



AUTUMN WINTER 17



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NEWSLETTER

AUTUMN WINTER 2017

» EVENT WRITE-UPS

THE NEW SHANNON P4

Representatives from the RNLI introduced the new waterjet propelled Shannon Class Lifeboat, as well as a history into the 193 year-old charity.

YOUNG MEMBERS FORTH VISIT P7

IMechE WC Young Members visited Forth Engineering to learn about the company and see first-hand the projects that they are developing.

LEYLAND TRUCKS VISIT P8

IMechE West Cumbria guests traced the history of British-born truck manufacturer Leyland Trucks, with a visit to their Lancashire factory.

GEOLOGICAL DISPOSAL FACILITIES P9

With 40 years of experience in the nuclear industry working with technical support, Alun Ellis uncovered the history of Geological Disposal Facilities.

HYDROGEN FUELLING STATIONS P10

Business Development Manager for ITM Charles Purkess shared his company's offering in the Hydrogen Energy Storage Clean Fuel arenas, focussing on Rapid Response Electrolyser technology.

» FEATURES

BURSARY AWARDS 2017 P5

Local students received financial contributions to their Higher and Further Education studies courtesy of our partnership with REACT Foundation.

ANNUAL DINNER 2017 P6

As the most highly anticipated event in our annual calendar, IMechE West Cumbria hosted a fantastic night with distinguished guests and food, in celebrating our local area and people.

BRIDGE THE SKILLS GAP P7

Coinciding with our annual dinner, IMechE Director of Engineering, Dr Colin Brown, and IMechE Head of Energy & Environment, Dr Jenifer Baxter, visited two of our regions largest employers to continue their investigation into the 'Engineering Skills Gap' among young graduates.

BLOODHOUND EDUCATIONAL EVENT P7

Joining this year's annual dinner celebrations were the BLOODHOUND SSC team, who participated in the STEM Outreach event at Lakes College in encouraging more of the next generation to take up Science and Engineering as a career.

» UPCOMING EVENTS

AUTUMN/WINTER EVENTS CALENDAR

Keep up with the latest engineering ideas, inventions and thought leadership at our local events. Check out the back page for our upcoming events and visits. Go on, get yourself booked on some!

"Our Vision is to improve the world through engineering, by inspiring the next generation, developing professional engineers and setting the agenda."

IMechE Vision Statement



CHAIRMAN'S COMMENT

Welcome back.

As I begin my second year chairman of the Area Committee, I am delighted to introduce this bumper edition of our Autumn/Winter Newsletter. In the following pages you will find information on the Engineering Activities we have undertaken over the last 6 months, including lectures on subjects including, Hydrogen Fuel for Cars, the Geological Disposal Facility and Lifeboat design plus a fabulous visit to Leyland Trucks in Lancashire. Numbers attending our lectures and visits continue to increase steadily, with this year showing a substantial attendance increased on 2015/16.

The West Cumbria Area continues to be very active promoting engineering in our local schools, colleges and places of work. This year is no different. In June we hosted a two day Educational Extravaganza where 400 local primary school children attended the Bloodhound supersonic car (SSC) STEM workshop. The event was so over-subscribed (a waiting list of 1000 school children), that we are already looking at see how we can plan and fund a return visit of the Bloodhound Educational Team, following the low speed trials of the Bloodhound car at Newquay this autumn.

The Bloodhound STEM Event was the curtain raiser for this Year's IMechE West Cumbria Area Annual Dinner, which was another fantastic night at the Lakes College West Cumbria, generously supported by our sponsors, whose logos and adverts you can find within. You can read more about the dinner and the additional events that were linked to it, as well what the Area Committee and the Young Member Panel have been up to promoting Engineering and Inspiring the Next Generation inside this edition of the Newsletter.

You'll also find on the back page a poster for our up-and-coming Autumn Events Programme. These include a talk in September on the exciting new mining venture at Haig, Whitehaven, a visit to Egger UK Ltd, the leading wood-based panel manufacturer in Europe at Hexham in October, a talk in November by Createc on the use of drones and scanning equipment at Fukushima, Japan and in January something slightly different; a talk by Harrison & Harrison on the Engineering to maintain and restore the finest examples of cathedral organs in the UK. Please come and book your place on the events, as well sharing the events poster and encourage your friends and colleagues to come along to them as well.

Work will be commencing soon on planning our 2018 IMechE IMechE West Cumbria Annual Dinner, so please keep an eye on our website (IMechE West Cumbria) for details of this and all our other activities. I would like to take this opportunity to once again thank all our sponsors for supporting our annual dinner. Without their fantastic support we would not have the funding to continue to grow our Educational Initiatives and the generosity through donations of those who attended to help our 2017 chosen charities Cockermouth Mountain Rescue, Hospice at Home and the Great North Air Ambulance.

Simon Mandale BSc(Hons) AMIMechE

Chairman – IMechE (West Cumbria)
simon.mandale@sellafieldsites.com

Institution of
**MECHANICAL
ENGINEERS**

IMechE West Cumbria: nearyou.imeche.org/near-you/UK/North-Western/West-Cumbria-Area

IMechE WC Young Members: nearyou.imeche.org/near-you/UK/North-Western/West-Cumbria-Young-Member-Panel

IMechE UK: www.imeche.org

Sign up to our IMechE West Cumbria mailing list, forward your email to: WCumbSec@imechenetwork.org

If you're a working engineer or technician, find out about membership or professional registration for you or your colleagues: membership@imeche.org

If you're an existing member of the Institution with a vision to be a future volunteer in education, become a STEM Ambassador: ambassador@imeche.org

SHANNON CLASS LIFEBOAT

21ST CENTURY RESCUE SERVICE

THE SHANNON IS THE FIRST MODERN ALL-WEATHER LIFEBOAT TO BE PROPELLED BY WATERJETS INSTEAD OF TRADITIONAL PROPELLERS, MAKING HER OUR MOST AGILE AND MANOEUVRABLE ALL-WEATHER LIFEBOAT YET.

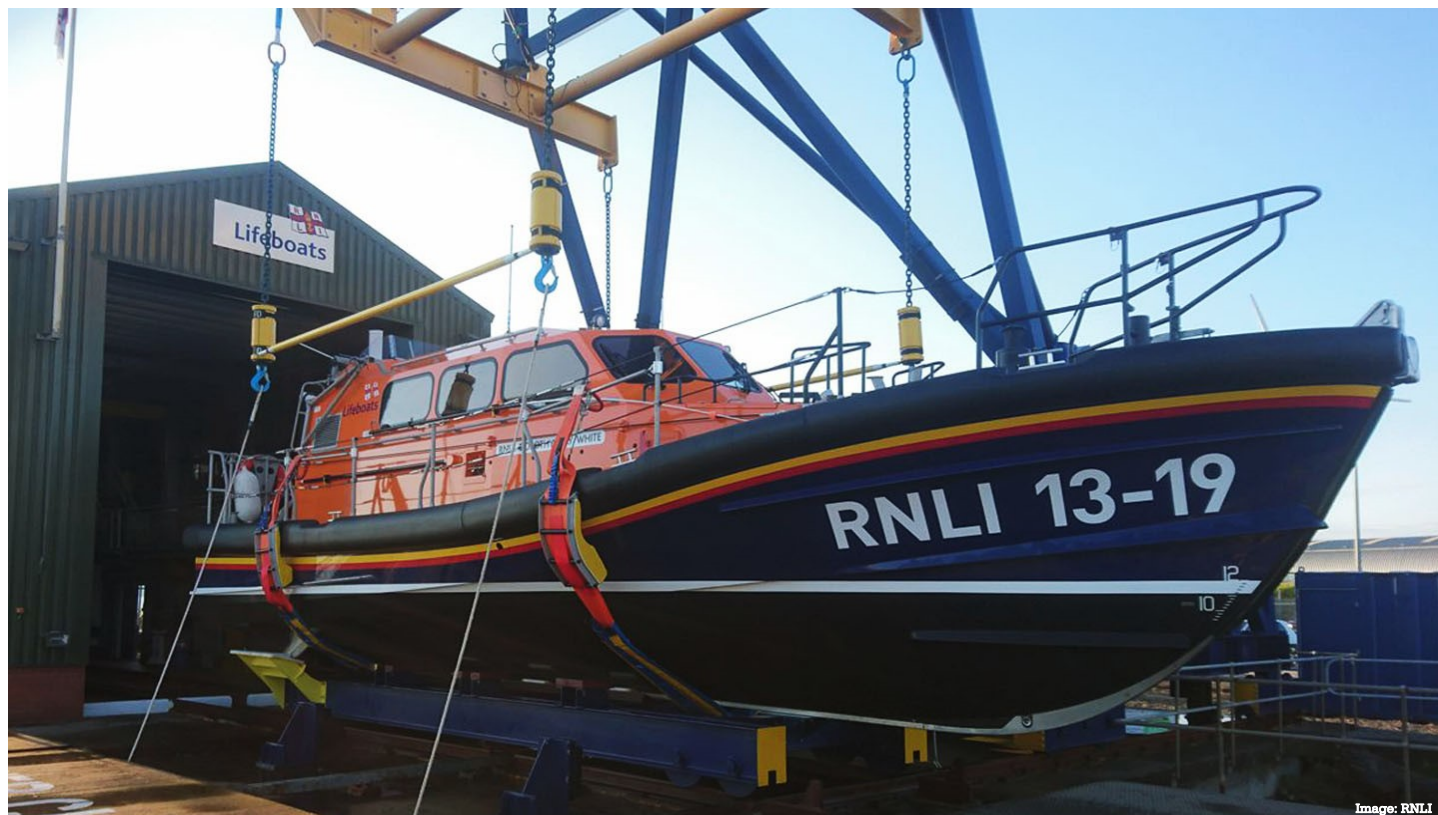


Image: RNLI

Throughout the UK, the Shannon will gradually replace Mersey and Tyne class lifeboats, which are now nearing the end of their operational lives

On Thursday 30 March 2017 Tim Chittenden, Workington RNLI Lifeboat operations manager, and Ed Davies, Senior Naval Architect, gave a presentation to local IMechE members and other local engineering enthusiasts on the new Shannon Class Lifeboat that has been recently received by the Workington RNLI Lifeboat station.

The presentation began with Tim describing the beginnings of the RNLI, which was founded in 1824 by Sir William Hillary as the National Institution for Preservation of Life from Shipwreck before having its name changed to RNLI in 1854. In the early days of the RNLI, the boats were rowed by a crew of volunteers. In 1890 the first steam-powered boat, the Duke of Northumberland, and in 1905 the first petrol-powered Lifeboat entered service.

Since 1992 Workington has been using the Sir John Fisher, a Tyne class Lifeboat. As part of the RNLI's plans for a faster and more efficient 25-knot all-weather fleet, it is replacing the Workington's Tyne class with the new Shannon class, which has been developed and built in-house at their All Weather Lifeboat Centre in Poole.

At this point in the talk, Ed Davies, Naval Architect for the RNLI, took over from Tim to provide an in-depth look at the design, testing, building and sea trials of the new vessel.

In order to ensure that the boat could meet all of its requirements, particularly its ability to maintain sufficient speed when negotiating large waves, a number of hulls were considered and tested. Using six different designs, radio-controlled scale models fitted with accelerometers were built

and tested to determine their transverse and vertical response during slam events when negotiating waves. Minimising the accelerations experienced when negotiating waves provides an improved course keeping ability and reduces the potentially hazardous movements experienced by the crew. The vertical accelerations experienced by the crew are further reduced by the six shock absorbing seats located in the wheelhouse.

The testing identified that the RNLI's own hull design was the most suitable for meeting the parameters that had been set. Using computer modelling and validating with a prototype hull, the stability and self-righting of the design were tested and approved. The hull is constructed from a fibre-reinforced composite and needs to be able to handle the different ways that it is launched at the RNLI's various stations around the UK. Most Lifeboat stations have a slipway or use the bespoke launch and recovery tractor and trailer. Workington has a unique davit system from the dock wall and the design team had to ensure that the boat and the launch system were compatible.

The vessel is powered by two 650hp Scania engines which help the Shannon to achieve the required top speed of 25 knots. In fact, it only needs 80% of her power to do so, meaning the engines don't have to work so hard and should last longer. Each engine has its own 1,370-litre fuel tank which can be refuelled at a rate of 200 litres a minute, meaning the lifeboat will never be out of action for long. The Shannon is the first modern all-weather lifeboat propelled by water jets instead of propellers, making it the most agile and manoeuvrable all-weather lifeboat in the RNLI fleet. With a draught of only 1 metre, the water jets allow the Shannon to operate in shallow waters and be intentionally beached.

To allow the crew to operate and monitor

many of the lifeboat's functions from the safety of their seats during a rescue, the vessel is fitted with an improved Systems and Information Management System (SIMS). These functions include: the navigation of the lifeboat, including direction finding, radar and charting; radio communications and CCTV; and the mechanics of the lifeboat including the engines, bilge and electrics. In addition to improving crew safety, SIMS allows better task sharing among the crew and negates the need for lots of separate systems and equipment, saving space and reducing weight.

Workington's new Shannon class Lifeboat was built at the RNLI's new All-weather Lifeboat Centre in Poole. This facility brings the construction, repair and maintenance of their all-weather lifeboats under one roof for the first time in their history. With two vast boat halls containing flexible bays, a covered courtyard area and a total workshop floor space of 5,000m², the All-weather Lifeboat Centre is the RNLI's first state-of-the-art manufacturing facility for over 40 years. It will be used to construct and fit out our current and future generations of all-weather lifeboats. The centre gives the RNLI complete control over the cost and quality of our all-weather lifeboats by removing uncertainty in the supply chain.



Construction of a Shannon lifeboat, which was designed entirely in-house by a team of RNLI engineers.

Although each Shannon class lifeboat is expected to have an operational lifetime of 25 years, the life expectancy of the Shannon's hull and wheelhouse is 50 years. So after 25 years of service, each Shannon lifeboat will undergo a total refit at the facility in Poole where the machinery, systems and equipment will be renewed or replaced and the hull and wheelhouse reused – creating a new Shannon class lifeboat ready to save lives at sea for a further 25 years.

As a show of thanks for the support provided by the raffle at the 2016 IMechE West Cumbria Area Dinner, Tim Chittenden invited the IMechE West Cumbria committee to have a look around Workington Lifeboat station and their new Shannon class Lifeboat on Friday 14 July 2017.

The event gave a fascinating view of all areas of the new vessel and the facility in Workington, allowing members of the committee to sit in the crew seats as well as squeezing past the two large diesel engines to see the hydraulic systems that control the steering using the water jets.

The RNLI is a charity funded by donations from the public and mostly run by volunteers who, by putting themselves in harm's way, provide a 24-hour lifeboat search and rescue service.

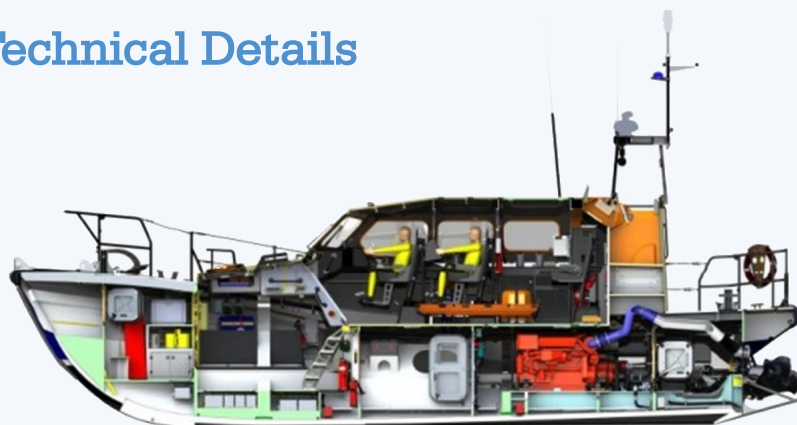
IMechE West Cumbria Area would like to thank Tim and Ed for their fascinating talk on the new Shannon class, for allowing us to visit their facility and for the great work that they do keeping the local community safe in the Irish Sea.

Simon Farrell, IMechE West Cumbria



IMechE West Cumbria's Simon Farrell thanks Tim Chittenden and Ed Davies for their presentation

Technical Details



2013
Introduced

23
Self-righting
Capacity

79
Non Self-righting
Capacity

25
Max Knots

250
Nautical
Miles

2,740
Litres Fuel
Capacity

ALL
Weather
Lifeboat

13.6
Metres Length

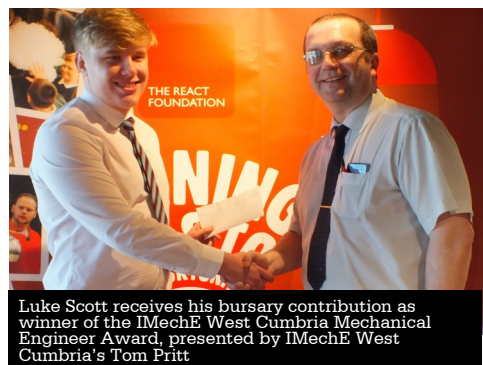
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STUDENT BURSARY AWARDS 2017

IMechE West Cumbria is once again delighted to have joined forces with the REACT Foundation in offering local students financial contributions to their Higher and Further Educations studies.

IMechE West Cumbria offered a £1,000 bursary to a worthy student who is going to University to study a Mechanical Engineering Master's Degree, accredited with the Engineering Council as meeting the academic requirements of Professional Registration. Luke Scott of Workington Academy picked up IMechE West Cumbria's £1,000 mechanical engineering bursary, while Stephen Gascoigne of Energy Coast UTC scooped the REACT Foundation's £3,000 bursary award.

The REACT Foundation, a registered local charity, has seen an outstanding response for the cash prizes this year - 13 other young hopefuls were also given cash promises of £200 each at the Foundation's Award Evening held at The Beacon,



Luke Scott receives his bursary contribution as winner of the IMechE West Cumbria Mechanical Engineer Award, presented by IMechE West Cumbria's Tom Pritt

Whitehaven on Tuesday 16th May 2017. Year 11 teenagers were also hand-picked from entries across the region's secondary schools after pledging to study an engineering, maths, technology or science-related subject at sixth form in September. The awards have been designed to help them kick-start their careers by offsetting some of the costs of going to university and sixth form.

REACT Foundation Chairman Pete Woolaghan handed out the pledges of cash to Stephen and the Year 11 prize winners, while IMechE West Cumbria's Tom Pritt gave his organisation's pledge to Luke. Students will pick up the cash in September following confirmation of their places at university or 6th form.

Mr Pritt said: "We are delighted to compliment the Foundation's bursary with our own mechanical engineering bursary each year. We need to encourage the pupils to study engineering subjects as it is essential to retain vital engineering skills in West Cumbria. This is a challenge very close to our hearts at the IMechE and we will continue to support the REACT Foundation wherever we can."

Mr Woolaghan said: "Our aim as a local engineering charity is to inspire and encourage young people from the area to follow a career in the industry. The whole purpose of the REACT Foundation awards is for us to give them a helping hand to follow their goals and aspirations in science, technology, engineering and maths. We have had another fantastic response this year for both the bursaries and the year 11 awards."

David Williamson, IMechE West Cumbria



- The Winners List -

REACT Foundation Bursary Award
Stephen Gascoigne, Energy Coast UTC

**IMechE West Cumbria
Mechanical Engineering Award**
Luke Scott, Workington Academy

Year 11 Awards

Ruben Sailer
Cockermouth School
Rebecca Tournay & Bradley Smith
Energy Coast UTC
Oliver Dustin & James Mattinson
Keswick School
Samuel Ketchen
Millom School
Luke Todd
Netherhall School
Craig McNicol
St Joseph's Catholic High School
Samuel Agnew
St Benedicts Catholic High School
George Fava
Nelson Thomlinson School
Ben Walkingshaw
Whitehaven Academy
Luke McDougall & Jaye Moore
Workington Academy

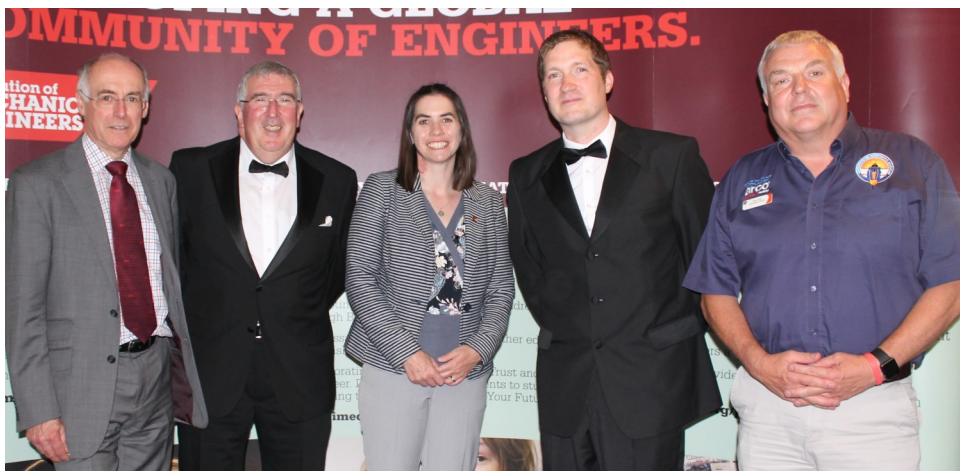
IMECHE WEST CUMBRIA ANNUAL DINNER 2017

THE MOST HIGHLY ANTICIPATED EVENT IN THE IMECHANICAL WEST CUMBRIA AREA CALENDAR DID NOT FAIL TO IMPRESS. WITH DISTINGUISHED GUESTS AND HIGHLY ACCLAIMED FOOD, IT WAS ONCE AGAIN A SUCCESSFUL NIGHT OF CELEBRATING OUR LOCAL AREA AND PEOPLE.

On June 22nd the IMechE West Cumbria Area hosted their annual dinner at the Lakes College West Cumbria. The event was attended by over 120 IMechE members, sponsors, local company representatives and guests. Our guest speakers on the night were Mike Ford, BLOODHOUND SSC, Dr Colin Brown, Director of Engineering IMechE and Dr Jenifer Baxter, Head of Energy and Environment at the IMechE.

The evening began with canapés and drinks in the Lakes College SEN Centre, where the life-size Bloodhound SSC interactive model used during the STEM Educational event earlier in the day was on display.

Before retiring to the restaurant for dinner, guests enjoyed brief end-of-year review speeches from Simon Mandale, Chair for the IMechE West Cumbria and Simon Walsh, Chair of the Young Members, followed by the evening's main speaker, Mike Ford, a Chartered Engineer at BLOODHOUND SSC and their Science, Technology, Engineering and Mathematics (STEM)



Guests of honour: From left to right, Colin Brown (Director of Engineering IMechE), Paul Schechter (IMechE North West Region Vice Chair), Jenifer Baxter (Head of Energy and Environment at the IMechE), Simon Mandale (IMechE West Cumbria Chairman) and Mike Ford (BLOODHOUND SSC STEM Communicator).

Communicator.

Mike took to the stage and gave an explosive (literally) presentation on the development of the car, as well as highlighting the up-and-coming speed trials and subsequent record attempts scheduled for this autumn and next year.

Mike outlined the amazing technology that has gone into creating a 1000mph vehicle, as he would to the young students at one of the Bloodhound SSC Educational Team events, which went down a storm with the audience.

His talk covered the Engineering Principles that help (aerodynamics, force) and more often hinder (friction, heat) the challenge of driving at such speed, as well as outlining the staggering facts and figures of the car: Length - 13.470 metres; Mass - 7786 kg; Turning radius - 120 metres; Design Speed - 1,050 mph; 0 to 1000mph - 55 seconds.

During the meal short presentations were given

by representatives from our chosen charities, Cockermouth Mountain Rescue, Hospice at Home and Great North Air Ambulance. Thanks to the generosity of those attending the annual dinner, the raffle on the night raised over £1385 which will be divided equally between the three charities.

In line with the Bloodhound World Land Speed Record theme, the menu for the dinner was devised by Lakes College catering student Jack Balchin to be posh "fast food" with Lamb Kebab shredded marinated lamb fillet, pickled red cabbage and a yoghurt, mint and honey dip for starter; Fish and Chips - deep poached Cod Loin, triple cooked chips and pea and mint puree garnished with crispy fish skin crackling for main course and Classic Italian Tiramisu - coffee soaked Genoese, creamy mascarpone and dusted with coco powder for desert.

As is the tradition of the IMechE West Cumbria Area Annual Dinner, a key element of the evening is recognising the outstanding achievements of the Next Generation of Engineers with Lakes College Engineering Students being presented with awards by Helen Pagel, Head of Asset Management.

The award recipients were Sean Fitzsimons - Best Higher National Diploma Mechanical Engineering Student and Steven Gregg - Best Higher National Certificate Mechanical Engineering Student. Additionally this year IMechE West Cumbria sponsored the Rotary Club of Workington 'Heritage' Apprentice Competition 2017, and the winners Charlotte Hicks and Kurtis Gregory, were presented with certificates of recognition, also by Helen Pagel.

The after dinner speech was provided by Dr Jenifer Baxter who updated the audience with news from HQ and the recent studies being undertaken into skills and gender gaps within Engineering, concluding that although there are still not enough female Engineers, that imbalance is less important than the overall lack of students of either gender taking up Engineering related studies at school and University, or considering Engineering as a worthwhile career.

Jenifer was followed by the illustrious Dr Colin Brown who gave an amusing address on his own view of Engineering, Brexit and the General Election, which went down a storm with the audience.

David McArthur, IMechE West Cumbria

Next Generation Achievements



Kurtis Gregory receives his award from Helen Pagel, Head of Asset Management



Charlotte Hicks receives her award from Helen Pagel, Head of Asset Management



Steven Grey receives his award from Helen Pagel, Head of Asset Management



Sean Fitzsimons receives his award from Helen Pagel, Head of Asset Management

SUPPORTING YOUNG ENGINEERS

YOUNG MEMBERS AT FORTH

On 23rd February, the West Cumbria Young Members organised a visit to Forth Engineering in Maryport to learn about the company and see first-hand the projects that they are developing.

Starting off manufacturing hoses to customer specifications, Forth Engineering has not only expanded its product range, but also its capabilities to include mechanical, electrical, electronics and CE&I design services. The company is now able to produce designs for components, sub-assemblies, full rigs, instruments and systems, whilst supporting the full project lifecycle. Forth Engineering has also become a



'Latro', an agile robotic spider, is one of the most recent additions to the array of tools available to deal with nuclear material in fuel ponds.

leader in development and supply of innovative remote engineering solutions such as hydraulic cutting systems, radiation tolerant cameras and remotely operated vehicles.

During our visit we saw first-hand 'Latro', an impressive robotic spider with six hydraulically actuated legs and two arms for carrying large grippers and cutters. 'Latro' will be used in the monitoring and decommissioning of both dry and wet nuclear storage facilities to cut, sort and retrieve material. We also learnt about and had a demonstration on 'Mona', an open-hardware/open source robotic platform that has been developed to be used in swarm robotic scenarios.

Following the presentations, the group were also given the opportunity to test their skills in driving a range of remotely operated vehicles, both on the ground within the rig hall and underwater in the depths of the 'pond'. This gave us some great appreciation of the skill required to use these craft. It certainly looked easier to drive a submersible than it really was! A huge thank you to Martin Lewis and Farshad Arvin for their hospitality on the evening and for telling us about the projects that they were working on.

Andras Kaldos, IMechE West Cumbria YMP



Forth Deep Recovery Facility is believed to be the largest scale wetted pond research and development facility in the UK.

ENGINEERING SKILLS GAP

As part of the visit of Dr Colin Brown and Dr Jenifer Baxter to West Cumbria, there was an opportunity to undertake industrial visits to Sellafield Ltd and Iggesund Paperboard, to continue their investigation into the Engineering Skills Gap.

The visit to Sellafield Ltd on the 22nd June started with a tour of the site's newly re-opened Apprentice Skills Centre. Colin particularly wanted to visit the Centre as a follow up from Sellafield winning the IMechE Visionary Award for Best Apprentice Scheme Provider in 2016.

The visiting party then moved onto the Sellafield Innovation Centre, to see what the company is doing to help graduates and developing engineers to hone their innovation skill in undertaking short (8 week), rapid "design by doing" prototype development using the latest CAD/CAE software and 3D laser printing technologies. The visit to Sellafield concluded with a visit to the Thermal Oxide Reprocessing Plant (Thorp) to see first hand the complex technology that is developed and utilised at Sellafield Limited.

The next day Iggesund Paperboard kindly hosted a visit to their plant at Workington. Again the focus was on skills, and Iggesund showcased their apprentice and graduate schemes with a very informative presentation and discussions with some apprentices and graduates.

Chris Sutcliffe, Iggesund Training Manager, explained how the company is now starting to attract high calibre apprentices and graduates, which bodes well for the future of the business. The visit also included a comprehensive plant tour, encompassing the board manufacturing machine, its control room and a behind the scenes visit to the plant's new Biomass Combined Heat and Power Plant, which enables Iggesund's plant at Workington to be self-sufficient for steam and electricity, as well as being Carbon Neutral.

David Williamson, IMechE West Cumbria

BLOODHOUND EDUCATION EXTRAVAGANZA

IMechE is proud to be a supporter and sponsor of The Bloodhound SSC Project. Once again, IMechE West Cumbria were honoured to have members of the Bloodhound SSC in attendance at this year's Annual Dinner and to take part in a thrilling educational event.

Bloodhound SSC is an inspirational project to break the world land speed record with a 1,000mph supersonic car (that's what 'SSC' stands for). We believe Bloodhound is a brilliant and engaging way to promote engineering to school children of all ages.

This year, in conjunction with the Annual Dinner, the Bloodhound SSC Educational Team held two full days of STEM Outreach Events at Lakes College for over 400 students, centred on Bloodhound and the Engineering that has gone into it encouraging more of the next generation to take up Science and Engineering as a career. The educational event was very kindly assisted by the REACT Foundation.

During the day the pupils learned about the history of land speed attempts and how the Bloodhound SSC team hope to reach 1000mph in South Africa during 2018 following a number of test runs later this year at the Aerohub in Newquay.

Mike Ford, Rob Bennett and Anthony Rhodes from Bloodhound Education were fantastically

enthusiastic in delivering the workshops which included building, running and fine tuning air powered K'Nex vehicles before racing in a number of heats and finals. The winners of each of the morning and afternoon sessions each day will have their team name emblazoned on the tail fin of the actual Bloodhound SSC as it races across the Hakskeen Pan in South Africa.

The workshops also involved investigations and experiments based around the educational model of the Bloodhound vehicle, which apart from the height of the tail fin is a full scale mock up. With the advantage of the cross section diagram, the Bloodhound team explained how the vehicle operates and explored the science and engineering behind its development.

The buzz in the room was great and the enthusiasm of the pupils and teachers was fantastic.

This two day event was made possible through the sponsor packages taken up at the area's annual dinner, we would like to thank all our sponsors with a special thanks going to Arup as the key sponsor for the Thursday and Lakes College as the key sponsor for the Friday.

Thanks also go to React Foundation for coordinating with the schools and organising pupil attendance.

Mark Holmes, IMechE West Cumbria



LANCASHIRE BORN TRUCK MANUFACTURER

THE ORIGIN OF TRUCK-BUILDING IN LEYLAND CAN BE TRACED BACK TO TWO MEN – JAMES SUMNER AND HENRY SPURRIER, WHO FORMED 'THE LANCASHIRE STEAM MOTOR COMPANY' IN 1896 TO EXPLOIT THEIR ORIGINAL PRODUCT, A 1.5 TONNE CAPACITY STEAM VAN



Image: Leyland

On Thursday 11th May, IMechE West Cumbria travelled down to Lancashire in order to visit the UK's leading medium and heavy duty truck manufacturer, who are also one of Britain's leading manufacturing companies - Leyland Trucks.

The visit to Leyland Trucks began with a light buffet lunch before a presentation by Jim Henderson, Product Development Manager at the company, about the history of Leyland Trucks and its development into today's international organisation.

The visiting party were then split up into two groups and were given an very extensive tour of the production line, following the build of a vehicle from incoming components, through frame assembly and painting, to engine and transmission fitting, cab fitting and bodyline assembly. The tour ended with a visit to the company's display area, where several modern vehicles were on show, as well as vehicles from the past. The trip was a long one from West Cumbria, but all agreed it was well worth the trek.

Leyland is a wholly-owned subsidiary of PACCAR Inc – PACCAR is a global technology leader in design, manufacture and customer

support of high-quality light, medium and heavy-duty trucks under the Kenworth, Peterbilt and DAF nameplates. Since Leyland Trucks was acquired by PACCAR in 1998, it has become the group's established centre for light and medium truck design, development and manufacture.

The Lancashire Steam Motor Company was founded in the town of Leyland in 1896, the start of an unbeaten heritage of engineering and production excellence that relates directly to the Leyland Trucks of today, 21 years later. Since its acquisition by PACCAR Inc. in 1998, Leyland has become the group's established centre for light/medium truck design, development and manufacture. Leyland designs and produces trucks from 6 to 44 tonnes to be sold under each of PACCAR's established global brands – Kenworth, Peterbilt and DAF.

The current facility was opened in 1980 and occupies an area of 710,000 sq ft. All DAF LF trucks and many of the DAF CF and XF variants are assembled at Leyland, as well as the factory bodied truck, with box and curtain side options for LF and CF. Leyland has a capacity to produce 12.5 trucks per hour and 50% of this production is exported, mainly to the countries in the widening European Community.

Leyland is also home to PACCAR Parts in the UK, a world class parts distribution centre comprising of 16,500m² and the capacity to store 76,000 SKUs.

Leyland Trucks has been a PACCAR company since 1998 and produces the full range of DAF product in support of DAF's markets in the UK and around the world. DAF occupies a leading position in the European truck market.

In 2015, the total market for heavy-duty commercial vehicles in the European Union was almost 269,000 units. This is an increase of around 18.5% compared with 2014, when almost 227,000 trucks were registered in this segment. DAF

expects the European market for heavy-duty trucks to amount to between 240,000 and 275,000 vehicles this year.

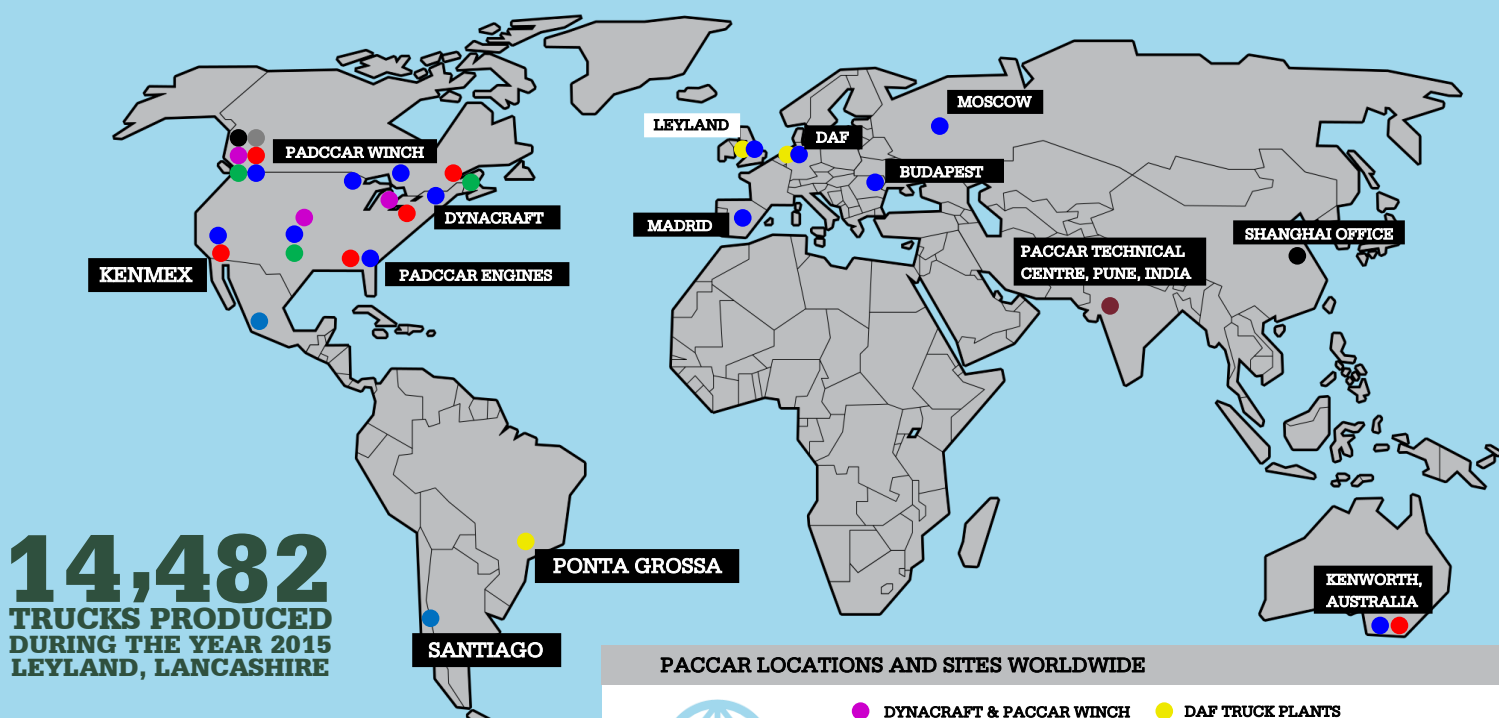
The Design Centre in Leyland employs 100 engineers who work with the latest computer aided technologies. The Centre has comprehensive research and testing facilities, including a state-of-the-art anechoic chamber for a wide range of noise measurements. The DAF Technical Center in Eindhoven also comprises sophisticated engine testing facilities, featuring 34 highly advanced engine test chambers. The engine test center plays a crucial role in the future development of the most efficient and environmentally friendly engines and enables DAF to build on its leading position in engine development.

Leyland Truck's world class manufacturing facility is operated in conjunction with the principles of the PACCAR Production System (PPS) and is supported by PACCAR investments in the most modern manufacturing equipment and the latest technologies.

Since its acquisition of Leyland Trucks, PACCAR has invested significantly in the Leyland plant to ensure it stays at the forefront of truck production and more recently to prepare for production of the all-new Euro 6 DAF model range that Leyland builds. The aim of Euro 6 is to reduce levels of harmful vehicle exhaust emissions, both in petrol and diesel engines. This includes nitrogen oxide (NOx), carbon monoxide (CO), hydrocarbons (THC and NMHC) and particulate matter (PM), which is basically soot from diesel engines.

As with all PACCAR plants, Leyland Trucks employs a continuous improvement approach to manufacturing supported by PPS and Six Sigma, to ensure that Leyland always gets the best out of its processes and equipment and continues to deliver world class products and services to its customers.

David Williamson, IMechE West Cumbria



HIGHLY-ENGINEERED ISOLATION OF RADIOACTIVE WASTE

THE NDA HAS BEEN CHARGED WITH IMPLEMENTING THE UK GOVERNMENT'S POLICY FOR THE LONG-TERM MANAGEMENT OF HIGHER ACTIVITY RADIOACTIVE WASTE BY PLANNING, BUILDING AND OPERATING A GEOLOGICAL DISPOSAL FACILITY (GDF)

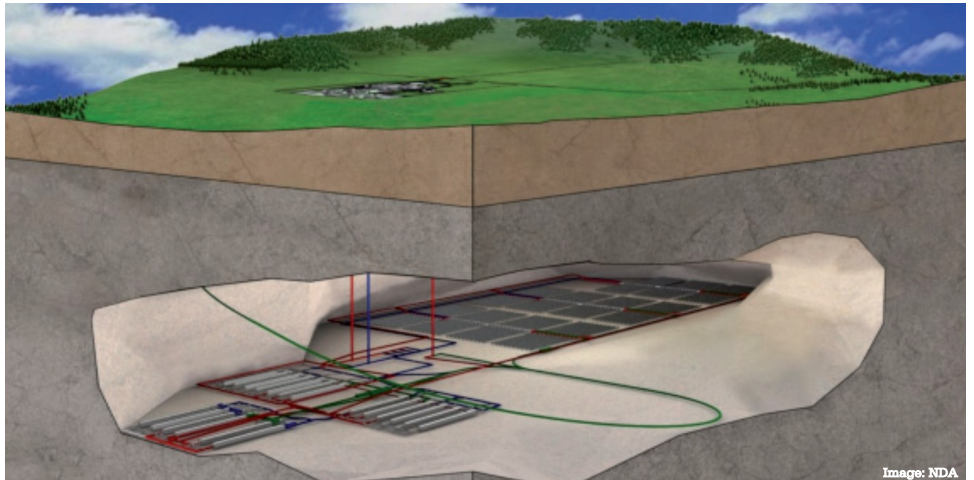
On 1 June 2017, IMechE members and friends were privileged to listen to a presentation from Alun Ellis CEng, FIMechE, on the History of the Geological Disposal Facility (GDF).

In April 2014, the Nuclear Decommissioning Authority (NDA) established Radioactive Waste Management Limited (RWM) as a wholly-owned subsidiary with the purpose of delivering a geological disposal facility (GDF) and providing permanent solutions for the management of higher activity radioactive waste.

Until his retirement last year, Alun was the Technical Director of RWM. This is the body charged with the design, development, construction and operation of the GDF for the disposal of the higher activity radioactive wastes that have already been and will be generated as the result of nuclear activities in England, Wales and Northern Ireland. As radioactive policy is one of the devolved matters, the Scottish Government has decided to adopt a different strategy of 'near facility, near surface management' of Scottish radioactive waste.

Alun began his talk by outlining the development of the policy of deep geological disposal, which dates back to the Flowers Report of 1976. At that time, there was an international consensus that sea dumping presented the best environmental option, but even as the report was being written, opinions were beginning to change. The London Convention that came into force in 1975 banned the sea dumping of high level radioactive wastes. Other radioactive wastes continued to be dumped at sea until 1982 when a voluntary moratorium began. This was finally given legal force in 1994 following the OSPAR Convention in 1992.

The Flowers Report had pointed the way towards the vitrification of high-level liquid waste, and following decades of development work, the first vitrification plant at Sellafield started up in 1991. Encapsulation plants were already operating to cement intermediate level wastes into drums: all of this work was designed to immobilise



Computer-generated image of a geological disposal facility

radioactive wastes with the objective of converting them into forms that would ultimately be disposable in a repository when this became available. In the meantime, intermediate stores held the immobilised wastes in a passively safe form. Most low-level wastes were still being disposed of at the surface facilities at the Drigg site (now known as the Low Level Waste Repository, LLWR), but by this time, practices had been much improved to drum, super-compact and cement the wastes into half height ISO containers placed into engineered vaults.

Alun described the early efforts of NIREX, the predecessor to RWM, to secure planning permission for a Rock Characterisation Facility (RCF) at the Longlands Farm site south of Sellafield, which included a Public Inquiry in 1995-96. NIREX's planning application was finally rejected by the then Secretary of State, John Gummer, on the eve of the general election in 1997. A good deal of surface-based work had already been done to establish the site's suitability, in the hope that if the underground exploration proved the rock satisfactory, a geological repository might follow.

However NIREX's approach to the choice of the Longlands site was claimed by opponents to be one of "decide, announce, defend", and its very proximity to the Sellafield site where most of the UK's waste was already situated was maybe perceived to be just a shade too convenient. The failure to explore other possible sites enabled some geologists to argue that Longlands was not the best location for a geological repository. The reality is that the chosen site does not have to be proved to be optimal, but simply good enough to meet the requirements of the repository's safety case.

After the rejection of the RCF, progress stalled somewhat until 1999, when a House of Lords Select Committee produced a report that resulted in the setting up of a new body, the Radioactive Waste Management Advisory Committee, RWMAC, to examine possible ways forward. Following a series of reports to Government, a successor advisory body, the Committee on Radioactive Waste Management, CoRWM, was appointed in 2003. Public engagement was seen as the key to making progress. In 2006 CoRWM produced a major report reaffirming "... geological disposal to be the best available approach for the long-term management of all the material categorised as waste ... when compared with the risks associated with other methods of management."

Although NIREX had been continuing with its work, in the absence of a chosen site for the repository, the repository designers had to consider a range of different possible host rock types. Three were chosen to be representative of the rocks found in the UK, and these geological environments are typical of those found in one or more of the other countries that are developing their own geological repositories. The three types are higher strength rocks (such as granite), lower strength sedimentary rocks (such as clay), and evaporites (such as rock salt). A number of other countries have progressed their explorations further than the UK, so there is a growing body of international experience on which the UK can draw. International bodies such as the IAEA and the NEA have also done much to draw together this experience, publishing guides that help point the way forward. Given that all nuclear nations share the same problem of dealing with their radioactive wastes, there is a great deal of international cooperation.

Each of the UK designs envisages the excavation of a series of underground caverns or vaults in which the radioactive waste will be

WHAT ARE THE WASTES FOR DISPOSAL?



Low Level Waste

Includes clothing, plastic, paper and metal that have become contaminated during maintenance and monitoring of nuclear operations at nuclear power plants and research facilities. The majority of LLW is disposed of at the Low Level Waste Repository near the village of Drigg in West Cumbria.

Intermediate Level Waste

Intermediate level waste (ILW) arises from the reprocessing of spent fuel and from the operation and maintenance and decommissioning of nuclear facilities including power stations. The waste is packaged and stored on site pending a disposal facility being available.

High Level Waste

High level waste (HLW) arises from spent fuel reprocessing. Liquid HLW is mixed with molten glass and poured into steel containers and is then cooled and stored pending disposal. It is intensely radioactive for several hundred years and produces significant levels of heat as it undergoes radioactive decay.

placed, each vault then being backfilled with a specially designed material to enhance the retention of radioactivity for as long as possible. The vaults will be at a depth of between 200m to 1000m, depending on the geology of the site selected. Shafts and/or drifts from the surface to the level of the vaults will allow the excavated spoil to be brought to the surface for potential reuse. Radioactive waste in suitable containers will be transported underground using the same route.

The aim of the repository design is to minimize the amount of radioactivity or toxic substances reaching the surface or aquifers that could provide a route for it to reach persons in amounts that might cause significant harm. The criteria being used are that the effect of the repository on those who might be exposed should be a very small fraction of the amount of natural background radioactivity to which we are all exposed. This is achieved through a multi-barrier concept, consisting of the waste-form itself, the waste container, the surrounding backfill within the vault, the rock immediately surrounding the vault, and the various rock layers between the vault and the surface. The retention period provided by these multiple barriers is such that the natural radioactive decay will greatly reduce its potential for harm.

The retention period is one of the main drivers when selecting a candidate site for the repository. The Government's policy is to use a 'voluntarist approach', inviting expressions of interest from

communities willing to participate in the site selection process. If the sites are judged to have potential, surface-based investigations leading to borehole drilling will be used to determine the site's suitability for construction work to be started. The current view is that a single site could be used for the disposal of all higher activity radioactive wastes that exist now and those that will be generated, assuming that a 16GW new build nuclear programme goes ahead. The Government has declared the GDF as a "nationally significant infrastructure project" under the terms of the Planning Act 2008, which puts it on the same level as HS2 High Speed Rail Route and Heathrow Runway 3.

The hope is that a practical solution allowing the permanent disposal of higher activity radioactive wastes generated in England, Wales and Northern Ireland will reduce concerns over the safety of their current storage in ageing facilities. Dealing with wastes responsibly should help to remove one of the objections to building new nuclear generating capacity and enable the UK play its part in reducing harmful greenhouse gas emissions.

After a question and answer session, IMechE event organiser Jim Furness thanked Alun for the highly informative presentation. Following usual IMechE West Cumbria tradition, Jim presented Alun with the customary 'Pit-Tankie'.

Jim Furness C Eng, IMechE West Cumbria

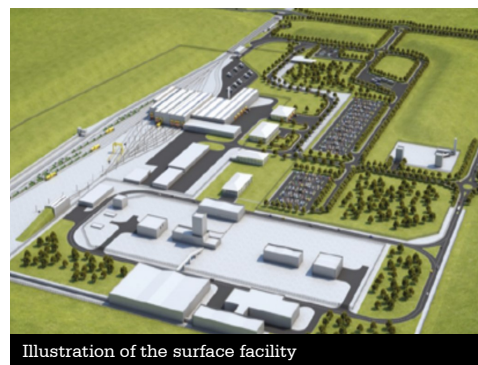


Illustration of the surface facility



Jim Furness thanks Alun for his presentation

HYDROGEN FUELLING STATIONS

ITM POWER IS AN ELECTROLYSER COMPANY MANUFACTURING HYDROGEN ENERGY SOLUTIONS FOR ENERGY STORAGE AND CLEAN FUEL PRODUCTION. WITH HEADQUARTERS IN SHEFFIELD, THEY HAVE OFFICES IN GERMANY, FRANCE, THE USA AND CANADA.

On Tuesday 14 February 2017, Charles Purkess, Business Development Manager, for ITM Power gave a presentation on the company's offering in the Hydrogen Energy Storage and Clean Fuel arenas.

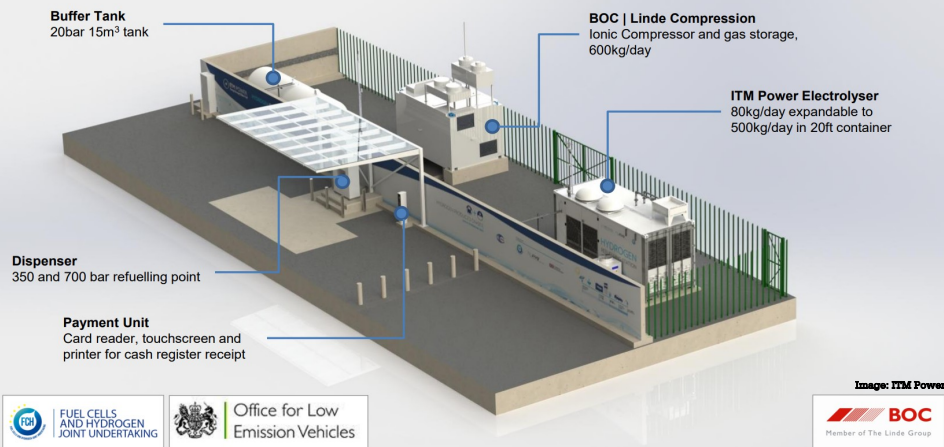
Charles's presentation focussed on the Rapid Response Electrolyser technology ITM has developed and which is currently being deployed in both Power-to-Gas and Clean Fuel projects across the globe. He explained that the move to hydrogen as a fuel had several benefits including the use of renewable energy to power the process, the ability to provide storage for renewable energy and the zero carbon footprint.

The basis of ITM Power's offering is to convert surplus renewable electricity, such as that available from wind turbines during the night, into chemical energy (hydrogen) and either store this in gas networks or use it as clean fuel. During 2016 some of the company's successes included winning a Power-to-Gas contract with National Grid, the opening of three new Hydrogen Refuelling Stations in the UK and establishing the first hydrogen refuelling station on a Shell forecourt.

Charles described the part hydrogen is playing along with other renewables in changing the energy landscape and highlighted that in order to sustain this growth, energy storage is required to help balance supply and demand. Whilst electricity cannot be easily stored, hydrogen can be stored easily in existing gas networks at much higher capacity than can be achieved using flywheel or battery technology. Typically Power-to-Gas hydrogen storage capacity is between 1GWh to 1TWh with a discharge range of 1 hour to 1 month demonstrating efficiencies in excess of 75%.

The other area covered was the use of hydrogen as a clean fuel and the development of the technology by ITM Power such that hydrogen is produced at the forecourt thus removing the need to transport the gas from a production

WHAT IS AN FCEV REFUELLING STATION?



Typical layout of a Hydrogen Fuel Cell Electric Vehicle Refuelling Station

facility. This is achieved with a system that combines an ITM Power Electrolyser with a 20bar buffer storage tank which in turn feeds an ionic compressor and storage unit that supplies the fuel dispenser at between 350 and 700bar.

To understand the benefits of hydrogen fuel cell vehicles, Charles gave an overview of current applications. A typical family saloon car can be refuelled in 3 minutes for a range of 300 miles. The drive chain incorporates hydrogen tanks and batteries so that regenerative power from braking can be utilised. Hydrogen is fed through a fuel cell stack to generate electricity, effectively reversing the hydrogen production technique, a power control unit is then utilised to manage delivery of electricity between the fuel cell and battery.

Other fuel cell vehicles currently growing in usage range from small commercial vans to double decker busses, the later having a range of 200 miles and likely to be seen on the streets of

London in the not too distant future. One of the added benefits of the relatively small footprint of the ITM fuel station is that it can be utilised to support fleet operations for vehicles with high usage over limited range, such as the metropolitan area of London.

The presentation prompted a good range of questions and conversations with all who attended agreeing it had been an interesting and informative event. Find out more about ITM's Hydrogen Energy Solutions on their website: www.itm-power.com.

Mark Holmes, IMechE West Cumbria

BEP Delivery Team



The Box Encapsulation Plant Delivery Team (BEPDT) are delighted to work with the West Cumbria branch of IMechE to inspire future engineers by supporting the educational work they do in local schools.



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Our work in Cumbria began 50 years ago and we now employ 250 people supporting Sellafield Ltd, BAE Systems Maritime-Submarines, Low Level Waste Repository Ltd, and NuGeneration Ltd.

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IMechE West Cumbria Educational Events

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IMECHE WEST CUMBRIA UPCOMING EVENTS

NOTE: ALL EVENTS MUST BE BOOKED ONLINE

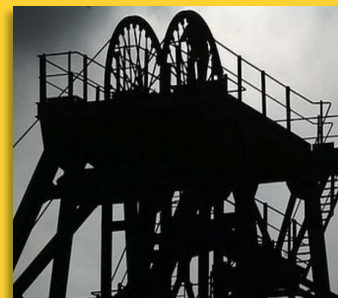
TALK: Coal Mining Re-Birth in West Cumbria

19 September 2017, 19:00 (registration from 18:30)

A talk by West Cumbria Mining discusses their developing plans for the creation of a metallurgical coal mine off the coast near Whitehaven, to supply the European steel-making coal market, which currently imports around 45 million tonnes per annum.

Location: Lakes College West Cumbria, Lillyhall, Workington, CA14 4JN

Organiser: Nick Taylor (nick.taylor@atkinsglobal.com)



VISIT: EGGER (UK) Ltd Hexham

LIMITED NUMBERS

10 October 2017, 11:30 (first pick up) 18:30 (last drop off)

An opportunity to visit EGGER at Hexham, Northumberland, which is one of Europe's most technologically advanced chipboard production plants. More than £400 million has been invested in their state of the art facilities since 1984, including a recent multi-million pound engineering building and apprentice training academy.

Cost: £12.50pp (payable in advance) for return travel from designated pick up points on route

Location: Anick Grange Road, Anick, Hexham NE46 4JS

Organiser: Ron Graham (ron.graham@sellafieldsites.com)



TALK: Createc - Fukushima

16 November 2017, 19:00 (registration from 18:30)

A talk about Createc robotic platforms and their respective uses, from plane inspection to radiation surveying at Fukushima, showing how these platforms keep people at a safe distance while allowing the collection of vital survey data, and how the fusion of software, electronics and mechanical engineering enables robotics to undertake work which would otherwise be inaccessible.

Location: Lakes College West Cumbria, Lillyhall, Workington, CA14 4JN

Organiser: Simon Mandale (wcumbchair@imechenearyou.org)



TALK: Cathedral Organ Refurbishments

25 January 2018, 19:00 (registration from 18:30)

A talk by Harrison & Harrison Ltd, will give a unique insight into the engineering which lies behind designing, building and maintaining one of the most significant items of the UK's heritage; the Cathedral Organ. These magnificent instruments which grace the worlds cathedrals are often taken for granted, however require specialist engineering skills to ensure their survival. Harrison & Harrison ensure the skills required to preserve this heritage is maintained for generations to come.

Location: Lakes College, West Cumbria, Lillyhall, Workington, CA14 4JN

Organiser: Mike Farrer (mike.farrer@arup.com)



For more details and to book your place on any of the events please visit;
nearyou.imeche.org/near-you/UK/North-Western/West-Cumbria-Area/events

Pre-booking your place on an event is mandatory, each event will become active for bookings nearer its date.

Events are for all ages with no specific requirements unless specified.

Visit the events page of our website for more information or contact the individual event organiser.

You do not need to be a member of the IMechE to attend our events, all are open to the public and free entry unless stated.

ARUP

Lakes College
West Cumbria

