

Summer 2023

WEST CUMBRIA NEWSLETTER

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PLUS

- 2020 and 2021 event highlights
- Your guide to membership and upgrades
- Upcoming events in 2023 and beyond

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ABOUT IMECHE

The Institution of Mechanical Engineers is the professional body overseeing the qualification and development of mechanical engineers. It has 115,000 members in 140 countries.

Visit imeche.org for more information about membership or professional registration and its benefits; visit www.imeche.org/membership-registration/become-a-member. Alternatively, contact David Williamson on our area committee via email: david.j.williamson@sellafieldsites.com

EDITORIAL

Design and Editor: Matt Williamson
Published on behalf of the Institution of Mechanical Engineers West Cumbria Area.

Views expressed in this publication are not necessarily those of the Institution, its members or its publisher.

Hi all,

It has been quite a while since the last Newsletter from IMechE West Cumbria, so first of all I would like to introduce myself as the new Chair of the committee. I have been on the committee for more than ten years now and have previously held the position of Treasurer and the Secretary before that. In my day job I work as a Forensic Engineer, primarily in collision investigation. Some of you may have added presentations I have done on my work in the past. That is enough about me. What have we been doing since our last Newsletter in 2020?

As I am sure you will all have experienced, the last few years have been an interesting time with a huge amount of upheaval caused by the COVID-19 pandemic. As would have been the case for most of you, the West Cumbria Area Committee of the IMechE, changed the way it worked to deal with the constraints of the pandemic and social distancing, and learnt some lessons along the way.

After cancelling several spring 2020 events due to the pandemic, our committee quickly adapted to organising virtual meetings. We created a revised calendar of virtual events from late 2020 to most of 2021. These covered diverse engineering topics, such as 'How to Become World Class from the Kitchen Table' and the thrilling 'Jet Suit Paramedic'.

We have now found ourselves returning back to a similar program to pre-pandemic with face-to-face committee meetings, in-person presentations and industrial company visits. However, we have not let the lessons of the pandemic go to waste, we now use virtual presentations for some events allowing us to extend pull into guest speakers who would not normally find their way to West Cumbria.

As ever, we have an exciting programme of events this Autumn including a presentation on Advanced Rubber Materials by James Walker and a talk on Medical Technology by Professor Jill Stewart from the University of Cumbria. Our upcoming events can be found in the Newsletter - with more to add soon.

One area of activity that took a real hit during the pandemic was our support of local educational activities. However, we continued our £1,000 bursary awarded to a local student each year to help them as they move into studying engineering in further education.

This year, we organized the Climate Change Challenge Speaking Competition to support budding engineers. It provided

young engineers and students with an opportunity to enhance their presentation skills. Participants presented ideas on how engineering can address the global challenge of climate change. The quality of the presentations was impressive.

However, I am most satisfied that after a few years off the calendar, we brought back our STEM education extravaganza for primary school students, which is being held in conjunction with the return of our annual dinner on 15th June. As with our annual dinner, the education event will use 'Space' as a theme. I was very pleased by the uptake of places at our STEM event with it being fully booked soon after invitations were sent out to the local schools, which shows that there is an appetite for these kind of events in West Cumbria.

This year, the education event was supported by our dinner Gold sponsor Jacobs and the React Foundation. These STEM events are funded by our Annual Dinner and we are grateful to all our sponsors. May I take this opportunity to thank them and hope for their continued support in nurturing the next generation of engineers.

As ever, we are always looking for new members to reinforce and supplement our Committee, so if you feel like enhancing your Chartership/ Fellow credentials and adding an extremely worthwhile activity to your CV (as well as wanting to help us maintain the West Cumbria branch as one of the most productive and successful Area Committees in the country) get in touch with me.

With best wishes,

Simon Farrell CEng MIMechE
Honorary Chair – IMechE West Cumbria Area Committee



Simon with 2022 bursary winner Tyler James Chambers from Whitehaven. Tyler completed an HNC in Mechanical Engineering at Lakes College and is now studying at Leeds University.



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Aqil Hussain

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> Find out more about becoming a member or upgrading your membership on page 15.



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DESIGNING FOR THE INTERNET OF THINGS

The event on the 10th December 2020 was a virtual webinar, with subject "Internet of Things", which was very appropriate for our virtual webinar. Being a virtual event, alongside our West Cumbria attendees, we also had attendees from elsewhere in the UK, as well as from Kenya, Botswana and Bangladesh.

The talk focused on the design considerations for the "Internet of Things" (IoT) and how these demands are being addressed. The speaker was Tim Wilmshurst who is an experienced professional in the electrical and electronic industry. John Foster, IMechE West Cumbria committee member, introduced Tim and highlighted their previous connection and work in Botswana.

Tim is a renowned academic and author of textbooks, with over 40 years of experience in designing systems with embedded digital control. In his career, Tim's work has ranged from scientific instrument systems, through to industrial systems using micro-controllers, to drone design and more recently multiple applications of the ARM Processor (ARM Embedded Technologies).

A design engineer or leading academic in three Universities; the University of Derby, Cambridge University and the University of Botswana, Tim has also worked in academia for many years. Beyond electronics and software, he is very interested in the process of engineering design and understands the place of mechanical engineering in the overall system design and prototyping. Now semi-retired, Tim enjoys being a freelance educator and technical author.

IoT Overview

The talk began by Tim discussing what the term "Internet of Things" (IoT) means and that the presentation would in particular focus on designing the "things", for the internet of things.

IoT enables devices to communicate autonomously, making decisions and taking actions without human involvement. These "smart" devices face conflicting demands, including low power consumption, affordability,

advanced capabilities, data processing power, and secure communication. Tim discussed how the IoT presents challenges to the original conception of the internet, which was primarily intended for human access to information and communication. This poses challenges to all of us, and even challenges the fundamental concept of the internet itself.

Tim reiterated that "things" do not always have to be clever or sophisticated devices. An example of this is Smart Farming which is a big application of IoT, whereby livestock can be fitted with biochip transponders or monitors to locally track field by field what's going on climatically or with soil humidity.

Topics touched on included the miniaturisation of sensors and processors; their integration into purpose-built smart transducers; communication protocols; economics; energy consumption at the level of the chip and size.

Challenges Surrounding IoT

It was important for Tim to point out that there are security issues that developers have to deal with. These are associated with devices that are easily attacked and that can be used to access the systems at a higher level, making it possible to substitute malware or modify the coded programs. The example Tim provided was vulnerabilities in the ZigBee Internet of Things networking protocol which left smart devices, such as Phillips Hue smart bulbs, open to exploitation.

With the smart bulb example, the attacker adjusts the colour or brightness settings to convince the user that the bulb is faulty, thus making the individual try and reset it. The user then deletes the bulb from the smart bulb app and attempts to reconnect the bulb (now hacker controlled with updated firmware) and re-joins the IoT network. The bulb bombards the controller with data requests, triggering a buffer overflow. The hacker installs malware

on the controller, which is connected to the target IP network. The attacker can then infiltrate the target network to spread ransomware or spyware. Work continues securing such security problems, problems in which manufacturers have constantly update and innovate to stay ahead of hackers.

Tim stressed that the simplest devices are most vulnerable to hacking, and not to think just because you're measuring temperature with a small 'smart' sensor that you're not going to be vulnerable - if you're connecting to the internet you've got to be aware. Once a hacker has gained access to the system, the hacker will identify and target the weakest aspect.

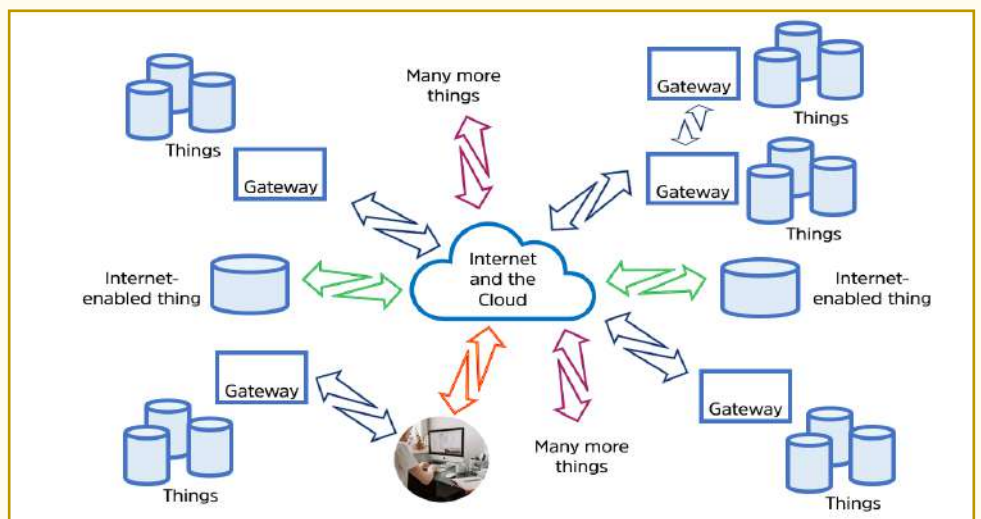
Project Spotlight: OSWAP Top 10

Tim reassured that there is help out there, not just from the tech giants. There is an organisation called OWASP, and every year or so they identify the top 10 security challenges for the IoT.

The Open Web Application Security Project® (OWASP) is a non-profit foundation that works to improve the security of software. Through community-led open-source software projects, hundreds of local chapters worldwide, tens of thousands of members, and leading educational and training conferences, the OWASP Foundation is the source for developers and technologists to secure the web.

The presentation was then drawn to a close with Tim concluding that the IoT is here to stay and is already impacting on daily life with lots more to come. For people like Tim who are designers working in different fields of engineering, they have huge opportunities and power now available to them with small low power and low-cost device. But these opportunities come with challenges, around security and energy supply which are just as interesting as the evolving IoT technologies.

John Foster



When we emerged from the pandemic, we resumed our "in person" events to continue providing the insights, inspiration, and education to people empowered by engineering. Below is a quick recap of some notable and well received events in 2021, that we successfully carried out as measures relaxed. Now back to full strength, we look forward to welcoming more attendees to our talks and events.



IMPLANTS AND HOW THEY BEHAVE IN THE BODY

On October 21st 2021, IMechE West Cumbria held its first 'in-person' event since the COVID-19 pandemic. Held at Lakes College West Cumbria, our guest speaker was Dr. Phil Hyde from Newcastle University, focusing on surgical implants.

Dr Hyde is a bioengineer and lecturer in orthopaedic engineering at Newcastle University. Additionally a chartered engineer, he has expertise in bio-tribology, biomechanics, biocompatibility, surface micro topography, and mechanical failure analysis.

The research of Dr. Hyde primarily revolves around artificial replacement joints, with a particular emphasis on

various aspects such as wear, friction, lubrication, materials science, corrosion, and forensic engineering. His work encompasses investigating the behaviour of artificial joint tribology, studying the interactions between implants and bone interfaces, examining biological reactions to wear, selecting materials for improved longevity, and exploring corrosion in various types of implants including spinal fusions, hip, knee, shoulder, and ankle replacements.

The presentation presented how the effect of damage to cartilage that separates the sliding surfaces of knee and hip joints can have cause the body to react. The body responds by growing blood vessels and nerves into the damaged region. This leads to chronic pain which can only be cured by joint replacement.

The cost of joint replacement is quite high: typically about £10,000 for a hip replacement, but the added cost of remedial surgery if the replacement is not effective is even higher. It is therefore important to minimise this remedial requirement for financial as well as medical reasons.

Dr Hyde reviewed the evolution of hip and knee implants, from ivory ball and socket in 1891 to stainless steel and

PTFE components in the 1960s. Materials like titanium alloys, ceramics, and polyethylene have been used with varying pros and cons.

Wear debris is generated when surfaces articulate, but natural bone joints efficiently degrade and eliminate these particles through the bloodstream. However, commonly used implant materials do not biodegrade, leading to an immune system response involving macrophages. Unfortunately, these macrophages stimulate osteoclast cells that absorb the surrounding structural bone, gradually loosening the joint and causing pain and instability.

Dr. Hyde discussed his research on modelling the acetabular cup's load and studying implant material wear under simulated in vivo conditions. This valuable basic research informs the design of improved implant devices, enhancing quality of life.

The presentation came to a close before questions were asked about the evening's topic and Dr Phil's work into orthopaedic engineering. A well received talk by all, and fantastic to have our first IMechE West Cumbria 'in-person' event.

Dr Jack Hale



STRAIN GAUGING AN ANCIENT WINDMILL

IMechE West Cumbria members and guests attended a presentation on Strain Gauging an Ancient Windmill on November 30 2021. The talk covered the mill's structure, force analysis, strain gauges on timber beams, calibration, windy night results, and mill safety analysis.

Dr Jack Hale, a retired mechanical engineering lecturer at Newcastle University, has experience in coal mining, nuclear, and research on composite structures, strain sensors, and engine timing chains. He taught mechanics and dynamics, and now resides in West Cumbria, associated with Newcastle University as a Visiting Fellow.

Dr Hale discussed the post mill structure. This is a structure made of large timber beams held together by

self weight and compression joints. The risk of failure arises when high winds unload a compression joint, causing a beam to dislodge. To monitor the joint loads, load cell insertion was not feasible. The solution was to use strain gauges on the compressed beams, effectively turning them into load cells.

All the heavy mill machinery is contained within the buck, which is supported on top of the main post about which it can be rotated to face the wind. The main post is in turn supported on the four slanted "quarter posts" of the trestle, with complex compression joints between them. There is a potential failure mode if a high wind gust should blow the buck back sufficiently to reduce the compression load on a joint to zero. The quarter post would then fall out and the mill would collapse. This has been known to happen to similar mills in the past and so was of great concern to the owners.

Dr. Hale tackled the issue of costly load cell installation in the structure, which was unaffordable for a charitable trust. Instead, he suggested attaching strain gauges onto the quarter posts as a practical solution, effectively creating in-situ load cells. He explained strain gauge usage and demonstrated a technique to accurately measure axial strain using two gauges on opposite

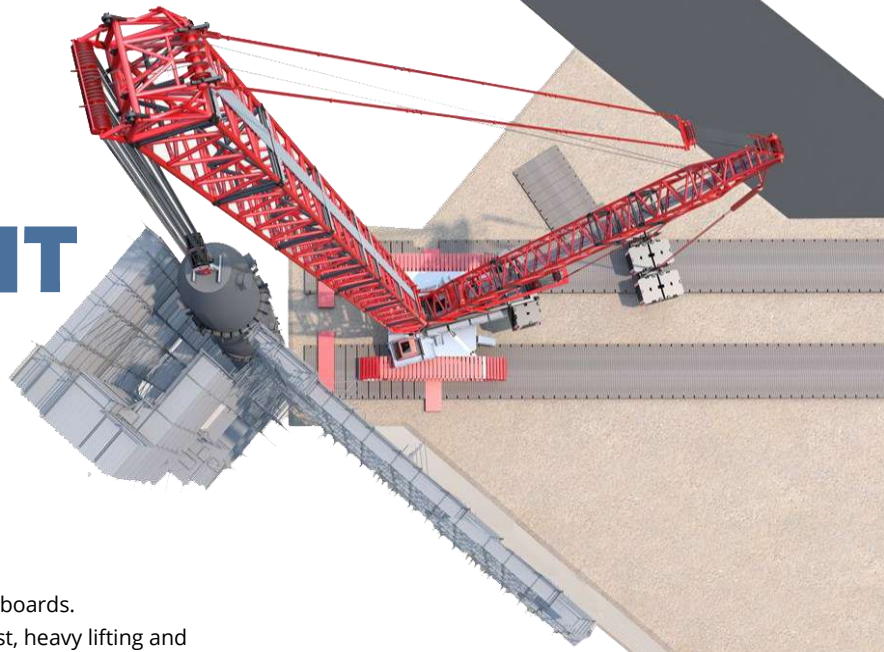
sides of the beam. By employing a Wheatstone Bridge configuration, the strains could be combined to negate the influence of bending effects.

Dr. Hale explained the calibration of the "load cells." Direct calibration was impractical, so an alternative bending method was used. Strain gauges were temporarily rewired in a Wheatstone bridge to measure the difference and calculate bending strain based on beam dimensions. Known loads were applied perpendicularly to the beam (Figure 3) to calculate bending stress and compare it with measured strain. This provided accurate calibration for the axial load cells when the bridge was rewired for axial strain measurement.

Dr. Hale presented results from a windy night in November 2010. Strain gauge signals showed reduced compressive load during a high wind gust. The decrease (20kN) was below the estimated static load, posing no collapse risk. Extrapolation determined a wind speed over 100mph would be needed for collapse, exceeding local records. Owners were reassured, and the mill remains a popular tourist attraction.

Dr Jack Hale

MAMMOET: BREAKING THE BLUEPRINT



Mammoet provides solutions to any heavy lifting or transport challenge and have developed a ground-breaking 3D digital platform that makes project planning more accessible, efficient and smart.

IMechE West Cumbria Area had the pleasure of Mammoet's Engineering Team on 24th May 2022, who gave a presentation of their new 3D Digital Twin Software solution - Move3D.

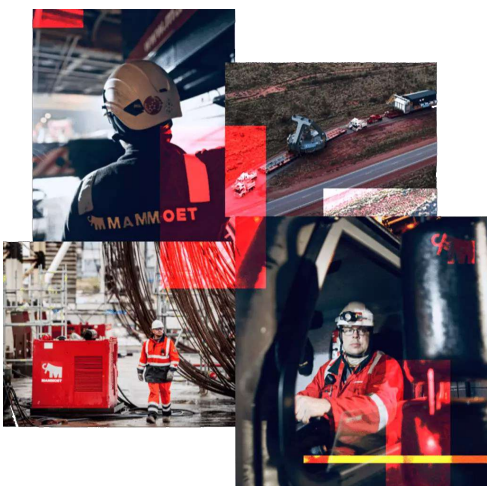
Mammoet's Move3D platform is a 3D engineering application that combines business intelligence, such as crane charts, with Mammoet equipment and client data. It is independent from crane manufacturers and has been developed with the end-user in mind - showing the customer what is going to happen, instead of having to rely on explaining.

The presentation was introduced by Mammoet's Sales Manager Yusuf Warsama who joined Mammoet as an Engineer in the cranes and rigging team. He created lifting drawings and safe work systems for the core cranes business. He also introduced his colleagues Dennis van den Boogart and John Malcolm.

Dennis has extensive experience and expertise in 3D engineering he was a member of the team that helped develop Move3D and acts as a technical consultant for clients around the world. John is an early pioneer of the newly developed Move3D software, combining it with the use of 3D LIDAR scanning to safely execute complex heavy lifting projects within the UK and introduced the impact 3D technology was having on the industry.

Traditional Planning

Modern engineers use tools like LIDAR surveys and digital mapping for efficient route planning and stability assessment. In the past, lift preparations were manual, resource-intensive, and done with pencils



and drawing boards.

In the past, heavy lifting and transportation projects relied on detailed planning to ensure success. This planning stage involved discussing client requirements and developing the best solution for the task at hand. Traditionally, two-dimensional technical blueprints were used to communicate and finalise plans. However, this approach had its limitations.

Mammoet Leading the Way

Yusuf discussed the evolution of the company. In the 1990s, Mammoet pioneered digital crane selection and planning in 2D project plans. This tool stored crane information, eliminating manual calculations for precise planning. While 3D CAD lacks immersive and interactive features, it fails to integrate heavy lift planning with projects, causing wasted time. Digitalisation has transformed industries, including industrial and energy sectors, using techniques like digital twinning.

The construction sector has embraced digital technologies, bringing numerous benefits to customers. These technologies have enabled better planning for challenges like unstable ground and hazardous materials, improved project and team connectivity, and enhanced data collection.

The use of 3D models has proven advantageous over traditional 2D formats. It allows for clearer communication of complex projects, reducing the risk of misinterpretation and providing a better understanding of chosen methods. Customers can interact with the 3D models, exploring different perspectives and timeframes, facilitating discussions and informed decision-making. Additionally, virtual tours of construction sites using the 3D models help identify potential issues early on, leading to proactive issue management.

While the potential for 3D project visualisations has long been recognised, technological barriers limited its widespread adoption. However, recent years have seen advancements in processing power, enabling real-time, high-quality visualisation of complex tasks that surpass the capabilities of traditional CAD applications. These advancements have opened up new possibilities in the construction industry.

The Development of Move3D

In 2018, Mammoet developed Move3D; a 3D engineering platform, offering customers accurate and immersive 3D project

visualisations. Move3D integrates business intelligence, client data, and Mammoet equipment to create visualisations that can be easily incorporated into customers' existing digital systems.

Dennis stated that The Move3D system by Mammoet enables the presentation of project plans in a clear and simplified manner, providing clients with a detailed view of the work from different perspectives and stages. This facilitates better comprehension of the project and enables early detection and discussion of any potential issues or modifications.

Move3D system has been effectively utilised in diverse projects, such as the BASF heat exchanger replacement in Germany, where it accurately depicted space limitations. BASF's project manager lauded Move3D for its ability to effectively communicate planned activities to decision-makers. Mammoet plans to implement Move3D worldwide and adapt it for evolving technologies as clients adopt advanced digital tools. The goal is to provide optimal support for project planning and workflow optimisation, ensuring Move3D remains an effective platform.

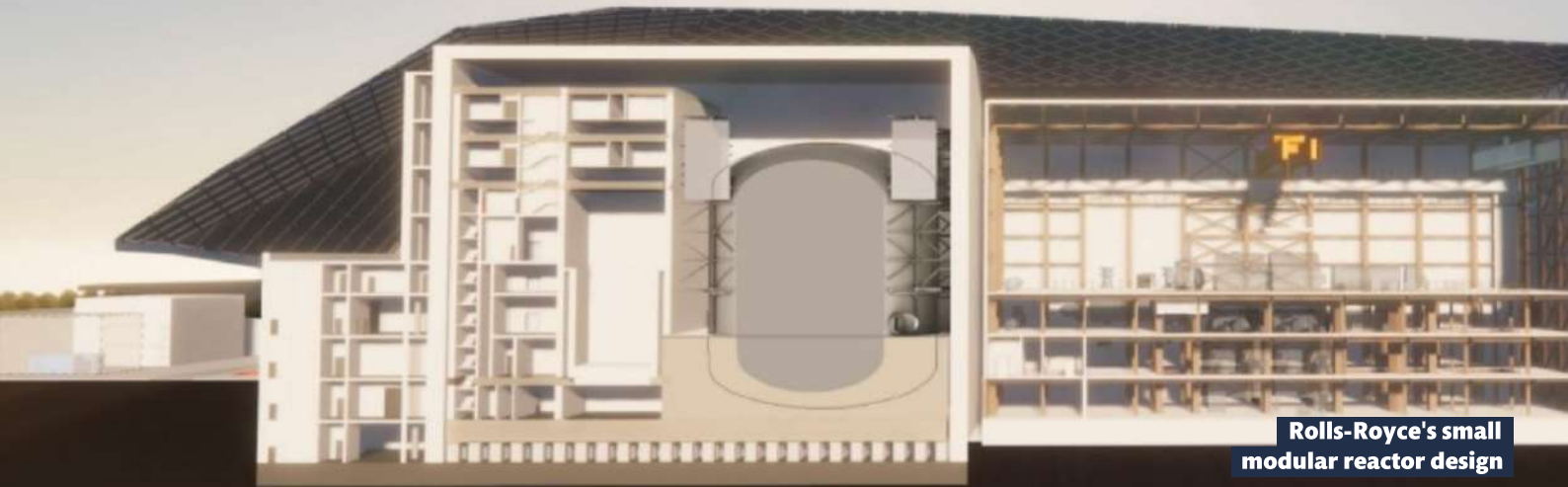
An intellectually stimulating talk on this pioneering modelling technique.

Adrian Norendal



CLEAN, AFFORDABLE ENERGY FOR ALL

With the government announcing its backing of development of Small Modular Reactors (SMRs) at COP 26, the race is on to realise the potential of this technology. Rolls Royce SMR is leading the way to make SMRs available to be produced with the ambition to start building reactors in both the UK and abroad within the next couple of years.



Rolls-Royce's small modular reactor design

On 27th September 2022, we were pleased to welcome Paul Howdle, a distinguished engineer from Rolls-Royce, who gave a talk on Small Modular Reactors (SMRs). Unlike traditional nuclear power plants, which are large and complex, SMRs are small and modular, making them easier to deploy in different locations. This technology has the potential to provide a reliable source of clean energy that can help to reduce greenhouse gas emissions and tackle climate change.

As the current Head of Engineering at Rolls-Royce SMR, with accountability for establishing and maintaining engineering capabilities necessary to deliver the SMR nuclear power station programme, Paul has a long history within the nuclear industry, having worked in various engineering and leadership roles at some of the largest companies in the sector. Prior to his current role at Rolls-Royce SMR, Paul was the Director of Engineering at Westinghouse Electric Company, where he led the design and development of new nuclear power plants.

Paul has also held a number of senior engineering positions at British Energy, a company that owned and operated nuclear power plants in the UK. He was responsible for leading the engineering team that designed and built a new nuclear power station at Hinkley Point in Somerset, England. With a degree in Mechanical Engineering from the University of Sheffield, he has also completed the Advanced Management Program at Harvard Business School. Notably, he is a Fellow of the Institution of Mechanical Engineers and a Chartered

Engineer.

The issue of climate change and what we can do as a society to try to reduce the impact of it is the most pressing issues facing the world today. Increasingly we are looking towards decreasing our dependence on fossil fuels to meet our energy needs to reduce the volumes of CO2 released into the atmosphere, a problem given even more prominence combined with the war in Ukraine causing many European nations to reassess the security of their energy supplies. The race is now on to develop new energy sources with renewables and nuclear looking the most promising solutions.

SMRs have the potential to be a game-changer in the field of nuclear energy, and Paul's talk provided a valuable opportunity for attendees to learn about the Rolls-Royce SMR design and its unique features that make it stand out from traditional nuclear power plant.

As an area with strong ties to nuclear, the talk was very well attended with a larger venue having to be arranged at Lakes College to accommodate all those that had expressed interest in coming. To a packed room, Paul delivered an informative and engrossing talk, covering all aspects of the development of SMRs.

Not only was the technology behind their operation discussed but also there were detailed explanations of the political, environmental and economic situations that needed to be understood in order to make the SMR deliverable. These issues have plagued larger scale nuclear projects and have demonstrated that it is not enough to just address the technical aspects in order to

progress these projects to completion.

Paul explained how Rolls Royce SMR had learned these lessons and how it planned to overcome them in an engaging style that held the attention of a diverse audience.

The event was well attended, with a diverse range of professionals from the engineering industry in attendance. The Q&A session after the talk was particularly engaging, with attendees asking insightful questions about the technology and its potential applications.

We hope that those who attended found the event informative and engaging, and we are pleased to see such a strong interest in the future of nuclear energy among mechanical engineers - a testament to both the interest in the subject matter and Paul's skills as a presenter.

Simon Walsh



Paul Howdle (centre) with event organiser Simon Walsh (right) and Young Members Chair Phil Howarth (left).

In April 2023, Rolls-Royce announced that its Small Modular Reactor (SMR) design has moved to the next stage of regulatory assessment in the UK. The UK's Office for Nuclear Regulation (ONR) and the Environment Agency have completed the first phase of the assessment and have approved the initial assessment briefs for the Rolls-Royce SMR design. The next stage will involve further assessments of the design, with the aim of demonstrating how it meets the necessary safety, security, and environmental requirements.



NESTLÉ DALSTON FROM COW TO CUP

IMechE West Cumbria secured the opportunity for members to be able to have a guided tour around one of Cumbria's household name companies - Nestlé, at Dalston near Carlisle. The site exclusively uses milk from local Cumbrian dairy farmers, taking on average around 350,000 litres of milk a day.

Nestlé Dalston Factory
"The Home of Cappuccino"



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Nestlé Dalston Factory
"The Home of Cappuccino"

10

ropes with a number of plastic knockers on each rope, which constantly knock against the side of the spray dryer body dislodging any powder that has built up.

As you can guess this system is somewhat noisy and instigated a number of questions from the tour participants! However the Nestlé technical centre in Switzerland informs me that this is the most reliable way to prevent powder build up!

The spray dryer dries one of 3 products - 2 dairy based products - Creamer and Booster Base, which go into the coffee mixes range, and one non-dairy based product - coffeemate

Next we moved to the afterdryer which is located underneath the spray dryer. This removes the final few percentage of moisture from the powder. In the summer of 2022 the afterdryer was replaced as part of a £6million project run by the projects department on site. The new afterdryer was manufactured by Vibra in Germany and has a fluid bed area of 25m²!

From the afterdryer we moved on to the Dry Mix Plant. This is where various ingredients (coffee, chocolate, sugar etc) are added to the base creamer powder to make the final coffee mix flavours. The final coffee mix is filled into a big bag before being transported to our final destination of the

night – the fill & pack Hall.

The Fill & Pack Hall is where the coffee mix is emptied from a big bag into a sachet on one of 15 sachet filling lines, or filled into to Jars on the jar line. On the tour we took a closer look at the newest of the filling lines Schmucker 9 – this was installed in September 2022 at a cost of circa £3million. Sch 9 is the fastest of the filling lines on site and has a maximum capacity of 24,000 sachets per hour. In peak season sachet output from the factory can be up to 25mio sachets per week so you better get drinking!

An interestingly aromatic trip to the site, we thank the Dalston factory for hosting us.

David Williamson



“““

Here in Dalston it's all about milk and therefore dairy farmers are crucial to us. As part of our ongoing First Milk partnership we work with local farmers to develop a more sustainable, and efficient supply chain that has a reduced environmental impact.

Paul Norris

Dalston Factory Performance Specialist

HSE TALK–IT'S NOT JUST CHILD'S PLAY

On January 31st 2023, we were fortunate to welcome Paul Grady of the HSE to give us a talk on the inspection of fairground rides. Paul is a HM Principal Specialist Inspector, who holds the HSE Portfolio for Machinery Safety, Fairgrounds and Pressure Systems.

Paul manages a team of mechanical engineers and supports HSE Inspectors in the Midlands, South of England, and Wales. He oversees the HSE Portfolio, which includes Machinery Safety, Fairgrounds, and Pressure Systems. Paul provides mechanical engineering expertise to shape HSE policies based on British, European, and International Standards. He also collaborates with industry user-groups and trade associations.

The HSE is responsible for the inspection of fairgrounds, to protect the public and provide assurance that rides are designed, operated, and maintained safely. Such equipment will therefore require input from HSE's mechanical engineering team, as part of interventions by the Regulator. The talk included several interesting examples of how Mechanical Engineering has played a significant role and which were discussed in this presentation and the subsequent Q&A session.

Paul outlined how thrill-seeking theme park rides are becoming faster and more technically complicated and even play inflatables have increased in size and complexity in recent years. Several high-profile accident investigations have prompted research and increased scrutiny by the HSE in recent years that have identified emerging 'engineering issues' that need to be addressed.

The talk focused on incident fairground rides like 'The Cyclone Twist' and 'The Smiler', examining their legal context and best practices. It clarified HSE's authority to



enforce or recommend measures, which can be challenged. Notably, fairgrounds and entertainments were not governed by prescriptive European Directives, which imposed strict control measures based on Essential Health and Safety requirements.

Instead, the EU stated National Regulations (in our case UK Law) would be applied, so different requirements were expected between different nations. For example, in The United Kingdom this would be Section 6 of the Health and Safety at Work act which provides a broad requirement for fairgrounds and entertainments devices to be supplied safe. There is also a caveat of 'as far as reasonable practicable'.

When considering documented practices, some National legislation have Approved Codes of Practice (ACOP) – HSG175 is an ACOP that requires a Design Review – where the information contained explains what is understood by the law to be accepted/ compliant. There are Standards – British,

European and International where some Standards are 'Harmonised in the EU' and now 'Designated in the UK' which give a presumption of conformity with the associated law. There is also guidance put out by industry and other bodies – this is referred to as 'good practice'.

So, without compelling standards or goal-setting regulation, it could be considered that sometimes the robustness and safety integrity of fairground and entertainment equipment is low. However, this may not be through ignorance given compliance with the law could also be considered difficult or vague in this sector where there are very few specifics.

An engaging presentation by Paul which highlighted impactful examples of mechanical engineering's role, which was discussed in detail during the Q&A.

Caroline Hamilton

EXCELLENCE IS COLLABORATION

Clyne Albertelli, Managing Director of Co-Lab Engineering, discussed how Co-Lab is designed to cultivate a collaborative approach between large organisations, SMEs and challenge owners. Alongside his colleagues, he outlined their "Engineering Academy" and show cased some of the successes to date including 'Scrubmarine'.



Tyler Lister, working on the 'Scrubmarine' project with the Co-Lab Engineering Academy

Hosted at the National College for Nuclear on 16th February 2023, members of the IMechE West Cumbria were treated to a presentation by Co-Lab Engineering; a West Cumbrian start-up, regarding their approach to innovation and collaboration. Young entrepreneur and Managing Director Clyne Albertelli delivered the talk, with support from participants in the first Engineering Academy program aimed at developing a solution to Biofouling on Royal Navy Submarines.

Clyne started his career as an electrical and instrumentation apprentice for Babcock, moved to Cavendish Nuclear as an instrument mechanic, and joined Sellafield Ltd as a System Engineer. He then joined the Engineering Portfolio management team and more recently worked as Solutions manager. Now full time with his start-up business Co-Lab, he and his team help organisations find solutions to industry challenges and develop engineering capability.

Now at the age of 26, Clyne explained that the vision of Co-Lab Engineering is to develop world-class engineering capabilities while solving the world's toughest challenges, with their mission being to empower people and organisations to achieve more through collaboration. The business has three objectives: to solve engineering challenges, to develop engineers and project professionals, and to enable other Small Medium Enterprises (SMEs) to gain exposure by working on new and novel projects.

Co-Lab's Engineering Academy involves collaboration with four esteemed partners to enhance participants' skills in crucial areas such as Leadership, Project Management, Innovation, Problem Solving, and Presentation skills. These partners are Centre for Leadership Performance, University of Cumbria, the IMechE and Jo Corbishley. The Academy adopts a practical approach to professional development, providing

participants with the necessary skills and expertise to excel in their field; continually reinforcing learning by applying these skills immediately to a live industry challenge.

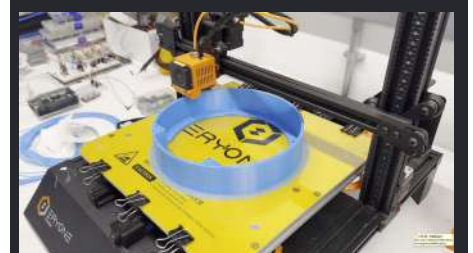
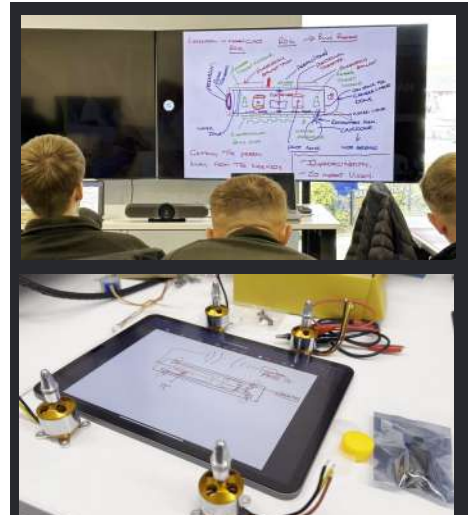
The presentation continued with academy engineers Tom Clayton, a second-year Mechanical Design Degree Apprentice from Sellafield, and Dylan Brennan, a first-year Nuclear Graduate currently on secondment with Jacobs. They explained their project, code-named 'ScrubMarine,' and how they worked to develop a problem statement and solution from the Market Exploration request from the Defence and Security Accelerator (DASA) by the Royal Navy.

They went on to explain that Biofouling is a challenge not just in the defence and renewables sector but is also a challenge in all aspects of marine shipping, costing the industry an additional £50 billion in excess fuel worldwide and contributing up to 1.3 trillion tonnes of carbon emissions annually. Their solution, a concept for a Submersible Remotely Operated Vehicle (SROV) that employs commercially available technology and high-pressure cavitation blasting to remove biofouling from complex structures, negates the need for divers, dry docking, or environmentally harmful chemicals.

Both young engineers encouraged that the Co-Lab Engineering Academy was a highly worthwhile experience as they were able to meet many competencies against the UK Specification, and able to lead autonomously to see a project through from definition through to manufacture.

Overall, Co-Lab Engineering is a valuable addition to the West Cumbrian engineering community, and their Engineering Academy is an excellent example of how collaboration can lead to innovation and growth. We look forward to seeing more from this promising start-up in the future.

David Williamson



LEADERSHIP AND HIGH PERFORMANCE TEAMS

The Judgement Index is a Values Based Behavioural assessment tool with over 40 years research and a Nobel Prize nomination behind it. Our speaker, **Rob Coulthard** is a performance coach, researcher, author and trainer who has spent most career either working amongst or training and developing elite performing individuals and teams.



Rob Coulthard, MD of Judgement Index UK

On 14th March 2023, IMechE West Cumbria held a lecture on Performance and Leadership by Rob Coulthard, MD of Judgement Index UK, a small niche consultancy focusing on the analysis, selection and development of leaders and teams around the world. Rob works across various sectors including corporate, health, military, sport and corporate environments.

Rob is a performance coach, researcher, author and trainer who has spent most of his life either working amongst or training and developing elite performing individuals and teams from a variety of environments. He studied at Manchester Met Uni and within the Military during his colourful Service career. He brought Judgement Index to the UK from the USA in 2008 having been astonished by the assessment's scientifically proven level of predictability of value-based behaviour.

The Judgement Index is a value-based analysis of judgement capacity, behaviour and stability; it is very abstract in its methodology yet highly accurate. Judgement Index UK has adapted the system, using 40 years of clinical experience, to aid recruitment in security and defence among other sectors.

The problem with most organisations' selection and review system is that they do not look deeply enough at the candidate, so can't really know who they are hiring or who is a risk. At selection, most organisations look backwards at a candidate's history, such as their CV, CRB check, interview and references. These alone are never enough to predict future risk or performance potential.

Identifying risk by analysing a person or team's value-based judgement, stress and wellness has synergy across any environment where there is risk, and this includes the security of assets and people.

The security sector is just one

environment where risk is increased if individuals and teams are under pressure and stress and their coping ability is weak or inhibited. It is critical to identify individuals and collective groups that represent a higher risk by highlighting key performance indicators and factors about a person's judgement, such as decision-making capacity, noticing ability and focus.

Regardless of someone's performance ability, stress and wellness issues will significantly decrease performance and increase risk and this is why it is critical to look at underlying factors that hinder performance. Defence and security organisations use psychometric screening to learn more about candidates. However, most psychometrics focus on personality traits and provide limited information about capabilities, wellness, and risk. Additionally, these tools are susceptible to cheating, especially when self-reported. These factors are also evident with the various stress evaluation tools on the market using typical questions like 'rate out of 5 how well you sleep at night'. These types of assessments are unlikely to uncover an unwell candidate if they are desperate for a job.

A unique but obvious approach would be to take a discreet look forward to gain foresight into an employee's potential performance and risk. This can be done in an abstract way, resulting in very deep understanding of the value-based judgement capacity of a person, their wellness and stability.

Reviewing the wellness of an individual is essential because regardless of their CV and past performance an unwell person will often fail to realise their potential, and in the extreme may become a danger or risk. Obtaining an accurate understanding of a prospective employee, manager or leader's capacity for good judgement, decision-

making and problem-solving has shown to be a critical element in making correct personnel decisions. For that matter, gaining understanding and knowledge of all employees' capacity for good judgement allows greater opportunity for developing and sustaining a high-performing team.

While the focus on skills and technical knowledge is important, failing to understand a candidate's capacity to deliver the desired skills and expertise makes the employee selection process a high-stakes gamble. Information without understanding simply represents random words with little to no value. Too often a manager hires a candidate based upon their respective rapport and connection – effectively a 'minime' – and so does not get the candidate who best fits the role.

Complacency in security and defence sectors has led to incidents caused by stressed individuals who should not have been in those situations. Some organisations are overlooking this issue and assuming everything is fine. Post-pandemic, stress levels have risen significantly, reaching over 45% in certain sectors, which is a concerning trend.

All interested parties have a moral and legal duty to push the standard of care as high as possible. Aside from doing what is right, failure to act will result in more incidents which will have a potentially destructive impact on the business concerned and increase scrutiny upon the industry in general. Despite the higher risk of prosecution, complacency among company directors regarding basic duty of care remains unchanged. The outcome of upcoming court cases will reveal if attitudes and actions shift in the coming years. Encouragingly, some organizations are actively working to mitigate risks and minimize such incidents.

A thought-provoking event, Rob's lecture encouraged attendees to reflect on their own leadership potential. Through engaging discussions and interactive exercises, he challenged participants to expand their boundaries, tap into unexplored capabilities, and unleash their true leadership abilities.

Adrian Norendal



NUCLEAR TRANSPORT VESSEL VISIT

Pacific Nuclear Transport Limited has been operating for more than 45 years between Europe and Japan and has the most experienced nuclear transport crews in the world. We take a behind-the-scenes visit to NTS Barrow and board one of the visit PNTL Nuclear Transport vessels.



The dedicated NTS marine terminal at Ramsden Dock, Barrow-in-Furness

On 18 May 2023, IMechE West Cumbria embarked on a thrilling expedition to the prestigious NTS Barrow. We ventured into uncharted waters, eagerly stepping foot aboard the colossal PNTL Nuclear Transport vessel, immersing ourselves in an unforgettable adventure.

NTS Barrow, also known as the Nuclear Transport Solutions Barrow, is a prominent facility located on the coast of Barrow-in-Furness. This facility holds significant importance in the field of nuclear transport and plays a vital role in supporting the nuclear industry.

The visit commenced with a briefing covering the activities of NTS focusing on the safety and security aspects of transporting some of the most hazardous nuclear materials across the world. Having established what the challenges are the briefing went on to describe how shipments are planned and executed and how many years of experience have been incorporated into the design of the current fleet of vessels.

NTS Barrow serves as a hub for the transportation of nuclear materials, including nuclear fuel, waste, and other related components. It operates a fleet of specialised vessels designed specifically for the safe and secure transport of these sensitive materials.

These vessels are equipped with advanced technologies and rigorous safety measures to ensure the protection of the environment and public safety. They are classified by the International Maritime Organisation (IMO) of the United Nations at its highest level of INF3. The INF Code regulates shipments by sea of packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes. In order to meet and in some areas exceed the requirements of the Code the vessels design contains some specific features. Such features including extensive duplication and back up of systems

giving great levels of redundancy and segregation of systems that would not normally be evident on standard cargo vessels.

The visit onto the vessel included a tour of the control room, engine room, machinery spaces, cargo holds and bridge where it was possible to view and discuss some of the features above. A change room with barrier procedure between cargo holds and clean side also featured, as one would expect in any Nuclear Installation.

The Barrow facility not only focuses on the transportation aspect but also encompasses various services related to the nuclear industry. It offers storage and handling facilities for nuclear materials, as well as expertise in logistics, engineering, and project management. NTS Barrow serves as a crucial link in the nuclear supply chain, facilitating the movement of materials between nuclear power plants, reprocessing

facilities, and waste management sites.

The visit concluded with a question and answer session giving the attendees further opportunity to understand the complexities of International Nuclear Transport and why NTS are regarded as World Leading Experts in this field.

NTS Barrow represents a significant milestone in the development and advancement of nuclear transport capabilities. Its presence in Barrow-in-Furness showcases the region's expertise in the nuclear industry and highlights the importance of safe and efficient transportation of nuclear materials in today's energy landscape. The visit was greatly appreciated by the members attending and we would like to extend our thanks to the Host, the Captain and the Chief Engineer for a highly informative and engaging event.

Andy Cumbor

Key Safety features of the PNTL Vessels

- Robust and tested structural design: strong and durable to withstand extreme environmental conditions and potential impacts
- Separate machinery and steering gear rooms: streamlining maintenance procedures, isolating potential hazards, and providing a more comfortable onboard)Radiation shielding materials and configuration to minimise exposure
- Containment systems to prevent release of radioactive materials: multiple layers of physical barriers and redundant safety mechanisms
- Emergency response equipment for prompt action in emergencies: multiple layers of physical barriers and redundant safety mechanisms
- Monitoring and surveillance systems for real-time data: monitoring radiation levels, temperature, pressure, and integrity of containment
- Strict operational procedures adhering to international standards.
- Trained crew skilled in safety protocols and emergency response
- Enhanced environmental and safety performance (advanced containment systems, radiation shielding, regulatory compliance, emergency preparedness, monitoring systems, risk mitigation measures, and technological innovative systems)

BENEFITS OF MEMBERSHIP

Our membership benefits are designed to support your career goals at every stage – from college and university, throughout your working life and through to retirement. We can support your professional development with structured and informal learning. Whether you volunteer with us, attend events and training or read *Professional Engineering* – it all counts.

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- Keep up to date with our free *Professional Engineering* magazine, app, IMechE UK e-newsletters and website
- Access the Developing Engineers Programme, a

Professionally registered engineers and technicians

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Connect to our engineering network

- Connect and network with members at talks, visits and social events in your local area
- Get involved with our volunteering opportunities to inspire future generations and support engineers

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- Attend high calibre training with member discounts

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- Advice and financial, emotional and practical support from our Support Network
- Discounted venue hire and business facilities at our head office in London

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If you are on an apprenticeship or your first degree, our free affiliate membership is for you. It provides all the knowledge, news and support you need throughout your studies.

Affiliate

For those with an interest in engineering and who want to be part of a leading institution in the sector – this is the membership for you.

Associate (AMIMechE)

If you have graduated with a science, technology, engineering and mathematics (STEM) degree, our Associate Membership can support you on your journey to professional registration.

Professional Registration

Professional registration is an independent, globally recognised benchmark demonstrating your engineering competence and experience. It opens doors for career advancement.

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For technicians who use proven procedures to solve practical engineering problems and can demonstrate learning to NVQ/SVQ Level 3 or similar.

Incorporated Engineer (IEng MIMechE)

For those who are often involved in operational roles, maintaining and managing the application of technology at the highest efficiency and can demonstrate learning to a Bachelor's degree level.

Chartered Engineer (CEng MIMechE)

For those involved in solving engineering problems either by innovation, creativity or change and can demonstrate learning to the equivalent of a Master's degree.

Fellow (FIMechE)

Fellowship with the Institution is a mark of your exceptional commitment to, and innovation in, mechanical engineering. It is the most senior category of membership.

Apprentice and Student Affiliate

Affiliate

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EngTech (EngTech MIMechE)

Incorporated Engineer (IEng MIMechE)

Chartered Engineer (CEng MIMechE)

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