*, the 3D space-trading and combat simulator, developed for BBC Micro and Acorn Electron computers. This groundbreaking game operated on just 22 kilobytes of memory; about the same needed to send an email today.

From these small beginnings came a raft of UK-generated video games – called 'computer



Stills from video games *Wipeout* (Psygnosis) and *Elite* (Acornsoft)

games' at the time – some of which appear in the set. *Dizzy* was an adventure game that could be played with a keyboard or joystick, followed by the games *Populous* and *Lemmings*, which could be operated with a mouse. The racing games *Micro Machines* and *Wipeout*,

the strategy game *Worms* and *Sensible Soccer* appear on their own stamps, with *Tomb Raider's* Lara Croft featuring on a separate sheet of four.

The UK video game market has grown significantly since these innovative games were launched – it is now worth over

£5 billion and growing. The game industry itself employs around 15,000 full-time staff in the UK, with a further 10,000 employed indirectly by the studios. The stamps celebrate the engineering, artistic and storytelling impact these games have had on generations of players.

FIGHT PLASTIC POLLUTION



The British International Education Association has launched its annual international STEM Youth Innovation Competition. Open to 9 to 21-year-olds, the 2020 challenge is to design a solution to 'save our shores from plastic pollution'. The entries need to be submitted by 31 March.

Competitors will need to research, design and write a report on an innovative and creative project that will help clean up plastic from remote mud banks and waterlines through innovative and creative solutions. Applicants can use the

internet and other secondary sources to research their entries.

In April, the teams that have made it through this stage will be given a budget and asked to prepare proof of concept videos.

The winning teams from the 9 to 17 age group will be awarded cash prizes up to £5,000 to contribute to their school STEM labs. The winners from the 18 to 21 age group will take part in a 'University Challenge' and become youth STEM ambassadors.

For more information visit: www.bieacompetition.org.uk

SILENT NO MORE

Engineers have recreated the 'voice' of an ancient Egyptian priest who died 3,000 years ago.

Writing on the Egyptian high priest Nesyamun's coffin said that he wished to speak and sing his liturgies in the afterlife. Now, Professor David Howard FREng from the Department of Engineering at Royal Holloway, has helped to create a sound from the priest's larynx and vocal tract. The researchers 3D-printed a reproduction of Nesyamun's vocal tract and combined it with an artificial larynx sound used in speech synthesis systems.

The concept of re-generating a voice came from Professor Howard's work on creating authentic vocal sounds for those who have lost their normal speech function of their

vocal tract or larynx. He was approached by Professor John Schofield at the Department of Archeology at the University of York to test the possibility of hearing the voices of historical figures.

The mummy of Nesyamun was lying in Leeds Museum and his soft tissue was thought intact enough to warrant further experimentation. His body was passed through a computed tomography (CT) scanner at Leeds General Infirmary and the 3D-printed vocal tract was generated. It is thought that Nesyamun may have died from an allergic reaction from an insect sting to the tongue.

Now, the archeologists and engineers involved want to develop a computer model that will allow the vocal tract



Nesyamun's mummified remains being passed through a CT scanner © Leeds General Infirmary

to be moved around to form different vowel sounds and eventually words. This approach could then be applied to other well-preserved human remains and enable those long-dead to

be heard once more. This has the potential to add an extra aural dimension when visiting museums in the future.

Listen to Nesyamun at <https://tinyurl.com/uuh4o8t>

MOBILE LAB AND LIBRARY

A mobile gadget library for schools won the audience vote at Africa Prize Live 2020. Martin Bruce, the co-founder and business analyst for Lab and Library on Wheels, pitched the innovation with the other entrepreneurs shortlisted for the Africa Prize for Engineering Innovation prize and won the public vote at the first ever Africa Prize Live event.

Lab and Library on Wheels is a mobile, solar-hybrid cart with gadgets and e-learning resources for under-resourced schools. Geospatial engineer Josephine Godwyll came up with the idea while teaching at a rural school during an outreach programme. Her students did not have access to library books or laboratories and had to rely on theoretical lessons only.

Her unit contains laptops, tablets and practical teaching

and learning materials, which are customised to suit the size of the school. Fixed libraries and laboratories cost up to \$25,000 to build and cater for a limited number of students in Ghana. Many schools are unable to afford these and operate without a regular power supply.

Lab and Library on Wheels eliminates the need for fixed libraries and laboratories, as the \$6,500 hand-cart with e-resources and kits can be pushed from one classroom to the next. Schools that are unable to pay upfront can arrange a payment plan. The team installs a solar panel on the roof of each school and energy from the panel is stored in a battery and used to charge all devices.

The winner of the Royal Academy of Engineering's 2020 Africa Prize will be



Martin Bruce with the Lab and Library on Wheels

announced at the final event in Accra in June. Innovations in the shortlist include facial recognition software to prevent financial fraud, a low-cost digital microscope to speed up cervical

cancer diagnosis, bamboo bicycles made from recycled parts, and two innovations made from invasive water hyacinth plants: an animal feed and a cooking fuel.

ENGINEERING PODCASTS



The DesignSpark team: (L-R) Harriet Braine, Professor Lucy Rogers and Bec Hill

A new series of the DesignSpark Podcast, featuring Professor Lucy Rogers, Visiting Professor of Engineering, Creativity and Communication at Brunel University, covers engineering topics including smart homes, space tourism and biometrics.

The former BBC Robot Wars judge is working with comedians, historians and engineers to create programmes about technology topics including augmented humans, big data and driverless cars.

The Engineering Edge series

has Rogers on tour visiting locations such as the Surrey Space Centre to talk about satellites, the National Research Laboratory for Fusion Energy, and the UK Drone Racing Open event that selects pilots to compete for the world championships.

To date, the DesignSpark team has produced 20 programmes over the last two years. Listen to the podcasts on Spotify, Apple Podcasts or www.rs-online.com/designspark/podcasts

GLOBAL SHORTAGE OF ENGINEERING SKILLS SAYS REPORT

A report published on World Engineering Day for Sustainable Development has measured the abilities of 99 countries to conduct key engineering

activities in a safe and innovative way. The *Global Engineering Capability Review* focuses on six measures of engineering

capability around the world: the strength and sophistication of the country's engineering industry, the availability and diversity of its engineering labour force, its knowledge base, built and digital infrastructure, and safety standards.

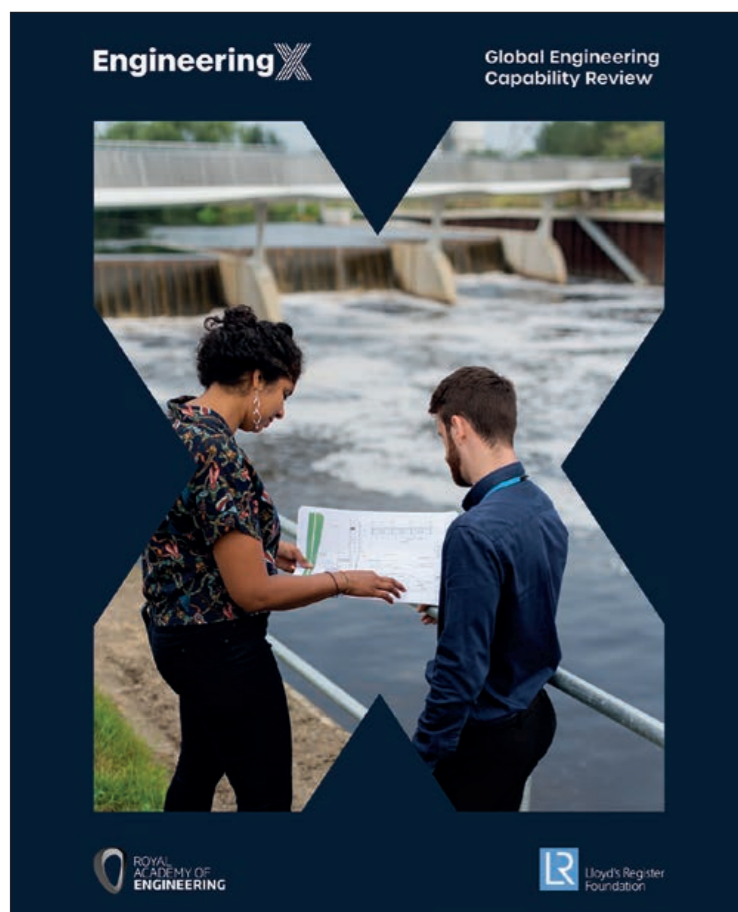
The report found that the lack of available data hampers action on safe and innovative engineering. Countries face challenges around quality of skills as well as quantity and the UK is lagging behind in supply of skilled engineers. The research suggests that, as the pace of technological change accelerates, no nation can afford to ease up on their efforts to conduct engineering in a safe and innovative way.

In the global engineering index of 99 countries, the UK features in the top 10 of just two categories — knowledge and safety standards. By contrast, Singapore is in the top 10 in five out of the six categories and comes first under labour force, digital infrastructure and safety standards. The US leads the knowledge rankings, in stark contrast with its safety ranking.

The review aims to provide a baseline to help policymakers, educators and business executives understand their country's relative engineering strengths and to identify and address capability gaps that are barriers to safe and sustainable development.

The review showcases top-performing countries with case studies, including Iran, which tops the index for the highest percentage of graduates (of both sexes) from tertiary education in the fields of engineering, manufacturing and construction, at 30%, and Rwanda, which is ranked 12th for the percentage of medium and large companies in engineering fields as a percentage of all medium and large companies in the country.

This research was commissioned by the Royal Academy of Engineering and Lloyd's Register Foundation and written by the Economist Intelligence Unit. The interactive version of the report can be found at www.raeng.org.uk/capability-review



GET INVOLVED IN ENGINEERING

THIS IS ENGINEERING FILMS

The Royal Academy of Engineering launched a new season of *This is Engineering* films on World Engineering Day for Sustainable Development. The films show how engineers can 'be the difference'. www.thisisengineering.org.uk



MAKEFEST

30 and 31 May 2020, 11am to 4pm
Science and Industry Museum, Manchester
 Makefest is taking over the Science and Industry Museum for another huge weekend of tinkering, testing, coding and creating. Get hands-on with dozens of DIY activities, brought to you by a whole host of engineers, hackers, coders, makers, artists and scientists.



WES 100 VIOLETS EXHIBITION

21 March 2020
Brunel Museum, London
 How do we predict the weather, recapture carbon from factories and power our homes? For one day only, seven teams of engineers from across the country will answer these questions and many more in family-friendly interactive engineering exhibits for the Women's Engineering Society 100 Violets Challenge. www.wes.org.uk/100violets

PHOTO ELECTRONIC LIGHT ORCHESTRA SHOWCASE PERFORMANCE

20 May 2020
Arts and Innovation Centre, Pontio, Bangor University
 This event will bring together eight participating schools, who have been developing unique musical instruments utilising coding skills and photonics to demonstrate their achievements over the course of the project.



GLASGOW SCIENCE FESTIVAL

4 to 14 June 2020
Glasgow
 The festival will host a range of events across the city, including the Ingenious Circus, a project that explores the engineering that underpins circus performance. www.glasgowsciencefestival.org.uk

FORMULA STUDENT 2020

22 to 26 July 2020
Silverstone
 Each year, Formula Student sees over 100 university teams from around the world travel to Silverstone to compete in motorsport static and dynamic events. www.imeche.org/events/formula-student

These events are not organised by the Royal Academy of Engineering. Please check with the organisers nearer the time.