

Partner News



Flying High

NATS revolutionise
transatlantic flight tracking





The IET Annual Dinner 2020

19 February 2020
JW Marriott Grosvenor House | London



Hosted by
Sue Perkins
*Comedian, presenter,
writer and actor*

Partner News is edited by a steering group of IET members and staff. The group includes:

- Michelle Richmond MBE**
Director, Membership and Professional Development
- Mark Organ**
Head of Membership
- Sally Davidson Jones**
Partnership and Development Manager
- Debbie Swale**
Membership Scheme Coordinator

Partner News has been produced by:

thePageDesign
Second Floor, The Old Pumping Station, Great Northern Terrace, Lincoln, LN5 8HN.
01526353555
info@thepagedesign.co.uk
thepagedesign.co.uk

Content has been coordinated by **Joe Bewin** and edited by **Keri Allan**.



Partner News is a news magazine for partners of the Institution of The Engineering & Technology (IET).

The IET is not as a body responsible for the opinions expressed in Partner News.

The IET is registered as a Charity in England & Wales (No. 211014) and Scotland (No. SC038698).

©2019: The Institution of Engineering & Technology. All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without the permission in writing of the publisher. Multiple copying of articles is not permitted except for personal and internal use. Multiple copying of the content of this publication is always illegal. Wherever possible the IET gains permission to use photographs and quotes from members before the publication of Partner News. There may be circumstances, such as 'IET headlines' and 'Social round up', where a copyright work has been included under fair dealing as defined by the UK Government.

Printed by Villanueva Visual Communications.



Connect with future clients

Meet over 800 engineers, including CEOs, Directors, R&D Managers and senior engineers. You'll have lots of time to network and open conversations about new partnerships.

Support new talent

Meet some of our talented scholarship and bursary recipients and find out more about how vital these schemes are to their future, and how you can get involved. Make valuable connections and keep them in mind – they could be your future workforce!

Reward your staff and clients

The food, drink and hospitality at Grosvenor House is second to none – you won't be disappointed! You can also book your dedicated meeting point and have your reception drinks delivered directly to your group.

Book your company table or individual ticket at
theiet.org/annual-dinner

Discounted rates available for IET Partners.

Please contact your partnership representative to book at the favourable rate.

The Institution of Engineering and Technology (IET) is registered as a Charity in England and Wales (No. 211014) and Scotland (No. SC038698). The Institution of Engineering and Technology, Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire SG1 2AY, United Kingdom.

≡ Welcome to Partner News

This edition

MOD	4-5
HMS Sultan hosts Sea Cadets engineering summer camp	4
Academic	6-10
Virtually breaking the sound barrier	6
Durham researchers take part in Transport Africa project	7
Warwick students are smooth submarine operators	8
Edinburgh Napier is in HySpirits	10
Enterprise	11-24
GES Group helps Ireland's largest enhanced anaerobic digestion facility	11
Who is Quarch?	12
Virtual engineering: nmcn's journey to BIM 8D	12
Holovis breaks the mould at Madame Tussauds	13
CEMA helps turn sludge into electricity	14
ID management in education	14
Solverboard unveils new platform to support innovation	15
Cosworth brings hybrid power to touring car championship	16
Students show their STEM potential	16
Coderus to work on America's Cup campaign	17
Sinewave drives the charge with electric vehicles	17
In the pipeline	18
Silver Fox's commitment to quality	19
IR35 reform rules – are you ready?	19
Engineering at the Intellectual Property Office	20
Lauryn Bailey – an apprentice's story	21
HV/LV Inter-Tripping and Protection Systems – What does it mean?	23
Stansted Airport's Track Transit System	23
Supacat unveils autonomous hybrid off road demonstrator	24
Corporate	26-36
Bringing more power to Merseyrail	26
Introducing the youngest Chartered Engineer in Scotland	28
Lockheed Martin launches GBAD family of systems	29
IET partners collaborate on world-leading simulators	30
Ultra Electronics' grads develop summer school	32
Preparing for 5G – the 700Mhz clearance project	33
How satellite tracking is revolutionising air traffic control	34
Leonardo engineers take on Three Peaks Challenge	36

For any enquiries, please refer to pages 38-39 for contact details.



Sally Davidson Jones, IET Partnership & Development Manager

Welcome to this issue of Partner News. The magazine for our partners by our partners, and in this edition, we have decided to take that ethos to heart and showcase more stories from our partners for you to enjoy. In this issue you will see the excellent initiatives and projects being undertaken by our partners in the MOD, academia and industry.

With the academic season now in full swing we are delighted to share exciting news from Warwick, where a team of MEng final-year undergraduate students have won the 'Smooth Operator' award at the International Submarine Races held in Maryland, USA. Turn to pages 8-9 for the full story.

There's also a lot of exciting news from our Enterprise Partners, as we welcome new companies to our ever-growing partnership community. New partners include Quarch, which supplies some of the biggest names in the data industry with

the tools they need to test their devices, and Solverboard, which is doing innovative work and pioneering business management platforms.

In this edition we also hear from Gareth James Mitchell, the youngest person to achieve a CEng in Scotland. Read about his journey from a student member of the IET to a registered young professional working for SSE on page 28.

We hope that you enjoy this partner-focused edition of Partner News and can draw inspiration from the diverse and dynamic work going on across industry and academia.

If you have any comments or would like to submit an article, please contact partnernews@theiet.org or tweet us [@TheIET](https://twitter.com/TheIET) using the hashtag [#IETPartnerships](https://twitter.com/IETPartnerships).

Sally Davidson-Jones
IET Partnership & Development Manager



HMS Sultan hosts Sea Cadets engineering summer camp

“

The camp offers an exceptional opportunity to showcase Royal Navy engineering.

”

This July Sea Cadets from across the UK engaged in an exciting week of science, technology, engineering and mathematics (STEM) and leadership-based activities at the Royal Navy's Sea Cadet Engineering Summer Camp.

Hosted at HMS Sultan, 19 cadets, aged between 14 and 18, were given hands-on experience of air and marine engineering within the Defence College of Technical Training's Defence School of Marine Engineering and the Royal Naval Air Engineering and Survival Equipment School. This was in support of the UK Government's Engineering: Take A Closer Look campaign to encourage young people into engineering.

An introduction to the sector

As well as promoting engineering, the week also offered the cadets an opportunity to visit QinetiQ, the Royal Navy's research agency, go onboard HMS Diamond and undertake a series of practical leadership tasks. They were also given the opportunity to meet Rear Admiral Paul Marshall CBE, the Senior Responsible Owner for delivery of the T26 and T31e Frigate Programmes and Fleet Solid Support Programme.



The cadets were accommodated throughout the week within the HMS Sultan Royal Naval Cadets' Unit and were charged with ensuring that 'Fort Grange Keep' was kept fit for a rounds inspection throughout.

Passing out parade

On the Friday morning before heading home, the cadets ensured that their boots were sparkling as they attended a special passing out parade. Certificates were presented to each cadet by Captain Matt Bolton, Royal Navy, Assistant Chief of Staff (Engineering Support).

This course was launched last year as part of the Year of Engineering and has since developed to provide students with an Open Award in Maritime Skills upon completion.

"I've always had a passion for engineering and I did the dry run of the course last year. I jumped at the chance to come back as it was just such a phenomenal experience," says 17-year-old Leading Cadet Holly, from Training Ship (TS) Exeter.

"It's given me an insight into both engineering and the Royal Navy as well as the Merchant Navy. This year we also managed to get a qualification, which will help widen my CV and add another dimension to me, as I will have my A-levels, but this will also show that I can do practical things as well."

"I wanted to see what it would be like to work on engines in the Royal Navy and I thought the course would give me a greater insight into what they do," continues 16-year-old Able Cadet Liam, from TS Duke of Lancaster.

"It's given me the chance to look at the different roles that are involved in

maintaining them. I've loved coming on the course and I'm now thinking about becoming a marine engineer once I've finished at college."

A commitment to young people

"The Royal Navy is a leading employer of engineers and technicians, with an ongoing commitment towards enthusing young people to enter into an engineering career," notes Captain Bolton.

"The camp offers an exceptional opportunity to showcase Royal Navy engineering, enabling the cadets to take a closer look at our exciting and rewarding sector and increase their awareness and understanding.

"As an ex-Sea Cadet and Chairman of a local unit, I have been delighted to see such enthusiastic young people achieving their Open Award and hope this might set them on course for an exhilarating future in naval engineering," he concludes.



Virtually breaking the sound barrier

Virtual reality is an immersive experience that owes as much to sound as it does vision, and research from the University of York is now being used to provide the most realistic 3D audio.

The University of York's Audiolab, based in the Department of Electronic Engineering, is used to seeing its research make an impact. Now an established relationship with Google has seen its work in 3D audio adopted within Google apps and services such as YouTube 360, underpinning virtual reality (VR) sound across the Internet.

"Our research focuses on spatial audio – the creation of immersive 3D sound fields that give you the impression of hearing sound all around you, either over headphones or using loudspeakers," says Lead Researcher Dr Gavin Kearney. "This immersive sound can be used in cinema, VR, games or any application in which sound is a factor. We're creating a plausible sound field, where the listener really feels that the virtual acoustic environment is a real one."

Catching Google's eye

Although his team's recent work was specifically aimed at VR headsets, Gavin says that wasn't their initial goal. It was earlier work on improving soundbar technology that caught the attention of the team at Google.

"Typically soundbars use multiple loudspeakers with the aim of creating a pseudo 3D audio experience through some clever signal processing and psychoacoustic techniques," he explains. "My initial research – the EPSRC-funded SADIE project – was intended to improve these soundbar systems, which we mainly achieved through using the soundbars in combination with motion tracking technology."

As a precursor to this work on soundbars, part of the SADIE project considered how 3D audio could optimally be delivered using headphones. This is a process which requires tricking the brain into thinking the signals it receives at the ears are the same as those experienced without headphones, giving the perception of 3D sound; a feature known as binaural sound.

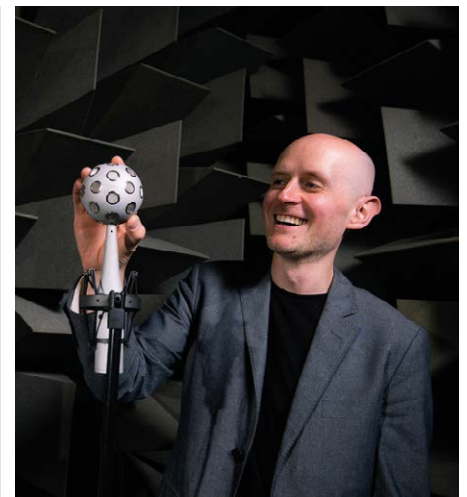
"The difficulty is everyone's ears are as unique as their fingerprints," says Gavin. "So when someone is listening to a binaural recording, instead of hearing the voice as being in front of them, the brain might get confused and interpret the sound as coming from behind."

Binaural sound

The team knew that motion tracking of the head could help with this problem, because it can adapt the signals going to the headphones so that it remains stable in 3D space. And to find out what level of binaural sound quality they could achieve, they combined their knowledge of how sound impacts on the ears from different directions with their ability to adapt sound fields to accommodate for head movements.

To facilitate this work, the team built a database of binaural acoustic measurements by placing subjects in a sound absorbing anechoic chamber, with microphones in their ears and facing a vertical array of loudspeakers.

While this method of measuring sound's interaction with the human ear is not new,



Dr Gavin Kearney from the University of York's Audiolab.

Gavin's team carried out the measurements and created 3D audio decoders that were optimised for the sound processes specific to VR, and their work was soon noticed.

"We published the data and it was Google that got in touch," says Gavin. "They liked the measurements and had used them in comparison against similar measurements they'd undertaken themselves."

"After rigorous tests they'd found that the perceived spatial audio quality was much higher with our work."



We're creating a plausible sound field, where the listener really feels that the virtual acoustic environment is a real one.



Durham researchers take part in Transport Africa project

Durham University's Department of Engineering is working with partners in Africa to find ways to use cheaper and more sustainable local materials to build all-weather, low-traffic roads and railway lines. This has significant impact because poor transport is one of the main barriers to investment and growth in Africa.

Professor David Toll is leading this research, which is part of Transport Africa project, funded by the Global Challenges Research Fund.

Good roads provide a lifeline for people in rural areas for access to trade, mobility and access to education and health services. This helps reduce poverty and improve lives.



Durham's researchers are looking at how locally available soil materials can be used successfully in road and rail construction. However, these local materials are more sensitive to water movement than those traditionally used to build roads or railbeds that lie underneath railway tracks.

This means Durham's research has to identify how these materials react when they get wet or dry out and which are suitable for use in a changing climate.

To do this, sensors have been installed to see how much rainwater penetrates roads and railway embankments in Ghana, Tanzania and South Africa, and how the material might change as a result.

Using data from the sensors, the team will create a computer model to test the impact of future climate changes on materials used to build transport links. This is vital as infrastructure built now will still be in use in 50-100 years' time when the climate might be different.



Academy

Stand out from the engineering crowd

Expert e-learning for engineers

Whatever your career stage, the IET Academy is the only mobile training resource of its kind to give you in-depth, expert e-learning that will equip you with the specialist skills you need to thrive in your business.

Choose from a growing range of courses covering technical and professional skills.

Find your next course at theiet.org/academy



Also available for companies - if you are interested in a training solution for your team or company email us at academy@theiet.org

Academic



Warwick students are smooth submarine operators

Warwick Submarine is a group project for MEng final-year undergraduate students at the University of Warwick's School of Engineering. They're tasked with designing and building a human-powered submarine and racing it on an underwater course, competing with other top science and marine engineering students from across the world.

Breathing from onboard scuba equipment, the pilot lies prone in the submarine and propels the vehicle by pedalling. Derived from a bicycle, the pedal power transfers through a bevel-gearbox powertrain, which is connected to the contra-rotating propellers. To steer the submarine, the pilot pulls levers that operate dive-planes to control pitch and yaw.

For safety, an emergency buoy is released to the surface if the pilot lets go of the spring-loaded dead man's switch. A light attached to the hull helps the support team of US Navy divers locate the submarine in low light conditions.

International Submarine Races

In June 2019, the latest team – made up of students Helen Boyle, Sarah Kemp, Rebecca Seal, Ash Leonard, Giles Collee and Lewis Robbins – took part in the 2019 International Submarine Races (ISR), held at the Naval Surface Warfare Center, Carderock Division in Maryland, USA.

The ISR is a biennial design and racing competition, which involves various challenges including presentations, reports and time trials on a 100m-long straight-line course.

In the racing, Warwick's 2.8-metre-long submarine, named Godiva 3, was able to achieve a speed of 2.88 knots, the best yet for the Warwick team and possibly a UK record.

Smooth operator

Warwick also came home with the Smooth Operator award, which recognises the team that was best organised in terms of race preparation, efficiency of operation,



The Smooth Operator award is testament to the hard work that the team have put in all year.



Academic



Warwick submarine team pictured with their award

problem-solving, effecting running repairs and overall reliability. It's a huge accolade for the Godiva team to have won this against very significant competition.

"Once again the Warwick Submarine Godiva team has achieved an excellent result at the International Submarine Races. The Smooth Operator award is testament to the hard work that the team have put in all year, not just to the engineering aspects of the project but also to such necessities as gathering the support of sponsors and the logistics of simply attending the competition with a viable racing submarine.

"In this project they have received support and advice from many people but the end result places us in a strong position for future development. I am immensely proud of all that they have achieved," says Dr Ian Tuersley, who has been Project Director of Warwick Submarine for the past seven years.

Technical and academic support

The base for building the submarine is the engineering hall in WMG's International Manufacturing Centre at the university. There are dedicated workshop areas for students to work side by side with expert technicians, engineers and business partners.

Together with their academic home in the School of Engineering, immediately opposite WMG's International Manufacturing Centre, MEng students are at the heart of Warwick's central campus – right where the university's reputation for manufacturing excellence and innovation in engineering is forged.

Being able to draw on the technician support, facilities and various research groups while also gathering support and advice from Industrial sponsors is a fantastic opportunity for undergraduate students. They can put their academic learning to the test, tackle design challenges as a team and gain valuable experience working with commercial partners to build a submarine.

Research expertise

Students can also draw on research from across the university, particularly in innovative manufacturing, which is one of Warwick's 11 global research priorities (GRP). These programmes bring researchers together to address some of the most challenging problems facing the world today.

Dr Peter Wilson, Post-Doctoral Research Fellow in the Sustainable Materials and Manufacturing Group at WMG and Innovative Manufacturing GRP member, specialises in fibre-reinforced polymer composites. His research into recycled carbon fibre was applied in the materials used to make Godiva 3's hull. This was a major leap forward in Warwick Submarine's development. As well as winning the award for Best Use of Composites at the 2017 International Submarine Races, Godiva 3 is the largest example of this kind of technology used anywhere in the world to date.

Another member of the Innovative Manufacturing GRP and Associate Professor at WMG, Dr Stuart Coles, also contributes his expertise on sustainable materials and manufacturing to the student project.



I'm immensely proud of all the students have achieved.



Edinburgh Napier is in HySpirits

Edinburgh Napier will play a key role in an investigation into the feasibility of hydrogen as a fuel to decarbonise the distilling process.

The HySpirits project has been awarded £148,600 by the Department of Business, Energy, and Industrial Strategy (BEIS) to conduct the study at The Orkney Distillery.

The project will investigate the development of a thermal fluid heater system to operate with hydrogen as the combustion fuel within the distilling process. This system will remove the need to use fossil fuels such as kerosene and liquid petroleum gas.

HySpirits brings together Edinburgh Napier, project lead the European Marine Energy Centre (EMEC) and Orkney Distilling Ltd. The university will assess the distillery site and develop the hydrogen system design and specification.

Industrial Fuel Switching Competition

HySpirits was awarded funding after successfully competing in the Industrial Fuel Switching Competition run by BEIS earlier this year, which aims to stimulate early investment in fuel switching processes and technologies.

The competition offers funding for feasibility studies into developing technologies that enable the use of a low-carbon fuel across industrial processes. The winners were announced by Climate Change Minister Lord Duncan.

"Using the power of hydrogen could help cut emissions, create jobs and make industrial processes cleaner and greener, benefitting the whole economy as we work towards net zero by 2050," he says. "This innovative project from HySpirits/EMEC will help our efforts to roll out hydrogen at scale by the 2030s – a crucial step towards the end of the UK's contribution to global warming."

The first hydrogen-fuelled distillery?

Hydrogen has been identified as an alternative fuel for energy intensive industrial processes such as distilleries. If the technology and business case detailed in the feasibility study proves viable, this offers a substantial decarbonisation opportunity for the wider industry and The Orkney Distillery could become the world's first hydrogen-fuelled distillery.

It is hoped that the findings of this study can be replicated across the sector. The aim is to design the technology to enable it to be retrofitted into existing infrastructure.

"Industrial fuel switching in order to lower carbon emissions provides a significant challenge, particularly in the food and drink sector. This project has brought together a partnership which has enabled the development and exploitation of a readily-deployable hydrogen technology that can make a significant impact across the process industries in order to help achieve our global objectives," says Professor John Currie, Director of the Scottish Energy Centre at Edinburgh Napier.

"We're proud to be partnering with Orkney Distilling Ltd and Edinburgh Napier University on this transformational project," adds Jon Clipsham, Hydrogen Manager at EMEC. "The HySpirits project blends tradition with innovation. Decarbonising the distilling process with green hydrogen derived from local renewables is a great example of the creative ways Orkney is addressing the challenges of the energy transition."

GES Group supports Ireland's largest enhanced anaerobic digestion facility

GES Group was appointed to supply and install additional low and high voltage infrastructure on the Granville Eco Park site, which is the largest enhanced anaerobic digestion (AD) facility in Ireland.

The works included the installation of two 11kv–433v transformers and all associated low voltage (LV) and high voltage (HV) switchgear and cabling for both the CHP3 and CHP4 installations and the pure-gas plant on site.

GES also designed and installed two bespoke containerised sub-stations, one LV and one HV, to meet the need for rapid turnaround and to comply with the connection agreement from the distribution network operator (DNO).

This project was delivered in line with GES' commitments to health and safety, quality and the environment, with all installations tested and commissioned to meet the highest Industry standards and comply with its NQA-accredited ISO Management Systems (14001, 9001, and 18001). Full risk assessment method statements were made available to the client.

A sustainable Ireland

Granville Eco Park went on to become the first AD plant to obtain a prosperity agreement with the Northern Ireland Environment Agency, whereby the two parties have pledged to work together to divert more food waste from landfill, develop



The first Anaerobic Digestion (AD) plant in the UK to achieve certification under the AD Certification Scheme (ADCS), an industry-led initiative that recognises good operational, environmental, and health and safety performance at Anaerobic Digestion plants.

innovative solutions to maximise energy production, work with the community to deliver environmental initiatives and more. It's also been recognised as a market development leader, with a prestigious award from Sustainable Ireland for its work in food waste and the circular economy.

By sending waste to the Granville Eco Park site, food producers can reduce their impact on the environment and may reduce the cost of disposing of their food waste. Up until September 2017, the plant had diverted 130,000 tonnes of food waste from landfill, which is a CO₂ saving of 70,000 tonnes.

Renewable power is a source of significant economic potential over the coming decade. That's why GES Group strives to provide its clients with the most efficient products and services to meet the demand that our overloaded grid network is shouting out for.

Renewable power

GES Group can support a wide variety of renewable technologies, in-house within its own infrastructure, and it works closely with clients to agree and achieve specific green strategic targets and objectives. It's expanded its strengths, expertise and

unique abilities in recent years, enabling the company to continually identify and build supply chain technologies, support opportunities and develop partnerships with like-minded professionals. It's managed energy effectively for many of its internationally recognised clients through good planning, organising, commitment and understanding, through successful implementation of the agreed programme and by ensuring the relevant controls and monitoring are in place.

IET support

"IET-associated companies are the lifeblood of our engineering industry and we are increasingly challenged in attracting suitably skilled employees to grow and sustain our businesses," notes David Moore, Managing Director of GES Group.

"To succeed, we need to attract and train professional and incorporated technicians to make the engineering and manufacturing sectors more attractive, minimising barriers to entry and developing a more significant and robust skills pipeline. Support from the IET is invaluable, enabling us to identify potential solutions to future-proof our skills development in relation to the age of digitalisation."

Who is Quarch?

Operating within a niche and sophisticated industry, Quarch's mission is straightforward: to solve complex testing problems with simple, powerful automated tools reports **Mike Dearman**, Founder/CEO.

From our HQ tucked away in the Scottish Highlands, Quarch supplies many of the biggest names in the data storage industry with the tools they need to test and qualify their devices for use.

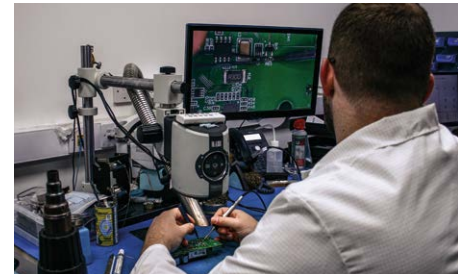
Before storage devices are loaded with critical data, it's vital to test how they perform in different power and fault scenarios. Our tools automate this process, eliminating the need for tedious manual testing while dramatically improving test coverage. Ultimately, due to the time and cost saved by streamlining tests in this way, companies using our tools are able to develop, debug and launch their products more quickly.

Quarch exhibits annually at Flash Memory Summit in California, the world's largest conference for the solid state drive (SSD) industry. Every August we meet dozens of people from corporate labs and start-ups alike, who could – and do – benefit from using our tools. This year's summit was particularly interesting as there was a buzz around the new generations of high-speed storage interfaces, for which we've been developing test solutions.

We cater to a fast-growing market, so the future is exciting for us. We also have a foot in the door of the networking and automated vehicle markets; both require advanced testing.

We have a small, talented team and we're proud to serve globally.

To find out more about Quarch and the people it works with, please visit www.quarch.com.



Virtual engineering: nmcn's journey to BIM 8D

Report by **Mark Hanrahan**, Business Development Director - Water.

Capturing clear and accurate existing asset data is an essential part of our journey to achieving the eighth dimension of building information modelling (BIM); streamlining design in the digital space. We're aiding this process by further developing our fully immersive virtual engineering approach.

The first stage of a project is now centred on creating a 3D virtual engineering environment that captures all existing site and asset details. Using state-of-the-art equipment, sites and building internals can be scanned in a matter of hours, with subsequent geospatial photos stitched in to create a fully immersive engineering environment. Ground penetrating radar is also used to capture an accurate layout of buried services. Further site visits are negated as measurements to an accuracy of +/-1mm over 70m can be taken straight from the

virtual environment. Likewise, with the application of geospatial photography, there's no need to create a 3D model of the existing site and assets.

The next stage of our journey is creating an intelligent 3D federated model of the new assets and layering this into the virtual environment along with the buried services scan. The federated model is further populated with build sequencing



and timelines as well as cost data, thus providing an accurate earned value analysis.

Being a federated model enables our clients and supply chain to work in a single model, adding specific asset data and attributes for embedded carbon, maintenance regimes and material specification. Similarly, procurement schedules are directly linked to the federated model ensuring that changes are reflected automatically.

We're now at BIM 7D, ready for future facilities management, operation and maintenance. We now need to learn from the asset in real-time and use this data in the digital space to streamline our designs and complete our journey to BIM 8D.

Then a new journey will be embarked upon to maximise the use of robotics and AI: BIM 9D and 10D.

Holovis breaks the mould at Madame Tussauds

Experience designer Holovis has worked with Merlin Magic Making to design and deliver a new experience for Madame Tussauds in Orlando and Sydney. Guest can now interact with and star in the attraction alongside the wax figures in a way never before experienced.

Justice League: A Call For Heroes is a walkthrough attraction where guests face a series of interactive adventures and engage with the superheroes to bring their powers to life. This is experienced through interactive sequences using combinations of projection mapping, enhanced audio, lighting and SFX.

Immersive effects

Holovis has been responsible for designing, producing and delivering the AV, show lighting and interactive elements of the experience and focused on keeping the technology invisible, so guests are unaware of the high tech world around them.

"Throughout every aspect of this experience, we wanted to make it as natural as possible for the guests to interact with the superheroes, then be amazed at how their environment changes when the power is triggered," explains Holovis Experience Designer Jon Tozer. "We've achieved this by making all of the tasks motion-based and things that guests are naturally compelled to do, making it seem like real magic when the immersive effects then occur."

Helping the Justice League

The journey begins with Batman interrupting a news broadcast, telling guests that LexCorp is planning to take over the city and that they have to awaken the Justice League to stop them. Guests then move through to a themed environment where they find each of the Justice League wax characters.

Guests need to run on the spot alongside The Flash, strike Wonder Woman's iconic pose alongside her to activate her power gauntlets, crack the code with Cyborg and enter it into the keypad, use Superman's strength to lift a helicopter alongside the first dynamic, fully-articulated Madame Tussauds figure, fire the Bat Signal to summon Batman and grab Aquaman's trident to harness its power.

"This level of interaction with the figures is one of the most immersive and unique experiences ever produced by the Madame Tussauds brand worldwide," says Jon. "By keeping the technology invisible, the immersive sequences are even more impactful when they engulf the guests."



CEMA helps turn sludge into electricity

Knostrop WwTW is Yorkshire Water's largest waste water treatment plant and serves the Leeds area. It recently completed a £72m upgrade to its sludge treatment facilities, which recycles 94% of Leeds's sewage sludge and generates enough electricity to power the equivalent of 5,000-plus homes.

The project allowed the closure of the on-site sludge incinerator and removed the requirement for third-party disposal of treated sludge. The project also incorporated a sludge import facility aligning with the ongoing digester rationalisation programme, which aims to drive down the cost of sludge processing.

CEMA Ltd was contracted to provide low voltage (LV) assemblies and associated systems integration including on-site

commissioning, supervisory control and data acquisition (SCADA) and telemetry works. All motor control centres (MCCs) were built in accordance with the requirements of the LV Directive and EMC Directive and certified accordingly. MCCs are of form 4 type 3 construction, IP54 rated, front and rear access with bottom cable entry. Each MCC includes filtration to correct harmonic distortion, and reactive power compensation to correct power factor.

Mitsubishi Q Series programmable logic controllers (PLCs) were used to control the processes via Gott 2000 local operator interfaces (LOIs). The PLCs were programmed by Mitsubishi Certified Engineers using GX Works 2 and GT Designer 3 and all PLCs were supported by standalone 230V uninterruptable power supplies (UPS).



ID management in education

Magocard's Chief Marketing Officer, **Simon Craddock**, discusses the challenges that make ID management in the education sector unique.

Identity card technology in the education sector does more than just provide visual security. If leveraged correctly, it can help provide a secure and efficient environment for learning.

However, there are challenges that make the education sector unique. One of these is that an individual may have multiple roles. Each one of these roles enjoys different rights and hence demands different access and privileges that need to be configured with their ID credentials.

Across terms students may change their classes and tutors, and of course, the teachers may change roles and institutions. To keep pace, the identity system needs to facilitate quick and automated provisioning/termination of access on the campus as well as cater for temporary guests like substitute teachers or visitors.

Student ID cards are capable of more than photo ID. Many universities use magnetic

stripe, smart card and proximity card technology to integrate student IDs with everything from access control systems to meal plans and laundry machine operation. Some IDs work as debit cards for purchases both on and off campus.

Some key applications:

- Access control – is this student or member of staff allowed in this part of the building or campus?
- Attendance monitoring – record attendance automatically.
- Allow for classroom clock-in/out and if a student goes missing, track when they entered a building and at which location.
- Making payments – preload the ID card with credit or link to an account so students can pay for food in the cafeteria or purchase on-site print services.

Educational institutions of all shapes and sizes are implementing ID card programmes to not only increase security,

but also to provide a multitude of other unique and convenient functions.

You just have to look at how functionality of cards keeps getting enhanced year after year to realise that ID solutions provide an effective answer for schools and universities to reduce risk, increase efficiency and improve accuracy across people, building and information.

For more on Magocard's education solutions, or to download its related whitepaper, please go to www.magocard.com/education or email updates@magocard.com.





Being good at innovation is more than just gathering ideas

Solverboard unveils new platform to support innovation

Engineering and technology companies are invited to trial Solverboard's innovation management system ahead of its full launch in 2020.

Tech start-up Solverboard has announced the imminent release of a business management platform designed to help organisations improve innovation.

The system is based on insight gathered from leaders across industries including engineering, manufacturing, technology, energy, aerospace and defence. It brings business strategy, idea generation, validation and project management together into a flexible workflow to measure the total impact of an innovation programme.

Organisations are always improving processes, overhauling systems and launching new products and services in order to create more value. But as global trends shift and remodel the business landscape, leaders are continuously

interrogated on how their organisations will thrive and increasingly being held accountable if their answers fall short.

"Being good at innovation is more than just gathering ideas," says Solverboard Co-Founder Charlie Widdows.

"It's about aligning them to business strategy, persevering and championing them through testing, prioritisation and eventually to actualisation, often bringing together disparate team members and getting them to collaborate.

"This is why we took a fresh look at how an innovation management system should work. We asked innovation leaders what they needed the most, and then built Solverboard."

Solverboard's workflow is designed to make it easy to increase the volume and velocity of new initiatives by bringing the main processes involved in project delivery together. This helps organisations bridge the gap between creative people and those focused on actualisation by using them for what they're good at and getting them involved in the right stages of the process.

As Solverboard continues to develop, the team is inviting engineering and technology companies to take part in a 'pioneer' trial phase before the finished platform is launched in early 2020.

To find out more and request to take part, please visit www.solverboard.com or send an email to hello@solverboard.com.

Cosworth brings hybrid power to touring car championship



Cosworth has won the contract to design and supply a new hybrid system for the British Touring Car Championship (BTCC). This will be introduced in the 2022 season.

Cosworth has fast established its credentials as a tier one supplier to the automotive and motorsport industry with its high-performance powertrain and electronics solutions. Being chosen by BTCC organisers TOCA showcases the company's ability to lead the next generation of hybridisation – both in racing and on the road.

"It's an important validation for the groundbreaking work we're carrying out in hybrid technology," says Cosworth's Managing Director Electronics Tom Buckler. "BTCC has been a trusted partner of Cosworth's for many years. This contract is validation of the technical relationship we share and reinforces motorsport's position as an excellent proving ground to develop technologies for our automotive partners."

The BTCC was the first major touring car championship in the world to announce the move to hybrid in August 2018 and is now the first to specify the exact timing, pathway and technical details of its hybrid power.

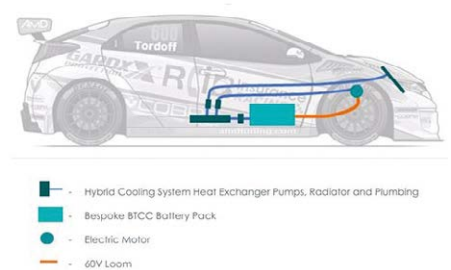
The contract was awarded to Cosworth Electronics after a successful round of tenders that met with the very challenging specifications – particularly those regarding packaging, performance and low cost – that TOCA had outlined.

All major TOCA technical partners worked closely together in order to define the specification, technical integration and performance parameters of the hybrid system.

The additional hybrid power will be used by drivers for either passing or defending. Performance simulations undertaken by Cosworth show that the most significant gains will be achieved at the low engine

RPM ranges; the hybrid power burst will bring the engine up into the turbo window more quickly. This will provide drivers the chance to pull alongside or gain ground on the opposition and will introduce new competitive strategies and opportunities to each BTCC race.

Hybrid layout



Students show their STEM Potential

Students from the Oundle, Peterborough and East Northants (OPEN) Learning Partnership recently visited Park Air Systems Limited, a Northrop Grumman company, as part of the STEM Potential programme.

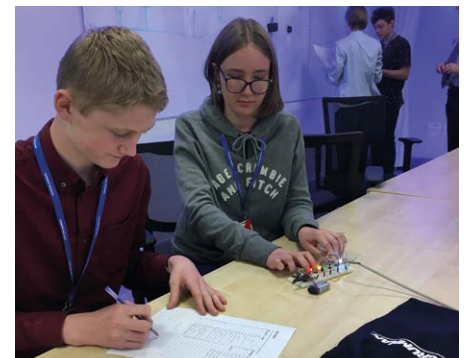
The partnership, run by Oundle School and Imperial College London, targets talented pupils from state schools, supporting them from Year 10 through to STEM courses at university.

As part of the STEM Potential programme, pupils spend a week on various activities and Park Air provided a day to round out the week. During their visit students were introduced to the Park Air product range and tasked with technical challenges.

Using Park Air's T6 radio, students were able to listen to real transmissions from aircraft communicating with airports such as Stanstead and Birmingham.

Following a tour of the Market Deeping facility, it was time for challenge number one. Students were split into small groups and tasked with building a simple model using LEGO®. This was passed to the next group to write a parts list and assembly instructions. These documents were then passed on to a final group, who had to build a model by interpreting the information.

For a task to demonstrate how electronic communications work, students were given a collection of components, cables and a



Students participating in technical challenges at the Park Air Systems Market Deeping facility

breadboard and asked to design a simple transmitter/receiver. Using their own code they were able to encode/decode messages sent between them. Tasked with asking and answering a simple question, all of the groups were able to receive an intelligible answer.



Coderus to work on America's Cup campaign

Coderus is proud to announce a second consecutive collaboration with INEOS TEAM UK, supporting Britain's campaign to win the upcoming 36th America's Cup.

The America's Cup is the sport's greatest design and sailing challenge, and now, backed by INEOS and led by Ben Ainslie – the most successful Olympic sailor in history – Britain has a fantastic opportunity to take home the trophy.

The team has turned to Coderus for its software and embedded systems expertise to deliver essential data to the sailing crew for a competitive edge during the America's Cup series. Coderus, based at Adastral Park and a part of the Innovation Martlesham cluster, is the team's newest official partner. It will be working to develop the technology that will support smart, fast and tactical decision making out on the water.

"It's terrific to have Coderus back with us and working on the next iteration of our onboard tactical and sailing data solutions. The company did a great job last time, and we know that its software expertise and support will give us a performance advantage," says Nick Holroyd, Technical Director of INEOS TEAM UK.



Sinewave drives the charge with electric vehicles

“ Our mission from day one has been to be at the forefront of the energy evolution. ”

As the UK commits to the net zero emissions target by 2050, finding alternative technologies and energy sources have been key to reducing the country's carbon footprint.

As new installations of solar and renewable assets have declined in recent years, Sinewave Energy Solutions recognised the need for diversification into emerging technologies, particularly the associated charging infrastructure needed to push the growth of electric vehicles (EV).

The move away from traditional grid connections to private networks is a good fit for the business, due to the agility required to succeed in such a fast-moving sector. Sinewave, now two years into its strategy to provide support to the EV market, believes

this paradigm shift will also help promote sustainable development.

Based in Swindon, Wiltshire, Sinewave has recently undertaken several programmes for high-end clients as part of a nationwide role-out of EV charging infrastructure. Acting as both designer and installer, it provided the full package of works including substation installation, cable laying, commissioning and re-instatement works. The company also provided expert electrical and project management support throughout.

"Our mission from day one has been to be at the forefront of the energy evolution," says Director Adam Woodley. "We're excited to be supporting key clients in delivering new technology-based infrastructure for the future of the UK."

In the pipeline

Meet **Phil Rawson**, a Project Engineer for pipeline technology specialists Atmos International.

Engineering is in Phil Rawson's blood. With both his father and grandfather having had long careers in the sector, it was almost inevitable that Phil would follow in their footsteps. Being stronger in maths and science subjects also helped steer him into a career with a global impact.

Having an interest in aviation, Phil achieved his master's degree in aeronautical engineering at the University of Salford. His natural passion and ability for IT was a perfect fit for a career in this sector, where he could combine his engineering knowledge and IT skills to solve complex problems for his clients.

Ten years ago Phil joined Atmos International. A global leader in leak detection systems for pipelines, Atmos' software and hardware is used on over 1,500 pipelines in over 60 countries, with clients including major oil and gas companies such as Shell, BP, Exxon-Mobil and Total.

No two jobs are ever the same

The range of projects and applications at Atmos means that no job is ever the same. Operating globally means working with colleagues from the company's offices in Costa Rica and North America, along with representatives in countries such as Indonesia, Vietnam, Columbia and Canada.

"Most people are completely unaware of how many pipelines there are around the world," says Phil. "These pipelines are used to transport products over

vast distances – distribution by road would be much more difficult and have all sorts of environmental impacts."

While at Atmos, Phil has continued his professional development and is a member of the IET as well as the Association for Project Management. Speaking about his membership of the IET, Phil recognises the value of the networking events and lectures available.

Benefits of IET membership

"It's opened up a wealth of additional information to help my development and my knowledge of engineering. I'm growing my own network and that interaction with other engineers is highly valuable."

Recently Phil has qualified as a Chartered Engineer (CEng), which is already proving beneficial in his current role.

"It's the next step in my engineering journey and demonstrates that I've achieved a higher level in my engineering and leadership skill set. I've also found that our clients appreciate it too. They instantly recognise the qualification and it helps show that I'm capable of understanding complex technical solutions. The help the IET's professional registration advisor gave me was invaluable too."

Reflecting on his journey to date, Phil has some advice to share with those considering engineering as a career option.

"Engineering can provide you with both interesting challenges and opportunities. You're positively contributing to solving complex issues and problems, plus it's been a great way to see the world too," he points out.



“

IET membership opened up a wealth of additional information to help my development and knowledge of engineering.

”

Silver Fox's commitment to quality

Silver Fox is a leading UK manufacturer of labelling solutions and has been successfully supplying a wide variety of sectors around the world for over 30 years. One of the ways Silver Fox demonstrates its commitment to quality is by testing its labels for a variety of critical and extreme conditions at independent laboratories.

One such test is the MIL-STD 202, Method 215K, which prescribes a chemical wash testing procedure to verify that markings or colour coding will not become illegible or discoloured when subjected to solvents and processes normally used to clean contaminants. The test is carried out both by soaking and rubbing with a toothbrush to test abrasion resistance. Four solvents are employed.

"The fourth part of the test, with isopropyl alcohol, was introduced in 2018, upgrading the test to a higher, more demanding level. We believe that Silver Fox may be the first company in our field to successfully pass this new stricter standard," says CEO Nick Michaelson.

Since Silver Fox labels are being used more and more in the aerospace and defence sectors, the decision was made to undertake independent testing although it is possible to self-certify.

"We also took the view that it's a far better reflection of our commitment to quality and transparency if we commissioned a properly approved and independent laboratory to conduct these tests," Nick explains.



The performance was evaluated by measuring changes in visual observation after exposure. All labels tested were intact after being exposed. Printed words remained legible the labels themselves had not deteriorated or discoloured.

IR35 reform rules – are you ready?

New tax rules for off-payroll labour in the private sector are proposed to begin on 6 April, 2020. These will have a significant impact on manufacturers that use large numbers of contractors.

From April 2020, medium and large size manufacturers that engage workers operating through an intermediary are responsible for determining whether or not each worker should be treated as a deemed employee – a responsibility that currently lies with the intermediary.

Manufacturers should put systems in place to manage this new responsibility

and to ensure they comply with the rules when they come into play. Failure to do so could lead to financial costs, project delays and risks damaging relationships with contractors and agencies. For ongoing contracts, determinations should be made in advance so that the new rules can be applied from 6 April.

When a worker falls within the new rules

Businesses that contract directly with the worker's personal service company must deduct PAYE and NIC from payments to the company. Where an agency pays the worker, deductions will normally be its responsibility, however businesses must communicate their 'determination' of each worker's employment status directly to the worker and any agency involved otherwise the business could be unnecessarily liable for tax and NIC.

Being considered an employee, rather than a worker, will mean increased tax and NIC for workers but they will not automatically be entitled to the benefits of being

employees, such as holiday pay or sick pay. Many may try to increase their rates.

Status reviews

Having a transparent determination process within the business will reassure workers. Businesses must review each contract and not make blanket determinations. Using HMRC's CEST tool will help but it does not currently consider all the factors relevant to a worker's status so cannot be solely relied upon to reach a conclusion.



How can BDO help?

Accountancy and business advisory firm BDO can work with you and your key stakeholders to identify what contracts may be at risk, assess the potential impacts on your business and implement changes to minimise them. For help and advice please get in touch with Senior Consultant Aman Nirwal at aman.nirwal@bdo.co.uk.



Engineering at the Intellectual Property Office

The British Patent Office was established in 1852. However, the history of patents in Britain goes back a further 400 years to 1449, when Henry VI of England granted the earliest known English patent for invention to John of Utynam. Since 1990, the home of the Patent Office, now known as the UK Intellectual Property Office (IPO), is in Newport, South Wales.

The IPO employs around 350 engineers and scientists across a range of technical disciplines. Employed as patent examiners, their function is to search and examine the tens of thousands of patent applications that are filed at the IPO each year. Revolutionary innovations such as TV and radio, radar, MRI, fibre optics and many others have all been developed and patented in the UK.

The role of patent examiners

Patent applications are detailed technical and legal documents that explain how an invention works, and define – in a series of claims – the legal monopoly to which the inventor is entitled. The patent examiners search through extensive

databases of technical literature, including patent applications published around the world, to assess whether each invention is genuinely new and non-obvious.

Patent examiners must be academically qualified to degree level in a relevant technical field. Some are already professionally registered with the Engineering Council when they join the IPO, typically as Chartered Engineers (CEng), while others work towards professional registration while employed as patent examiners.



IET's Mark Organ with Julyan Elbro from the IPO.

IPO becomes IET Enterprise Partner

Earlier this year, the IPO was delighted to become an IET Enterprise Partner when Divisional Director Julyan Elbro received a framed copy of the certificate from Mark Organ, IET Head of Membership. Being an Enterprise Partner is great news for the engineers and scientists working at the IPO, as the organisation now has a dedicated professional registration advisor (PRA) working with its IET members to help them achieve CEng status.

The IPO also benefits from discounts on the technical training that is essential for patent examiners working at the cutting edge of technological development. Access to the Enterprise Partner network, and a range of partnership events, were also incentives for the organisation to become an Enterprise Partner.

And finally, in case you were wondering, the patent granted to John of Utynam in 1449 gave him a 20-year monopoly for a new method of making stained glass that was used to create the stained glass windows of Eton College.

Lauryn Bailey – an apprentice's story

Apprentice Engineer Lauryn Bailey talks about working at Fundamentals Ltd, her passion for the industry and the need for more women to join the sector.

With a father as a mechanic and an uncle as an electrician, there was a reasonable chance that Lauryn might be inspired to seek a career in a technical industry.

Lauryn was studying at Universal Technical College in Swindon when she realised she wanted to focus on engineering.

"It's not like a normal college. It runs on business hours, we had to wear business attire and its huge workshop allows manufacturing and a proper taste for different elements of the industry," she notes.

Her interests quickly focused on electronics from a technical design and architectural perspective and she chose a more practical-based BTEC over exam-based A-levels.

"For anyone wanting to go into engineering, my advice would be to take a BTEC," Lauryn says. It provides much better practical knowledge and certainly helped in my interview at Fundamentals. I was more relaxed, and the soldering test was relatively easy because I'd been there and done that."

University or apprenticeship?

At the end of college, having gained distinctions in all three of her BTEC subjects, Lauryn was faced with another choice: university or apprenticeship?

"I looked at university courses, but I learn much more when I'm doing practical stuff. Universities deliver the information I would need, but do they actually provide the practical awareness? Most of my peers went into apprenticeships."

Lauryn's overall boss, Fundamentals' Managing Director Jon Hiscock, agrees with her choice.

"For the technical industry, the education system isn't doing enough – particularly universities. Whilst I was undertaking a lot of interviews for new Fundamentals staff, I was staggered at the poor level of maths. That's very worrying to me.

"It could be that all the good graduates are locked away in good jobs, but I believe the push towards the Blair target of 50% at university, has dumbed-down higher education and the perception that a practical or apprenticeship route is 'lower class', as opposed to going to university, is dangerous."

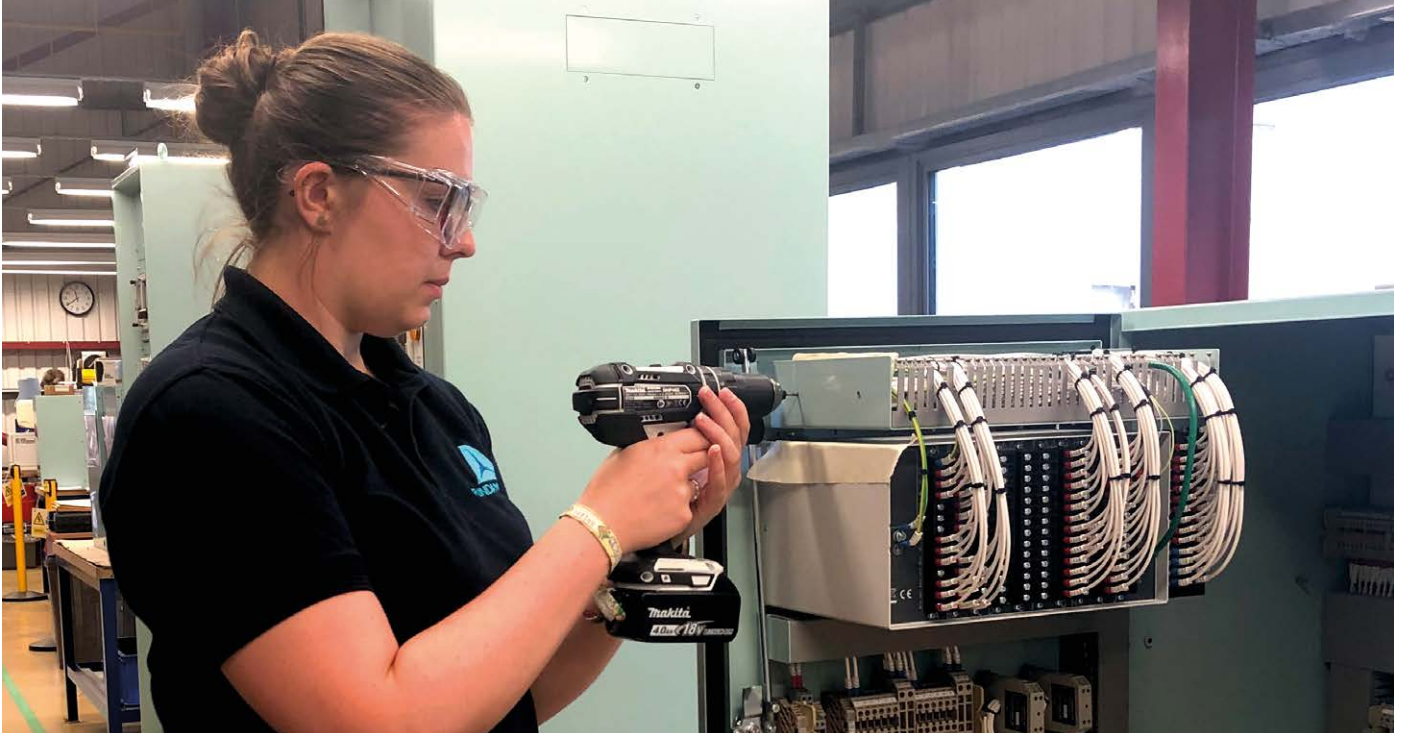
Working at Fundamentals

At Fundamentals, the structure of an apprenticeship is usually six months spent in different departments before the apprentice decides on their preferred area to focus on.

“

For anyone wanting to get into engineering, my advice would be take a BTEC.

”



Every apprenticeship must also include an academic element. For Lauryn this means completing a Level 3 NVQ in engineering and technology. She completes her NVQ around her day job, with an assessor visiting Fundamentals every quarter.

So, what elements of the work is Lauryn enjoying? "Everything!" she says enthusiastically. "The Operations Department where I'm currently working covers every element of the business, including health and safety, IT and production."

Lauryn quickly became the go-to IT support specialist for newcomers to the organisation, recently delivering a presentation on Fundamentals' new intranet to sixty colleagues. She also works hands-on with the team, fulfilling the contract with Electricity North West to build wall boxes, populate them with components and laser engrave the labels etc.

Women in engineering

Now aged 19, Lauryn just missed the current drive by politicians and the academic world to encourage more women into engineering-based careers.

"I was already motivated to go into this career, but there is definitely a lot more visibility of women in engineering now," she says.

"At one time I was the only woman in my class. That's changed and female engineering has gone up in college from six percent to 10 percent in just four years. But some women are potentially put-off by such a perceived male-dominated industry.

"Having access to engineers at school and having companies come into the schools made a big difference. The move to the engineering college in Swindon gave us access to Dyson, Johnson Matthey and there are many leading female engineers coming in to visit now."

Apprenticeship advice

So, what advice does Lauryn offer for other would-be apprentice engineers?

"Pick something you really enjoy, because if you enjoy it, you'll stick with it and be passionate about it.

"Make sure you have some form of qualification that reflects your passion – the STEM subjects are really important, including physics. Then target companies that work in areas as close to your interest as possible.

"An apprenticeship is never going to be easy, but that's a good thing. You'll never get bored and you'll always have questions to ask which can only be positive."



There's definitely a lot more visibility of women in engineering now.



HV/LV Inter-Tripping and Protection Systems – What does it mean?

Rick Seymour, Authorising Engineer with Eta Projects outlines the definition and extent of a HV system and outlines the level of protection required to meet good design practices:

The relationship between protection systems on HV and LV inter-linked is often misunderstood. High Voltage (HV) and Low Voltage (LV) systems are intrinsically linked, especially at the point of common coupling, where transformation takes place to lower the voltage to a safe working level at the consumer side on the network.

In general terms, HV and LV circuits are normally protected by some form of Overcurrent and Short Circuit Protection, whether this be by Miniature Circuit Breakers (MCB's), Moulded Case Circuit Breakers (MCCB's) and Air Circuit Breakers (ACB's) on the LV side, or Time-Limit Fuses (TLF's) and Inverse Definite Minimum Time (IDMT) relays on the HV side. Whatever the device the principles and function of over-current (O/C) and/or earth fault (E/F) protection are generally clear and

understood by most electrical designers and operators. However, the area between the HV breaker, its transformer and the first associated Main LV Air Circuit Breaker (ACB) is often overlooked and, in many cases, left unprotected i.e. "the HV/LV affected zone".

This paper outlines the potential hazards and the different HV/LV Inter-tripping protection systems that exist and are in common use, and how, when installed correctly work collectively to protect the critical HV/LV affected zone.

The protection systems detailed provide a robust protection across the area described as that of common coupling and interact between different inter-tripping functions. In summary these are as follows:

- Restricted Earth fault protection on all transformer LV windings.

- REF inter-posing relay on transformer HV breaker.
- Inter-trip signal relay from HV breaker to LV breaker via inter-posing relay on LV switchboard
- Transformer high temperature alarm to BMS via interposing relay on LV switchboard
- Transformer high temperature Trip to Trip LV ACB via interposing relay on LV switchboard
- Transformer alarm and trip signals configured via a single twin flag relay
- HV and LV Systems should have dedicated 30volt DC tripping /closing batteries (subject to voltage rating of equipment -sometimes closing coils can be 110 Volts)
- Transformer high pressure protection (where provided) should trip the HV breaker via interposing relay on HV switchboard (or via stand-alone relay box) for Ring main units).

Stansted Airport's Track Transit System

Report by Stephen Haynes, Director from Firstco.

The Stansted Airport Track Transit System (TTS) is an automated transport system that carries passengers between the main terminal building and two remote satellite buildings. The system came into service in 1991 and operates on 2km of elevated and tunnelled guide-way.

We specialise in developing mission critical control solutions using open and commercial off-the-shelf (COTS) technologies. Because of this, we were engaged to replace key components of the existing system that were considered obsolete, namely the central control system and the control room operator interface.

The upgrade

Our goals were to minimise disruption to service, develop a programme to de-risk the likelihood of failure using COTS components and provide a highly resilient, reliable and open system solution.

A supervisory control and data acquisition (SCADA) system replaced

the existing operator interface. The key to providing a user interface that the operator could use effectively was to engage the operators and relevant stakeholders in a series of workshops.

In addition to the operator interface, the system interfaces to a number of existing TTS critical subsystems, namely the:

- automatic train operation station computers via the Bitbus network
- operational radio system (ORS) via an RS232 interface
- interlocking system – including local control panel
- power distribution system

Throughout the project lifecycle, application performance management (APM) maintainers and operators were engaged and took an active role in reviewing the system design and also assisted in carrying out the integrated system tests. To expedite operator training and to expose and familiarise them with the new SCADA

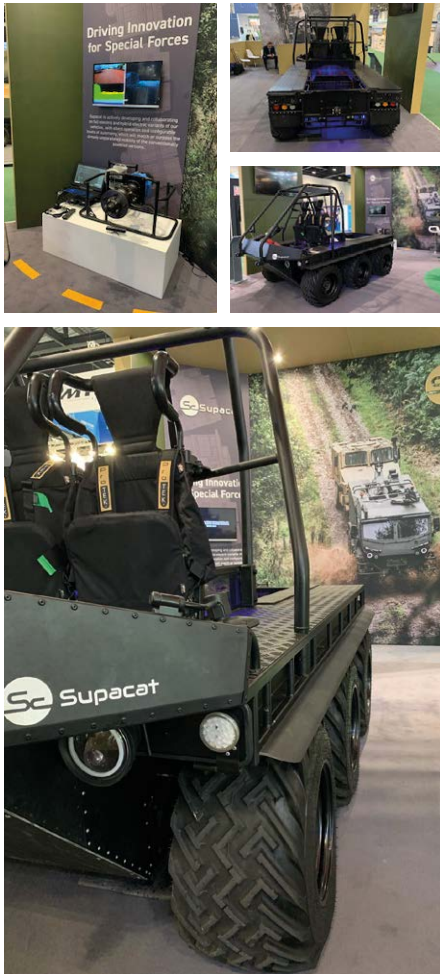
system, a full simulator was developed. The simulator also provided replay functions to allow the system to replay real events for both training and investigative purposes.

The results

This project releases Stansted Airport from dependency on the original manufacturer for future upgrades and maintenance. As a COTS open system solution, any competent software house can be appointed for changes or maintenance in the future. This represents a huge cost saving over the remaining life expectancy of the system.

In addition to financial gains, the new system is now highly flexible and scalable, allowing many other systems to be integrated into the new SCADA.

Most importantly, the safety features are now much more operator-friendly, providing guidance and reminders via context-sensitive pop-ups to ensure correct procedural decisions are made and in accordance with corporate philosophy.



Supacat unveils autonomous hybrid off-road demonstrator

Supacat, SC Group's defence business, unveiled an optionally manned hybrid off-road technology demonstrator vehicle at DSEi 19, developed with the University of Exeter through two Innovate UK-supported knowledge transfer partnerships (KTPs).

"Electric hybrid propulsion and automation will enhance the capabilities of users of our high mobility vehicles in defence, emergency services, energy and challenging environments," explains Steve Austen, Engineering Director of SC Group.

"We adopted open system architectures, allowing commercial off-the-shelf (COTS) components and system modules, which are key to a sustainable solution in a rapidly evolving technology sector.

"Our approach uses a common electric drivetrain, available with different powering options depending on mission, range, payload and operating environment. As battery or fuel cell technology advances and diesel engine development responds to legislation, these options will inevitably change and we must provide a vehicle architecture that can accommodate such evolution.

"We're incorporating autonomy in a way that permits the level of collaboration and control from human to vehicle or from vehicle to vehicle to be varied depending on the complexity of the work being

undertaken. Allowing vehicles to be optionally manned removes users from dull, dirty or dangerous tasks," he says.

The demonstrator utilises:

- Terrain detection and response system for enhanced mobility and optimised endurance.
- Object categorisation and response system for obstacle clearance or avoidance during technical off road driving.
- Path planning and motion behaviour system using simultaneous localisation and mapping for the navigation of lead and follow on vehicles.

Use of machine learning, supported by neural networks, will allow the system to develop and adapt to different off-road vehicles and applications. Supacat's mature, battle-proven All Terrain Mobility Platform (ATMP) provides the base vehicle as it enables rapid development of the new capabilities.

"Few autonomous vehicle projects focus on complex off-road terrain. The challenge is to reduce the volume of data needed to interpret unpredictable environments," says Steve.

Supacat is inviting potential customers to demonstrations over the next six months to present mission challenges so the team can benchmark the vehicle's autonomous performance.

“

Few autonomous vehicle projects focus on complex off-road terrain.

”



Make the most of your IET membership



Are you making full use of your IET membership? We can help you to develop the skills and knowledge you need to advance in your career. Discover for yourself the many benefits of membership.

theiet.org/member-benefits

Bringing more power to Merseyrail

Merseyrail will be introducing new trains to its network from next year, replacing the current fleet of electric multiple units, which are now approaching 40-years-old.

The new Stadler-built trains will be modern, fast and comfortable. They will also be able to carry more people more quickly, helping support the growth of the Liverpool City Region.

More power

Although modern trains are more efficient, they do have additional electrical requirements. The power supply network therefore had to be upgraded. These improvements are also scoped to eradicate existing direct current (DC) issues, which had often caused delays on the Southport services.

Contractually, the situation is somewhat complex. Network Rail is undertaking the work, funded by Merseytravel. VolkerRail is the delivery contractor, employing AECOM as the lead designer. The traction substation work needed was almost equally complex. Seven were to be upgraded by the provision of high voltage (HV) switchgear modules, auxiliary transformers and isolation transformers. One track paralleling hut (TPH) would be converted to become a full traction substation. In addition, three completely new traction substations would be designed and built.

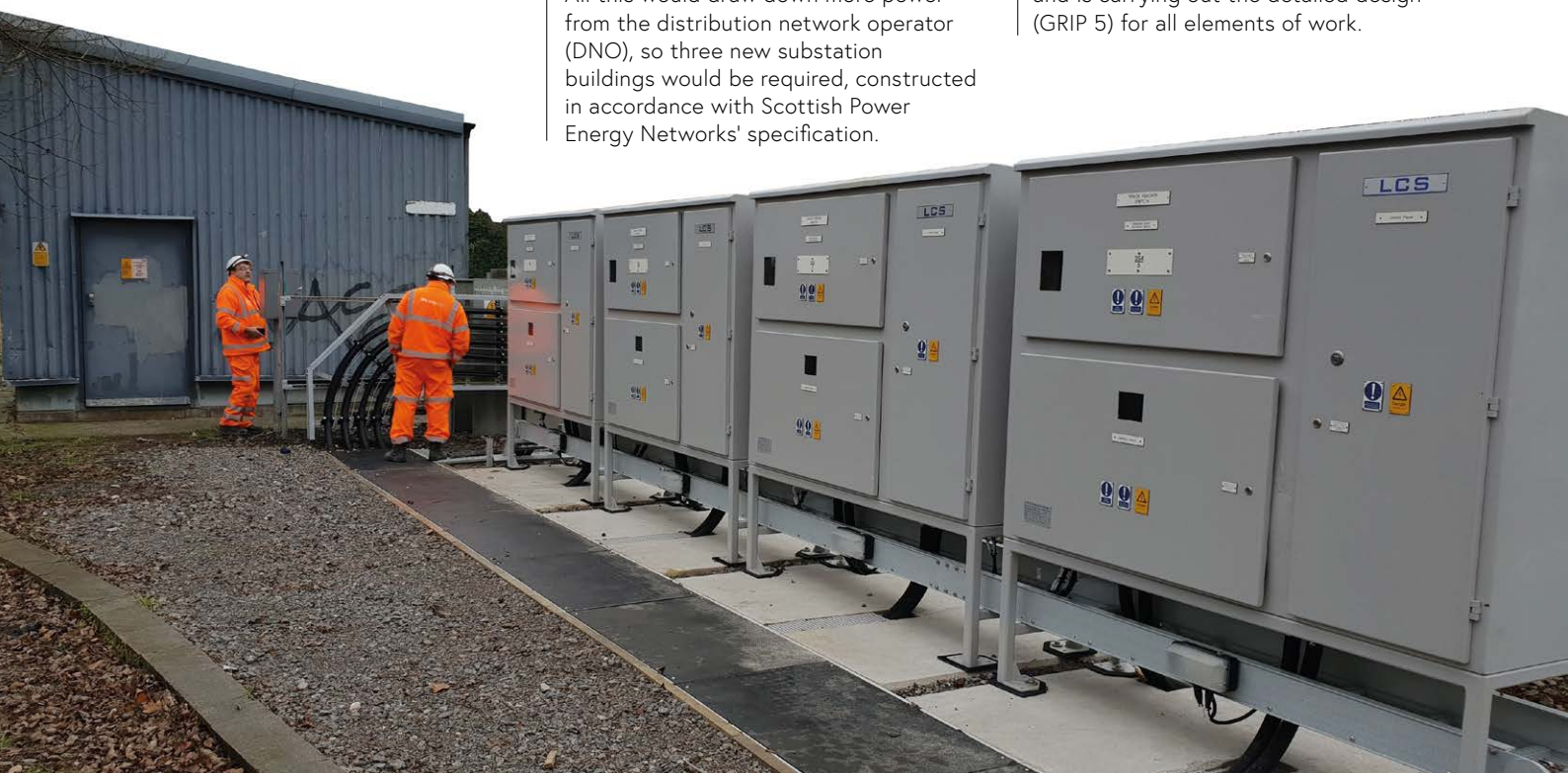
All this would draw down more power from the distribution network operator (DNO), so three new substation buildings would be required, constructed in accordance with Scottish Power Energy Networks' specification.

HV feeders

Modelling of the existing Network Rail distribution system identified three new HV feeders and modifications to one existing HV feeder – cutting mid point and terminating at one new traction substation. In addition, electrical traction equipment (ETE) enhancements include upgrades to the existing along-track continuity bonding, impedance bonds, negative DC track feeder cables and track isolation switches.

Ongoing design

AECOM has now completed detailed surveys, outline designs (GRIP 3/4) and is carrying out the detailed design (GRIP 5) for all elements of work.



Corporate

The design itself brought in the skills of AECOM's experts in:

- civil and structural engineering
- geotechnical
- highways
- environmental and ecological surveys and management

Smooth progress?

The design process went smoothly.

"The design submission was comprehensive and received only minor comments back from the client. The team was aware of the programme and deadlines by having effective/good communication," says AECOM Principal Engineer Azadeh Ghadamgahi.

"While going through the technical quality review process, everyone, whether they were a designer, checker, contractors responsible engineer (CRE) or lead verifier, was accountable for their own work, which helped us to have a successful submission.

"As there are several sites within this project, with a multitude of designers, our aim was to maintain consistency of approach in order to produce a standardised product. As with any major project, there have been requested changes to the design from the client later in the process, which we have integrated faultlessly."

One of the features of this project was the number of young designers working on the team. This included Luke Thurgood, who started his career as a rail design engineering apprentice and has learnt his trade through the support of senior engineers around him. He now has a strong knowledge of the design of heavy-rail electrification systems,

mainly focused around ETE and points heating supply and distribution.

In the past year, Luke has obtained Engineering Technician (EngTech) status with the IET and continues to develop his academic knowledge while working by undertaking a HND at London South Bank University. All his studies have been funded through the government's apprenticeship scheme – AECOM is a keen supporter of this initiative.

The AECOM E&P team

The AECOM Environment and Planning (E&P) team consists of 125 engineers in nine offices across the UK, Madrid and Bangalore.

All of AECOM's rail disciplines feature a comprehensive competency process. In addition, there is an independent process for internal assessment of CRE and contractors engineering manager (CEM) competency. This ensures that, at all levels, engineers are assigned to projects matched appropriately to their skills. This process is also used for staff training and development to guide on appropriate mentoring as required.

AECOM's teams are competent in all elements of trackside LV design, including points heating, signalling power, and station and trackside building M&E design to have the capability and competence to undertake any size rail station scheme. The company operates Bentley's ProjectWise, which supports a common data environment, for all its projects. This allows for unrivalled workshare abilities across all offices. This, coupled with AECOM's desktop Jabber system – for calls and screen sharing, enables virtual side-by-side working.



“

Three new substations were required, constructed in accordance with Scottish Power Energy Networks' specification.

”

Introducing the youngest Chartered Engineer in Scotland

SSE Electrical Engineer Gareth James Mitchell, 26, talks about his education, early career and path to chartership.



IET Regional Development Manager Fiona Harvie with Gareth James Mitchell.

I studied electronic and electrical engineering at the University of Strathclyde, joining the IET as a student member during my first year. I was 16 when I started university as I had been on an accelerating learning programme since the age of five, resulting in me skipping a full year of school.

I'd dreamed of being an Egyptologist when I was younger but realised this was far too niche a career so switched my attention to law. But after discussions with my physics and maths teachers and my cousin, also an electrical engineer, I changed my mind and applied to study electronic and electrical engineering. My own experience has made me strongly believe that young students should be inspired to do engineering and I've therefore volunteered as a STEM Ambassador on many occasions over the years.

IET-accredited graduate scheme

I developed a keen interest in renewables and the energy industry at university and was awarded a Fundación Iberdrola Scholarship for Master's Studies in the Energy and Environment. After graduating with an MEng with Distinction, I joined SSE's two-year IET-Accredited Engineering Graduate Programme at the age of 21 and worked across numerous teams within the renewables business.

There was a great focus on personal and technical development on the graduate programme and I knew that I was in a great place to build my evidence for each UK-SPEC Chartered Engineer (CEng) competence. I then joined the Engineering Centre where I covered thermal and renewables projects and asset work.

In my current role within renewables I work on hydro and wind farm projects throughout the UK and Ireland as well as operational asset work. This asset work includes electrical testing, asset status assessments and condition monitoring of transformers, switchgear, generators and earthing systems.

I have worked on over 1GW of renewables projects throughout the UK and Ireland which, when fully operational, could power around 800,000 homes.

I have been surrounded by experienced Chartered Engineers at SSE and viewed gaining CEng as recognition of technical

competence, ingenuity, interpersonal skills and project management. I strove to become chartered as quickly as possible and set myself the goal of doing so within five years of graduating.

Employer and colleague support

I was assigned an SSE Chartered Engineer as an IET mentor on my first day at the company and was enrolled on SSE's IET training programme on Career Manager. When writing my application forms, I found it particularly beneficial being able to talk to Chartered Engineers in the company who had recently gone through the application and interview process.

My line manager and IET mentor verified and supported my application and also provided feedback on the structure and content of my professional review interview presentation. I submitted my application in early 2019 and was invited to an interview. A month later I found out that my application was successful and that I was now a Chartered Engineer and the youngest in Scotland.



I set myself the goal of becoming chartered within five years of graduating.



Lockheed Martin launches GBAD family of systems

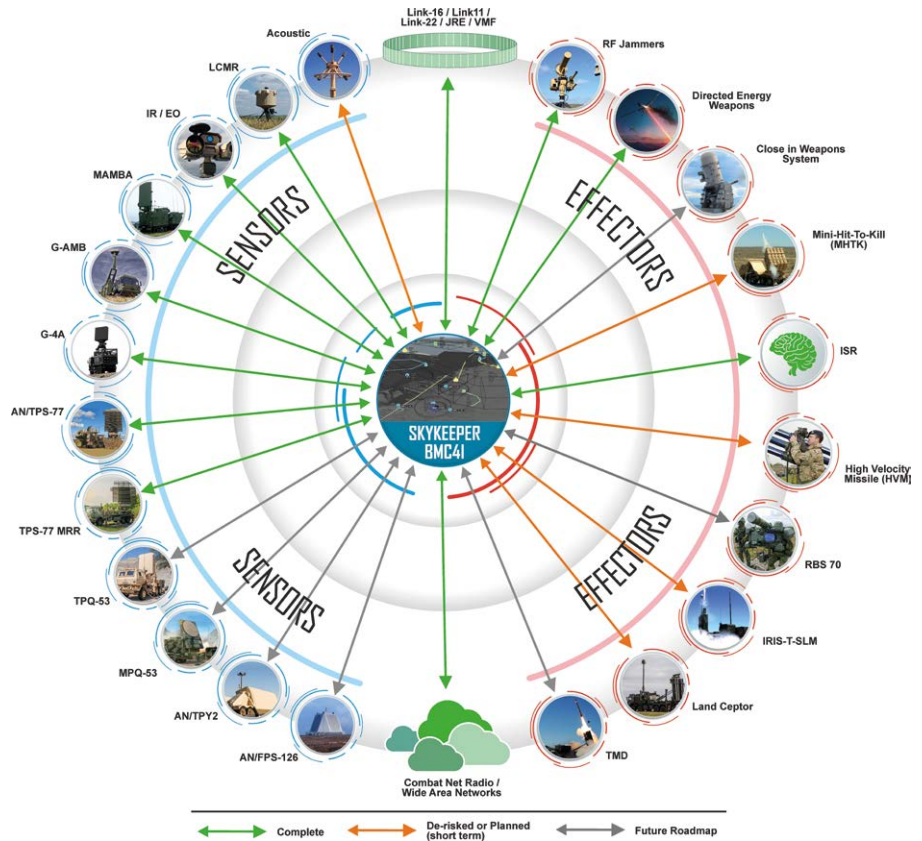
Lockheed Martin's tailored approach will assess, identify and address gaps to deliver a single, integrated ground-based air defence (GBAD) capability.

This September Lockheed Martin unveiled its ground-based air defence (GBAD) family of systems – an integrated GBAD capability as the complete air defense solution for current and emerging threats.

Traditionally GBAD systems have been developed to safeguard against specific parts of the threat spectrum; counter, rocket artillery and mortar, short-range air defence, medium range air defence and counter unmanned aircraft systems. But Lockheed Martin's 'family of systems' has all threats covered and is interoperable with allied nations.

SkyKeeper

The tailored and flexible system can integrate a range of radars, sensors and effectors, with the SkyKeeper battle management command, control, communications, computers and intelligence (BMC4I) system at the heart of the solution.



SkyKeeper is designed and developed by Lockheed Martin in the UK. It's a key GBAD capability which can be integrated with almost any type of effector, both kinetic and non-kinetic, providing automated engagement solutions across all threat spectrums. It acts as the single source of truth in a complex battlefield where multiple assets must be carefully coordinated to work together for best effect. Where achieving the right level of situational awareness, intelligence and engagement capability for the Land Commander is a crucial discriminator.

A changing battle landscape

"This is a really exciting evolution of our SkyKeeper system," says Howard Bromberg, Lockheed Martin's Vice President, Strategy and Business Development. "Our GBAD family of systems will offer customers a tailored, single GBAD capability which will cover all threat spectrums."

"The battlespace landscape is changing. In today's environment we are faced with multiple threat types being delivered simultaneously and asymmetrically. Modern warfare requires flexibility, responsiveness

and agility to take full advantage of all capability to defeat future threats."

Lockheed Martin will work with its customers to review, assess, recommend and implement field systems to address operational and strategic air defense requirements. The Lockheed Martin GBAD family of systems approach will assess, identify and address gaps to ensure customers are provided with a tailored solution which is flexible and has room for future growth. The system's interoperability will enable it to integrate with legacy and new platforms and systems.



Modern warfare requires flexibility, responsiveness and agility to take full advantage of all capability to defeat future threats.



IET partners collaborate on world-leading simulators

This October, BMT and the Universities of Bath and Exeter launched the first of two multi-million pound facilities, paving the way for multi-disciplinary research into human factors, virtual reality, healthcare and the built environment.

The VSimulator facilities are new test platforms that are being built at the Universities of Bath and Exeter. These consist of hydraulically and electrically powered moving chambers that allow researchers to study the impacts of vibration and movement on people's wellbeing in a range of environments, from working and living in skyscrapers and on vessels, to operating equipment in industrial environments.

£4.8m project

The £4.8 million VSimulators project aims to discover more about how to design environments to make their occupants and operators as safe and as comfortable as possible.

The facilities are being developed with funding from the Engineering and Physical Sciences Research Council (EPSRC) and the support from contractors including Holovis, E2M, Servotest Testing Systems, Temperature Applied Science and Antycip Simulation.

VSimulators

At the University of Bath's Faculty of Engineering & Design, the box-shaped chamber can sway up to 40cm horizontally which, when combined with climate, sound, air quality and visual controls and either VR headsets or highly-detailed 3D virtual projections onto the internal walls, will allow researchers to accurately measure human responses to their environment. This facility will accommodate two occupants for research purposes and opened for commercial and academic use this October.

Meanwhile, the University of Exeter is currently constructing a three-storey building at Exeter Science Park for its VSimulators multi-disciplinary platform. This will offer a state-of-the-art facility that will provide VR technology capable of immersing up to nine occupants simultaneously in headset-projected VR scenarios.

The custom-designed, 4m x 4m motion platform will be able to move in six degrees

of freedom and will be linked to the VR scenarios to help users perceive realistic motion as they move around in a virtual world. Optical and inertial motion-capture systems and an array of force plates will record their experiences. This facility will be open for commercial and academic use from January 2020, with applications within and beyond architectural design.

The impact of the built environment

One of the applications of VSimulators is helping to understand the impact the built environment has on humans. As tall buildings become increasingly common in the UK, the research so far has found that being in a swaying building can cause tiredness, low mood, difficulty in concentrating and a lack of motivation. Such symptoms can negatively affect wellbeing and productivity, so they must be understood and considered by building developers, designers and contractors.

"Our understanding of living and working in tall buildings is extremely limited



VSimulators offer opportunities for collaborative international and multi-disciplinary research and innovation, linking academic and commercial communities.



The VSimulators chamber will be able to replicate the feeling of being in a swaying building.

Corporate

and, crucially, the acceptability of these environments depends on the context. So for example, we all expect a train to rock from side to side when it moves, but we don't expect it of a building," says Dr Antony Darby, Head of Civil Engineering at the University of Bath.

"One of the things we'll be looking to investigate is Sospite Syndrome. This is the effect on the body of almost-unnoticeable movement that can cause tiredness – it's the same response as the one we take advantage of when rocking a baby to sleep. Understanding what kind of movement is acceptable and the level at which negative responses occur will help us inform designers creating the next generation of tall buildings.

"Understanding the human effects of swaying is particularly important from an economic perspective. Many people work

in tall buildings and if a swaying effect can cause an individual's productivity to drop by 5%, this could translate into billions of pounds of lost productivity every year."

Multi-disciplinary research

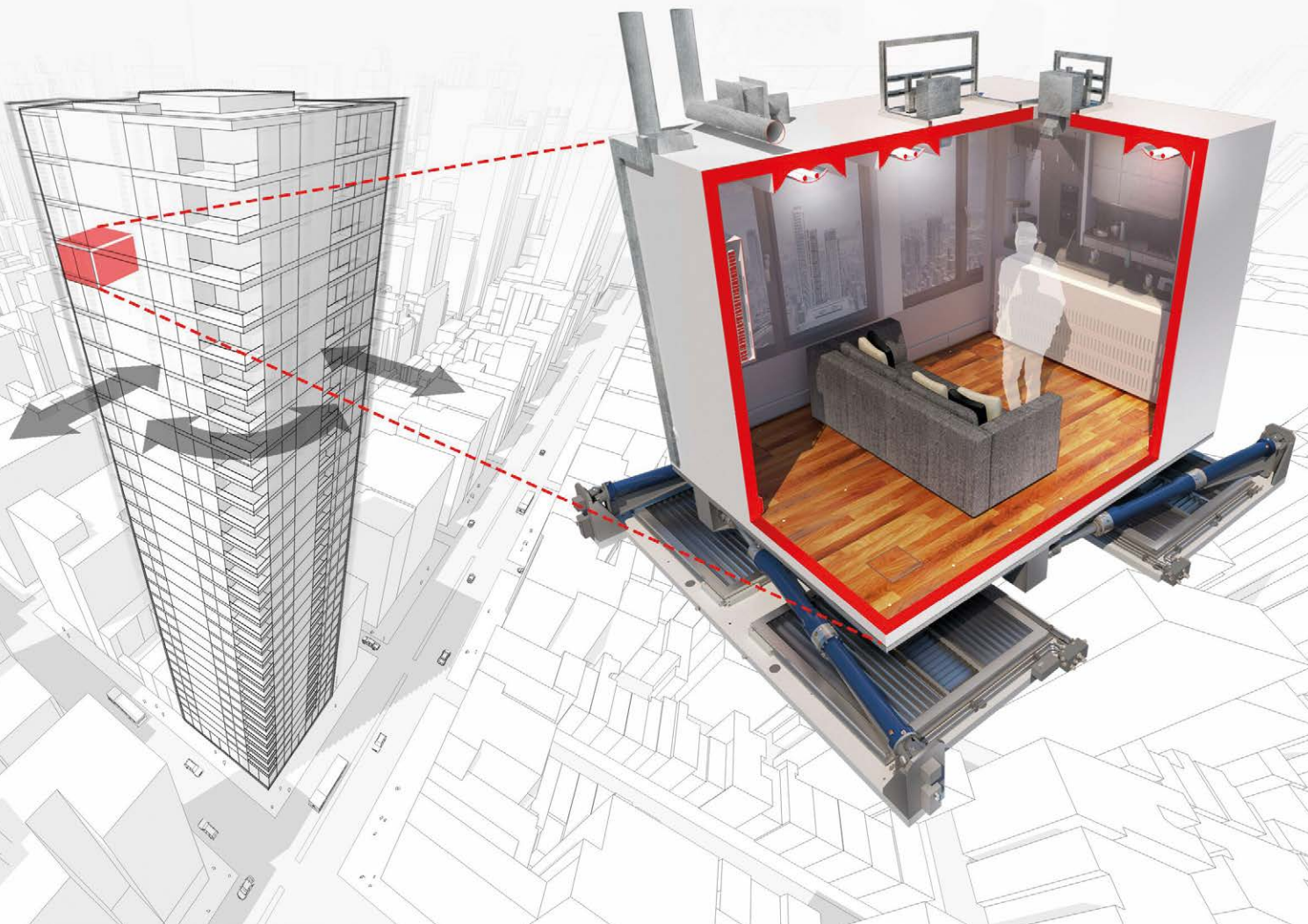
"VSimulators offer opportunities for collaborative international and multi-disciplinary research and innovation, linking academic and commercial communities," continues James Brownjohn, Professor of Structural Dynamics and Principal Investigator for VSimulators at University of Exeter.

"Our initial focus will be on factors including vibrations that compromise user experience in the built environment such as wobbly footbridges and bouncy office floors, but we will also study user-centred design of building environments, biomechanics of human balance on moving surfaces and rehabilitation physiotherapy."

These facilities will not only help design new physical environments, but can also help mitigate the impact of existing environments through better training as well as enhanced immersion in synthetic environments.

"I'm personally excited by the technical integration the VSimulators motion platform will bring to our immersive VR solutions at BMT," says Mike Cottrell, Visualisation Capability Manager, at BMT.

"Integrated immersion will bring a completely new dimension to what we can offer customers to simulate scenarios in a much more realistic way. Being able to move the environment independent of the individuals, whilst keeping immersion synchronised, will be a powerful combination that we are looking forward to exploiting."





Students work in teams to complete project tasks



Students received hand-on professional harness training from Ultra's experienced technicians

Ultra Electronics' engineering graduates develop summer school

Ultra Electronics Precision Control Systems (PCS) is a leading developer of mission and safety critical equipment in the aerospace and defence industries. It's

committed to supporting young talent and encouraging students into STEM subjects to maintain the pace of innovation and high standard of engineering work within the company and industry as a whole.

PCS' engineering graduates successfully built on previous experience to design and deliver an extensive week-long summer school with local students "who are at that critical age where they are choosing their future exam subjects," says Hisham Awad, PCS' Engineering Director.

If you ask any engineer what the key to their job is, they will say it's the fundamentals of their discipline. The summer school students were therefore taught both theoretical and practical aspects of the mechanical and electronic engineering fields. The practical segment of the week was a course normally reserved for new operators and engineers, featuring best practice and techniques used to create an aircraft grade harness, a vital, life-saving piece of equipment.

The goal was to give the students an idea of what it's like to work in engineering and what skills they need in their future education.

“

It's definitely reinforced my idea to pursue engineering in the future.

”

"This summer school was a great experience," says student Pranay. "Now I know exactly what I need to do to become an engineer."

The students also took part in professional skills sessions to develop their interview techniques and interpersonal skills.

The final challenge combined all the elements taught throughout the week and was a great way to assess the students' progress. The challenge was completed with a presentation where the students proposed their design solution.

"It was impressive how much they had progressed in such a short space of time," says PCS Graduate Engineer Millie Midwinter-Lean.

Feedback from the students was extremely positive and confirmed to many of the students that engineering was a career worth pursuing. "It's definitely reinforced my idea to pursue engineering in the future," says Pranay.

Ultra Electronics PCS aims to build on the success of this summer school with another week scheduled for summer 2020.

Preparing for 5G – the 700Mhz clearance project

Report by **Tony Mattera**, Technical Solutions and Architecture Director, Arqiva.

As the promise of 5G gains momentum, the race is on to ensure that enough spectrum is available on the most suitable bands to support it. Initiated by Ofcom in 2014, the 700Mhz clearance project involves Arqiva moving a large number of digital terrestrial television (DTT) multiplexes from the 700Mhz band to different frequencies so that the spectrum can be freed up to ensure the potential of mobile's next-gen technology is fully realised.

Considering 80% of our DTT transmitter sites are affected by 700Mhz clearance, this has been no easy task. Changing the transmission frequency of the nation's favourite channels, including the BBC, ITV and Channel 4 at major transmitter sites across the country has to be done with minimal disruption to viewers. And, with the enjoyment of 65 million people at stake, and a timescale that coincides with huge televised events like the 2018 FIFA World Cup and Wimbledon, this project has relied on a truly meticulous planning process.

Frequency planning

Once it was confirmed that the clearance was going ahead, we worked closely with all stakeholders – including Ofcom, Arqiva,

television and radio broadcasters, plus a number of delivery partners – to develop a new frequency plan. Alongside these key industry players, we created a transition roadmap which relocated services to new frequencies to maintain coverage, whilst minimising interference between transmitter sites in an increasingly congested lower frequency band.

In some parts of the UK, there are simply not enough frequencies available to support the number of transitions, which has led to whole number of new challenges for spectrum planners. In order to overcome this, we have been transmitting signals on the same frequency from adjacent stations to create a single frequency network. For

this to be successful, we also had to introduce time synchronisation systems.

Rollout planning

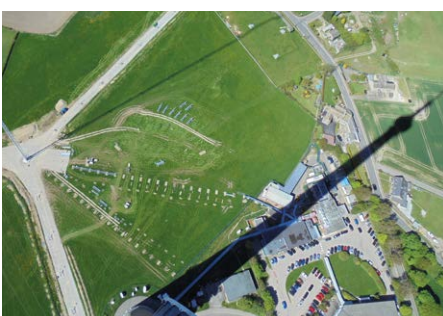
As well as a robust frequency plan, the smooth execution of the 700Mhz project depends on a strict order in which changes are made to avoid impact on viewers. With the main station frequency plan finalised by 2016, we once again collaborated with our stakeholders to develop an agreed transition sequence which dictates the order in which frequencies are to be changed. Once a stable sequence for the planned frequency changes was determined, this was used as the underlying plan against which all design and implementation activities have taken place.

Comprising of 54 retune events, each affecting multiple main stations and relays, this plan kicked off in 2017 and is expected to run until 2020. As well as taking a staggered approach, each step has also had to fit around protected events such as the June 2017 General Election, plus the May 2018 Royal Wedding and this Autumn's Rugby World Cup.

“

This project has relied on a truly meticulous planning process.

”

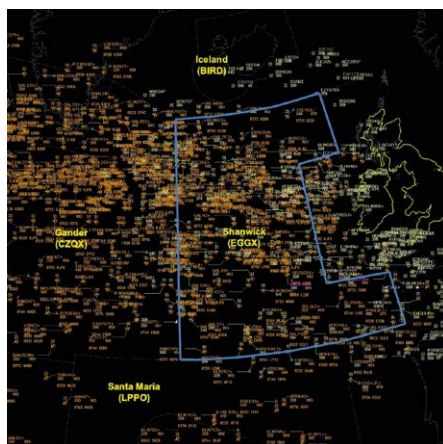


How satellite tracking is revolutionising air traffic control

In the days of the very earliest transatlantic crossings, pilots pitted their wits against the elements – just them and a canvas aircraft against a near endless expanse of sky and sea, no radar coverage and no way of contacting help if things went wrong.

Even today, with nothing to build radar stations on, it's traditionally been impossible to track flights across the world's oceans in real-time. Instead air traffic controllers have relied on infrequent position reports, with flights given very strict route and speed restrictions to keep them in the right place at the right time.

UK air traffic service provider, NATS, along with the Irish Aviation Authority (IAA), manages transatlantic flights crossing the North Atlantic to 30 degrees west. This is known as the Shanwick Oceanic Control Area. Their Canadian counterpart, NAV CANADA, provides a similar service across the other half of the ocean.



This corridor of airspace forms the gateway between North America and Europe. NATS handles around 80% of all transatlantic traffic and as such, the performance of that oceanic service is not only absolutely essential to the smooth running of both Europe and the UK's air traffic network, but also their wider economies.

Old limitations

With no real-time air traffic surveillance coverage, aircraft routes and trajectories had to be planned hours in advance, following what is known as the organised track structure. Flights on these tracks report their positions every 14 minutes and are kept apart by as much as 40 to 120 nautical miles (nm).

These large separation standards ensure safety, but the lack of instantaneous position reporting has been a limit on capacity and fuel efficiency. With traffic hitting record levels in 2018 with over 500,000 flights, and up to 800,000 forecast by 2030, a radical change was required, which is precisely what NATS introduced this March.

Space-based ADS-B

The use of satellite air traffic surveillance, known as space-based ADS-B, is now allowing NATS to monitor aircraft positions in almost real-time. This quantum leap in performance has allowed it to trial the implementation of reduced aircraft separation distances down to as little as 14nm, thereby making the airspace more flexible, predictable and capable of accommodating the immense growth predicted in the coming years.



The transformational power of ADS-B opens up new services and improves safety and environmental performance.



Corporate

From 28 March to the 31 August 2019, there were over 2,400 additional North Atlantic flights compared to the same period in 2018. In addition to accommodating this higher volume of traffic, space-based ADS-B has allowed NATS to improve safety and flight efficiency. Over 4,400 more flights were assigned their requested level when compared to 2018, most of which were previously flying 2,000 or 3,000 feet lower than requested last year, burning more fuel than they needed to.

These improvements not only reflect controllers being able to offer a better level of service, but also provide a corresponding safety benefit. They reduce the risk of level busts – where an aircraft mistakenly climbs or descends from the cleared flight level assigned by our controllers – or navigation errors, when flight crews may inadvertently follow their flight plan route and not the route assigned by controllers in their air traffic control clearance.

Over that same period, NATS was able to reroute 3,419 fewer flights from their assigned route, while its coincident speed trials enabled around 43,000 flights – over one third of all eastbound traffic – to be instructed to 'resume normal speed' for a total duration of 2.2 million minutes, or 37,000 flight hours. This allowed those flights



to fly at the speed that best suited them, as opposed to the inflexible fixed speed environment they had to operate before.

More to come...

From a technical point of view, since the end of March NATS has received over 134 million ADS-B reports. All arrived routinely, updating within the target of eight seconds, with most as low as 2-3 seconds. The average time it took for those position reports to reach a controller was just 0.19 seconds, against a target of two seconds. These changes are a fantastic start, but there's more to come.

This autumn NATS is introducing reduced lateral separation minima, safely reducing separation from wingtip to wingtip from

23nm down to 19nm. In addition, in collaboration with the IAA, it will introduce very high frequency (VHF) radio communications in the airspace over the Bay of Biscay for the first time. This will enable this key European network traffic artery to remain available at all times to augment capacity elsewhere within Europe.

"What we're doing here is important not just for our customers, the airlines, but for the wider industry worldwide," says Andy Smith, NATS Head of Strategic Oceanic Engagement. "It's hugely exciting to see the progress we've made so far, and what's to come elsewhere as the transformational power of ADS-B begins to open up new services and improve safety and environmental performance."



Corporate



Leonardo engineers take on Three Peaks Challenge

“ We've gained so much from this challenge as a team and our passion for our shared charities brought us closer together. ”

A team of enterprising Yeovil trainees and managers from aerospace engineering company Leonardo have scaled the highest mountains in Scotland, England and Wales to raise over £2,700 for Mind in Somerset and Yeovil Opportunity Group.

Over the course of 24 hours, the team drove 466 miles, walked 23 miles and ascended a height of 3,400 metres to complete the challenge. The team of Leonardo climbers were drawn from a wide swathe of the Yeovil-based business, from graduates and apprentices through to helicopter production managers and project engineers.

The climbers were supported by a team who took care of them during the challenge, often driving through the night to take them safely to their next mountain. This support proved vital to the forward momentum of their climb, as no sooner had they completed their Ben Nevis hike on the Saturday night, they were swept into cars for an overnight journey to an early Sunday morning climb up Scafell Pike, which stands at a height of 978m in the Lake District National Park, in Cumbria.

Having completed the climb in just over four hours, the team were then driven to Mount Snowdon in Wales, to scale the final 1,085m which stood between them and the completion of their challenge.

The fundraisers have formed strong bonds with both Yeovil Opportunity Group and Mind in Somerset over the course of their community activities. Yeovil Opportunity

Group is a unique pre-school dedicated to giving children and families extra help and specialist support through the early years learning journey. Mind in Somerset provides support to those who are suffering from mental health issues, with a special focus on young people aged 11-18.

"When the team were climbing Ben Nevis we saw a twelve point stag and moments later an AW189 flew above us on a mountain rescue mission. The AW189 has been produced by Leonardo and we're very proud of our technology," says support team member Claire Cole.

"The challenge was such a fantastic display of camaraderie amongst our team. In a way it is quite fitting that one of the charities we are supporting is Mind in Somerset, as towards the end it really was a game of mental strength to get everyone through the last hike up Snowdon. We've gained so much from this challenge as a team and our passion for our shared charities brought us closer together."



Professional Registration Webinars

Whether you're just starting on your journey, already have your application underway or just need some questions answering, our webinars provide direct support on your journey towards professional registration.

theiet.org/registration-webinars

The Institution of Engineering and Technology is registered as a Charity in England and Wales (No. 211014) and Scotland (No. SC038698). Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire, SG1 2AY, United Kingdom.

Make a difference to future engineers

Donate now and we'll match it,
pound for pound.

Learn more about our
initiatives and how to support us:

theiet.org/development

The Institution of Engineering and Technology is registered as a Charity in England and Wales (No. 211014) and Scotland (No. SC038698). Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire, SG1 2AY, United Kingdom.

Membership Contacts UK



Mark Organ

Head of Membership
 T: +44 (0) 1438 765685
 M: +44 (0) 7889 317908
 E: markorgan@theiet.org

Partnership and Development Team



Sally Davidson Jones

Partnership & Development
 Manager
 T +44 (0) 1438 767409
 M +44 (0) 7725 498135
 E sdavidsonjones@theiet.org



Matthew Barber

Senior Partnership Account
 Manager
 T +44 (0) 1438 767292
 M +44 (0) 7720 090918
 E matthewbarber@theiet.org



Sam Law

Regional Development Manager
 Area: *South West*
 M +44 (0) 7843 344489
 E samlaw@theiet.org



Jordan Osborn

Academic Account Manager
 T +44 (0) 1438 761495
 M +44 (0) 7725 205684
 E jordanosborn@theiet.org



Jo Deal

Senior Development Manager
 Area: *London and South
 East England*
 M +44 (0) 7713 387567
 E jdeal@theiet.org



Mark Samson

Regional Development Manager
 Area: *Midlands*
 M +44 (0) 7710 725112
 E marksamson@theiet.org



Kayleigh Winter

MOD Development Manager
 M +44 (0) 7720 090913
 E kayleighwinter@theiet.org



Paul Stephens

Senior Corporate Account
 Manager
 M +44 (0) 7725 498152
 E pstephens@theiet.org



Jack Crosswell

Regional Development Manager
 Area: *East of England*
 M +44 (0) 7710 320760
 E jcrosswell@theiet.org



Nidhi Shukla

Partnership Account Manager
 T +44 (0) 1438 211477
 M +44 (0) 7725 498150
 E nshukla@theiet.org



Fiona Harvie

Regional Development Manager
 Area: *Scotland and Northern Ireland*
 M +44 (0) 7711 406376
 E fharvie@theiet.org



Matthew Walton

Regional Development Manager
 Area: *North West and North Wales*
 M +44 (0) 7725 207931
 E matthewwalton@theiet.org



Ed Harrison

Regional Development Manager
 Area: *North East*
 M +44 (0) 7761 525640
 E edharrison@theiet.org

Membership Contacts UK

Partnership and Development Team



Heather Brophy
Regional Account Manager
M +44 (0) 7936 341419
E heatherbrophy@theiet.org



Sam Heron
Regional Account Manager
M +44 (0) 7936 341410
E samheron@theiet.org

Professional Registration Account Team



Adam Parnell
Professional Registration Account Manager
M +44 (0) 7720 090921
E adamparnell@theiet.org



Clare Peacock
Registration Account Process Manager
T +44 (0) 1438 211472
E cpeacock@theiet.org



Rhiann Birch
Technician Account Manager
T +44 (0) 1438 765516
M +44 (0) 7850 731444
E rbirch@theiet.org

UK International Operations



Ian Mercer
Head of International Operations
T +44 (0) 7872 844419
E imercer@theiet.org



James Howe
International Business Manager
T +44 (0) 1438 765631
E jhowe@theiet.org

International Contacts

India



Shekhar Sanyal
Country Head
T +91 (0) 9538 400777
E ssanyal@theiet.in



Raghavan S
Head - Membership and Partnerships
T +91 (0) 9538 400137
E raghavans@theiet.in



Working to engineer a better world

Read more inside...

Our offices

London, UK

T +44 (0)20 7344 8460

Stevenage, UK

T +44 (0)1438 313311

Beijing, China

T +86 10 6566 4687

Hong Kong

T +852 2521 2140

Bangalore, India

T +91 80 4089 2222

New Jersey, USA

T +1 (732) 321 5575

@TheIET       theiet.org



By using Carbon Balanced Paper for this publication of Partner News, the IET have helped protect 312m² of critically threatened forest. And balanced through World Land Trust the equivalent of 446kg of carbon dioxide.

The Institution of Engineering and Technology (IET) is registered as a Charity in England and Wales (No. 211014) and Scotland (No. SC038698). The Institution of Engineering and Technology, Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire SG1 2AY, United Kingdom.

