



# THE SWORDSMAN

Issue 41, November 2018

The Worshipful Company of Engineers

(Incorporated by Royal Charter 2004)



# The Swordsman



Issue 41 November 2018

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*Front cover: Photograph of HMS AUDACIOUS at BAE's shipyard in Barrow - in Furness just prior to being lowered into the water.*



# A PROFILE OF THE MASTER DAVID JOHNSON FREng



## From the Editor

This edition includes a report on the Awards and Dinner which is one of the highlights of the Company's year. The new generation of engineers are always highly motivated and their enthusiasm is infectious. Many of our members are now mentors to prize winners and they were invited to write why they enjoy mentoring and to provide some insight to their experience. If you are inspired to be a mentor you should contact Malcolm Vincent or the Clerk.

The EEF has produced a recent report that the economy has added 145,000 manufacturing jobs in five years to March 2018. We have just been through the longest period of jobs growth in manufacturing for 40 years. But do not be too fast with a toast to the successes of manufacturing. Economists are warning that sustained growth in manufacturing employment is fuelling the UK's productivity crisis. They assert that the industry hires people instead of investing in new technology that would

boost output per hour worked. The good news is that engineers are also the answer to improving productivity!

The UK recently passed another milestone in electricity generation. On 7 June 2018 the energy output of wind turbines and solar panels helped to meet more than half of the UK's electricity demand. The record 19.3GW output of renewable energy was enough to meet more than 50pc of midday power demand which reached 35.4GW.

Those members of the Company who went to the Out of Town (OOT) in Derbyshire have written up some very interesting reports but the meeting of old and making new friends remains one of the best reasons for signing up for and Out of Town. If September is always a difficult month to take a few days for the OOT the good news is that next year's will be in June 2019.

**Contributors :** *Diana Blair-Fish, Peter Blair-Fish, Barry Brooks, Audrey Canning, John Canning, Elizabeth Chandler, Dave Cooper, Yuli (Chaido) Doulala-Rigby, Suzanne Flynn, Kenneth Gray, Richard Groome, Peter Hartley, David Johnson, Yvonne Joyce, Peter Liddell, Andrew McNaughton, Rod Muttram, Philip Ruffles, David Shillito, Janet Smart, Malcolm Vincent, Andrew Walker, Andy Ward, Matthew Waterhouse, Patrick Waterhouse.*



Intense curiosity about how something works, wanting to improve it and use the components and knowledge to make something else, have been 'a constant' in the life of Master Engineer, Professor David Johnson FREng. As a child, dismantling and re-assembling car engines, radios and other electronic devices were the norm. Computers fascinated him. As a teenager he, with others, improved and maintained an old valve - based (Elliott 405) computer, increasingly learning about computer coding, electronics and the mathematics of algorithms. The more complex the problems, the more he used computers and electronics, and greater was the enjoyment

Discouraged from studying computing science – “*there is no future in it*” - and noticing the first year electronic engineering syllabus at Leeds University taught him little new, he read Civil Engineering where his computing experience enabled him to develop computational solutions to fluid dynamics problems – a forerunner to present day Computational Fluid Dynamics analysis. On graduation, David joined British Rail’s Research Division working in track research. Traditional measuring techniques and slide rules were the norm, but he wanted to use laser technologies to measure and computer power to calculate. His chance came when his department head let him take his ideas forward to reduce recovery time after track renewals (a big component of journey time) through a measured approach to ballast removal and replacement. Faith in him was rewarded when in 1987 for the first time, a renewed track was opened at full line speed - 125mph instead of the usual 20mph or 40mph. Financial benefits ensued. The bright ideas generated innovation because of champions, a willingness to take risks, and a clear business case.

Increasingly David recognised that the relationship between measurement, calculations, and computing meant engineering issues had to be looked at differently. He left British Rail for John Kelly Lasers, increasing his knowledge of lasers and their potential use in structure gauging. In 1989 he set up his own company – Laser Rail - where he combined laser measuring technologies with the analytical power of computers to determine the space between the train and the railway infrastructure (gauging) thus optimising train size safely.

At Laser Rail he wrote ClearRoute - the seminal analytical software system for gauging. It changed the face of gauging. Gauging, instead of being primarily a safety issue became a 'business' issue, creating business value. Because of ClearRoute trains could be made bigger and move faster; containerised freight traffic grew; and the Pendolino – a tilting train - was made possible. A PhD at Imperial College subsequently enabled him to systematically and rigorously describe mathematically the parameters that impact on clearance.

It gave him the fundamental information base for advanced computer processing to replace the empirical methods used in ClearRoute. David’s systems are now used to introduce all new trains onto the British railway network, and to later move them to other routes.

After Laser Rail was sold he set up DGauge, where he continues to use powerful analytical and processing capability of computers to develop new software gauging products such as PhX and RouteSpace, speeding up analysis time and processing large data sets. ‘Probabilistic gauging’ is his new market - ready invention. All this innovation demands both new mathematics to solve the problems and the invention of new ways of thinking about and dealing with the engineering issues. His work is grounded in the engineering issues of the day and driven by his lifetime’s desire to improve the railways cost effectively.

His expertise and reputation in gauging grew. Involvement in railway standards, writing and reviewing papers and books, serving on EU and UK committees, being an expert witness were the ‘norm’. (It is rumoured that he is referred to as ‘The God of Gauging’ in the industry). Collaborating with universities grew from teaching to leading research, supervising PhDs, securing research grants and receiving an honorary professorship from City University. An FREng followed in September 2018.

David sees and describes, with great clarity, the way computer technologies are driving change in engineering and how important it is for professional engineers to ‘keep in touch’. Engineering uses the new technologies of sensors, nanotechnology, communications and additive manufacture to create intelligent systems and infrastructure which generate new possibilities - and Digital underpins it all, generating vast quantities of data. As computer power continues to grow, the challenge is to harness the volume of information generated from these masses of data in novel ways, including the use of artificial intelligence.

Recognising how important it is for established engineers to stay connected to these dynamic changes, he has chosen ‘Digital Engineering’ as his theme for the year and champions the establishment of ‘Associates’ of the Company for younger engineers - they are the future. As he says “*The generations coming up are grounded in 'digital' - it is second nature to them. Young and established engineers being together will keep engineering vibrant, dynamic, continuously innovative and 'in touch'.*”

Marilyn Wedgewood

## AWARDS DINNER at PLAISTERER’S HALL 10 July 2018

This year’s Awards Dinner, was held at Plaisterers’ Hall on Tuesday 10th July 2018 which was an evening of celebration and showcased excellence in engineering.

This prestigious event in the Company’s annual calendar is where the Company celebrates the successes of the people that we support in our awards, which includes significant numbers of young people who look up to those who have contributed to their achievement.



The Master and Wardens looking out, at what?

The principal guests were Lady Belinda Gadsden, wife of the founding Master and past Lady Mayoress, the Chief Royal Engineer and Dr Hayaatun Sillem, the new CEO of the Royal Academy of Engineering. However, they had to work for their supper because between them they presented an outstanding variety of Awards and Prizes provided by the Engineer’s Trust. This year, the Sir Peter Gadsden Britain Australia Award was presented by Lady Gadsden, which encourages exchanges between British and Australian engineers undertaking postgraduate studies. The full list of the awards and award winners is in the Appendix to this edition of the Swordsman.

Nearly all the award winners were able to attend the dinner and receive their awards personally. For many of the guests, who had the pleasure of the company and conversation with the young engineers it adds another uplifting dimension to what is always an outstanding occasion.

The format of the evening had been changed from previous years so that there were citations and awards between each course of the dinner which proved to be very popular. Also a hit with the members of the Company who attended was the price that had been significantly reduced from that of last year.



The Master and Mistress

Some of the mentors of the recipients of the Horizon Bursaries were invited to provide some insight into the mentoring benefits in the hope that more of the Company’s membership step forward to become mentors.



Prizewinners from the military and senior military representatives



## The Oxford English Dictionary definition of **Mentor** is,

**‘An experienced and trusted adviser.’**



### The paradox of mentoring

*By Andrew Walker*

The paradox about mentoring, and its reward, is that you start by thinking that you will share your enthusiasm for engineering (as opposed to managing or financing engineering businesses which was probably what most of us were doing latterly) and solving customers/clients problems with a young engineer. But the paradox is that you become inspired by their enthusiasm and their problem solving.

You start by thinking, as mature people do, that you will make life brighter for a younger person; but they wind up making it brighter for you--or perhaps it is that they remind you of the things you truly enjoyed about engineering.

Then you do get the opportunity to help, in situations where you have been around that buoy before. That too has its rewards in passing on the attitude that one does not have to accept "no" or it "can't be done" for an answer. Perhaps that really is Engineering!!!

### Sheer determination to succeed

*By Patrick Waterhouse*

I volunteered to become a mentor with an open mind, not knowing what to expect.

I was introduced to my mentee, a 19-year-old woman keen to progress a career in the aviation industry. Initially she had obtained an apprenticeship at one of the major London airports, but the logistics of a 3 hour daily round trip got in her way. Moving to work in an unrelated job, she was keen to obtain a relevant apprenticeship elsewhere. I helped her with her cv and with how to

write applications to companies. I also showed her a range of companies that advertised apprenticeship opportunities. Many of the firms whose names we know and recognise are not known by the outside world, nor what they do. I hope that my identification of target companies opened her eyes to the opportunities available.

She has now changed her career plans and is hoping to start a degree in mechanical engineering at University soon. This wasn't something that we discussed so I wasn't able to help her in her application. But her sheer determination to succeed in engineering has impressed me and has enabled me to view the opportunities for young people in a different light.

Her move to University has probably ended our mentoring relationship, at least for now. But I found my limited role in her career development to be rewarding for me and I hope that it was for her too.

### Why I Mentor

*By Matthew Waterhouse*

The world is full of good advice and guidance as to “why you should mentor/coach” another person. Or what mentoring is about and how to do it. Or what is the difference between mentoring and coaching. At least the internet is and many academic institutions are trying to broadcast this as the latest “in-thing”.

Well, this is all good and useful stuff but it does not seem, to me, to get to the heart of the issue and cover or explain why I was happy to volunteer, when asked, to mentor a new entry into automotive engineering.

I have spent virtually all my working life in the automotive industry and I have enjoyed (almost) every day. So, it seems to me that some of this enthusiasm and enjoyment can be “passed on” to future generations and I can help them enjoy, also. I am, I hope, relatively realistic in this exercise. I know, for example, that knowledge transference is never able to reach 100%. In my experience getting 20 or 30% of a learnt experience transferred to the next project/generation/activity is actually “doing well”! Therefore, all I can do is explain, show by example, recount my experience, offer, my view but I cannot tell, make, force or guarantee. It still needs to recipient to ask, understand, wish to learn and then to do.

So, for me, mentoring is about this offer of my

experience to help, to reduce the painful learning, to speed-up the gathering of knowledge and to see a young person come to love and enjoy the experience of being an engineer in the modern world.

I cannot imagine being anything other than an engineer. The ability to ask why and how, to see the world working and moving – is there any other profession?

***“ Paul has a wealth of knowledge and experience within engineering, which is both useful and inspiring”***

So said Daniel Swain who is a recipient of an IET Engineering Horizons Bursary. His mentor is **Paul Wood**.

Paul was quoted in the IET Impact Report 2017 as follows.

Although I’m three times as old as Daniel, we quickly found that our shared passion for engineering enabled us to establish a good rapport. We’ve used some simple tools to establish goals for the mentoring relationship, and to address specific areas such as public speaking where Daniel felt he could use some advice.

I hope I’ve helped Daniel look beyond his immediate goals to thinking about longer term opportunities in engineering, especially in new and emerging technologies that will offer exciting challenges and fulfilment in the future. I look forward to my regular contacts with him, and I’m very happy that the bursary scheme has given me the opportunity to pass on my knowledge and experience to a new generation.



*Civilian prize and award winners*



# JUNIOR WARDEN'S LECTURE

## Evolution of Offshore Structures – from Oil and Gas to Renewable Energy

Delivered by Dr Peter Blair-Fish at HQS Wellington 20 June 2018

This lecture summarised the development of offshore structures in the North Sea and nearby waters, and their evolution from the extraction of oil and gas from below the seabed to the harnessing of offshore wind power and other sources of renewable energy.

### TYPES OF OFFSHORE STRUCTURES

Fig 1 shows fixed steel structures in shallow water, fixed steel structures up to 200 metre water depth, and gravity base structures. Early steel structures in shallow water were “jackets” through which piles were driven to carry the weight of a deck or “topside” down into the seabed. In shallow water, jacket structures are installed by lifting off a transport barge. In deeper water, heavier jacket structures have been launched off a transport barge then upended and installed by sequential ballasting, sometimes assisted by the hook of an offshore crane vessel. Of the five hundred or so fixed structures for oil and gas production in the North Sea, around 13% are in water depths of under 25m, 56% in water depths of 25-50m, 12% in 50-75m, 7% in 75-100m and 13% in over 100m.

The capacities of offshore crane vessels (Table 1) and hence the maximum size of lift-installed jacket have increased since the 1970s when the first Semi Submersible Crane Vessels (SSCVs) came into service. Also shown in Fig 1 is a large gravity base structure, of which there are about thirty for oil and gas production in the North Sea.

To date, offshore wind turbines are closer to the shore and predominantly use monopiles, although some projects are using jackets or Gravity Base Structures, as indicated in Fig 1 (b,c).

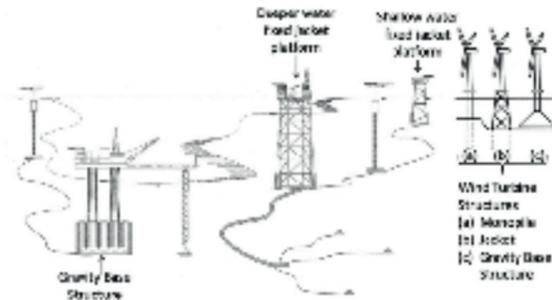


Fig. 1 Fixed offshore structures

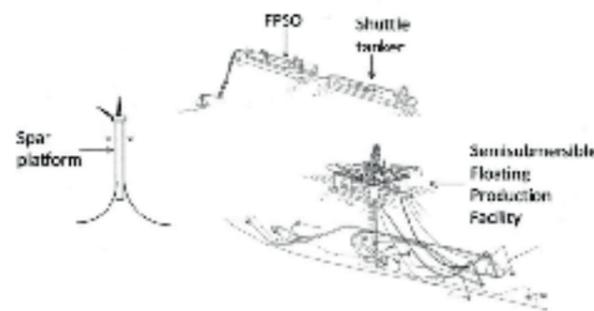


Fig. 2 Some floating production platforms

Table 1: Increased capacity of crane vessels

Vessel	Type	Operator	Year into service	Lift capacity (tonnes)
Balder	SSCV	Heerema	1978	Originally 2,700 + 1,800, upgraded 1984 to 3,600 + 2,700
Thialf (was DB102)	SSCV	Heerema	1985	Originally 2 x 6,000, upgraded 1997 to 2 x 7,100
S7000	SSCV	Saipem	1986	2 x 7,000
Stanislav Yudin	Monohull	Seaway	1996	2,500
Saipem 3000	Monohull	Saipem	2003	2,175 (Crane from Pearl Marine)
Oleg Strashnov	Monohull	Seaway	2011	5,000
Aegir	Monohull	Heerema	2013	4,000 (Pipelay vessel)
Pioneering Spirit	Catamaran	All Seas	2014	Topsides 48,000; Jackets 20,000
Sleipnir	SSCV	Heerema	2019	2 x 10,000 (combined 18,800)

The first oil produced in the UK Sector of the North Sea was from a semi-submersible drilling rig converted into a floating production platform. There are a few such structures. Floating Production Storage and Offtake vessels (FPSOs) are more numerous, with a shuttle tanker to export oil. In calmer seas, as found off West Africa, an FPSO may face the same heading all the time with spread moorings. In rougher waters such as those found in the North Sea or West of Shetland, the moorings and flowlines to the FPSO are brought into a turret (not shown in Fig 2) about which the FPSO can rotate to face the weather. Spar platforms have been used for oil storage and loading, and in deep water in the Gulf of Mexico as production platforms.

### FIXED STEEL PLATFORMS

The 10<sup>th</sup> edition of the North Sea Field Development Guide (Ref 1) lists 36 floating production platforms, 29 gravity base structures, 11 jack-up platforms and almost 500 fixed steel structures. In the Aberdeen Maritime Museum there is a 1:33 scale model of the Murchison platform, which was installed in 1979 in 156m of water and removed in 2017. Its 25,000 tonne jacket structure was installed by launching from a barge and sequential ballasting, and secured by battered piles driven by above water steam hammers and followers. The piles were driven through guides which can be seen on the model (Fig 3) and grouted into sleeves clustered around the main legs of the jacket. Its 18,000 tonne topside was



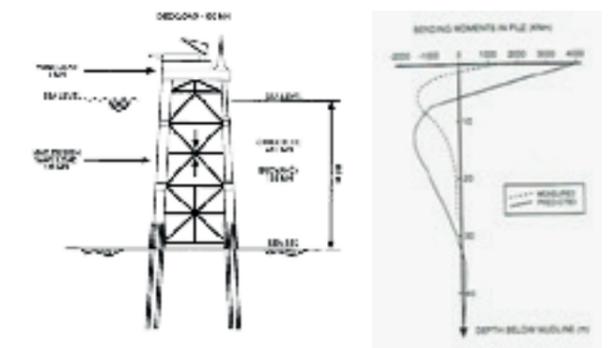
Fig 3 Model of Murchison platform at Aberdeen Maritime Museum

installed in several modules with a maximum lift of under 2,000 tonnes. By contrast the Britannia gas platform was installed in 1997 with vertical piles driven by an underwater hammer so no pile guides, a lift of 10,500 tonnes for its integrated deck, so more onshore commissioning, and four other lifts of about 2,000 tonnes.

The Magnus structure was installed three years after Murchison in a water depth of 182m. At the time, it was too heavy to be launched from a barge so was designed with two legs of 10.5 metres diameter over their full length so that it floated with limited auxiliary buoyancy. It was built on its side in a graving dock at Nigg (Fig 4a) and was designed for a deck load of over 30,000 tonnes (Fig 4b).



(a) Fabrication at Nigg Bay

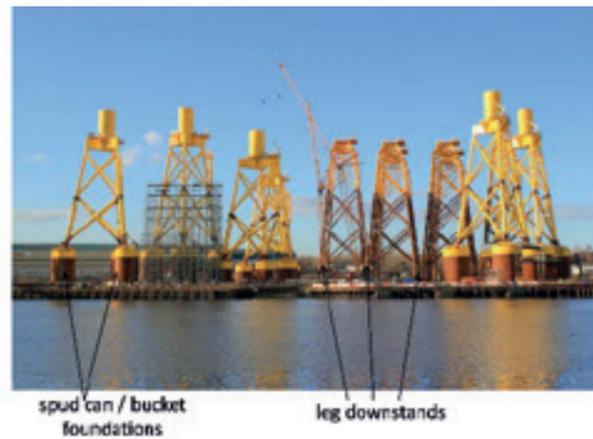


(b) Load schematic in place (Ref 2) (c) Bending moment in pile (Ref 2)

Fig 4 Foundation monitoring on the Magnus structure



**Fig. 5 Veslefrikk wellhead jacket – 9,100 tonne lift (Ref 3)**



**Fig.6 Fabrication of jacket structures by Smulders at Wallsend, March 2018**



**Fig. 7 Subsea pile installation frame**

Simple observations of the whole structure indicated that its natural period was about 25% less than predicted. Analysis from the foundation monitoring system fitted to the structure indicated that it was at least twice as stiff as predicted, in any mode (Ref 2). The monitoring system also showed that the maximum bending moments in the piles and their distribution down the pile were not as predicted (Fig 4c). The difference in bending moments may be due to overestimation of interaction between piles, underprediction of stiffness, absence of scour around the top of the piles and other conservatisms. So far as the author is aware, the insights from the Magnus Foundation Monitoring Project have helped to recertify the Magnus structure for increased loads but not led to a general reduction in conservatisms in design.

A different challenge was posed in 1986, just four years after the Magnus structure was installed. Could a slender wellhead jacket be installed by lifting in a water depth of 175 metres and support a topside deck load of 6,300 tonnes? All process plant was installed on a floating semi-submersible rig alongside the wellhead platform. The answer was yes, after a few headaches. A jacket structure of 9,100 tonnes was loaded out on a 1,400 tonne sledge onto a barge and transported to the mouth of Sognefjord where it was lifted off the barge and sledge and into the water (Fig 5), then towed semi-submerged to the Veslefrikk field in the North Sea where it was upended and 5,400 tonnes of piles and 1,560 tonnes of other items were installed. These items included a deck support frame and thick walled inserts for the top 86 metres of each leg, to resist impacts by supply boats. Also, from the time the jacket landed on the sea bed to grouting at least one pile per leg, the jacket was supported by mudmats made of aluminium rather than steel. This is one innovation that the client was disinclined to repeat, because of concerns about galvanic corrosion.

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## OFFSHORE WIND

Most offshore wind turbines and some electrical substations are supported by driven monopiles (see Fig. 1a, Fig 8 and Ref 4). Following concerns that existing design methods underpredict the natural frequencies of wind turbines on monopile foundations, a Joint Industry Project (the PISA project, or Pile Soil Analysis project) has developed a new design method for laterally loaded piles with low ratios of length to diameter. The method (Ref 5) was developed from 3D finite element analysis and static and cyclic testing of piles up to 2 metres diameter in stiff clay at Cowden and sand at Dunkirk.



**Fig 8 Wind turbines and offshore substation on monopiles at Gunfleet Sands Offshore Wind Farm**

Jacket structures now being installed for some offshore wind turbines have X-bracing (Fig 6), similar to that on the Veslefrikk wellhead jacket (Fig 5). Whereas the Veslefrikk jacket was supported by its mudmats until its piles were installed, the jackets for wind turbines either have piles pre-installed using a subsea pile installation frame (Fig 7), or have “spud can” or “bucket” foundations which are pumped out to secure the jacket to the seabed (Ref 6). “Spud can” or “bucket” foundations avoid disturbing marine life with the noise from pile driving. Where piles are used, the pile installation frame has mudmats and jacks to set it level. Once the piles are driven, soil on the inside of the pile is cleaned out so that the downstand legs of the jacket can be stabbed into the piles and the annulus between piles and downstand legs filled with grout.

Larger electrical substations use jacket structures similar to those for shallow water oil and gas.

Gravity base structures are being used to support five 8.3 MW turbines for the Blyth Demonstrator Wind Farm which is 6 km off the coast of Northumberland. Also, eighty three gravity base structures are planned for the Fécamp wind farm on the French side of the English Channel. For the Blyth Demonstrator Wind Farm, the gravity base structures are remarkably similar to the two Khazzan storage tanks installed offshore Dubai in the late 1960s (Ref 7). Both designs are shaped like a conical flask, are 60m high and have a dry weight of 15,000 tonnes.

Hywind, the world’s first commercial floating wind farm, has five 6MW wind turbines with 154m diameter rotors, mounted on spars and installed 25km off Peterhead in 2017. It started to deliver energy to the Scottish grid in 2017. Each turbine is supported by a vertical spar which extends to 78m below the sea surface and is moored by



three chains 2.4 km long and with a suction anchor at the end of each chain.

The numbers of wind farm structures in UK waters are summarised in Table 2, based on data from the Crown Estate:

	March 2014		December 2017		Total
	Operating	Under construction	Operating	Under construction	
Offshore wind turbines	1,115	335	1,762	1,161	2,923
Offshore substations	15	5	21	18	39
Export cables	44	5	61	25	86
Offshore masts	23	5	20	1	21

**Table 2: UK Offshore wind turbines, substations, export cables and meteorological masts**

## TIDAL AND WAVE POWER

A number of tidal turbines have been developed and tested. Nova Innovation has tested an array of five 100 kW turbines with 10m diameter rotors between Shetland and Unst and plans to deploy an array of ten turbines near Aberavon. Simec Atlantis has installed four 1.5 MW turbines with 18m diameter rotors in the Pentland Firth, with gravity blocks to hold the turbines on place and directional drilling for the cables from each turbine. Simec Atlantis says it will consider monopile foundations and fewer export cables in future. However, it is not getting the financial incentives that it would like for further tidal arrays in the UK.

Many wave power devices have been proposed and many prototypes tested. Several "Pelamis" sea snakes were built. One was connected to the Scottish grid at the European Marine Energy Centre on Orkney. Pelamis Wave Power went into administration in 2014 after being unable to secure additional funding to develop its technology. Wave power devices do not yet seem to be commercially viable.

## MAJOR INCIDENTS

Technical problems are rarely publicised. The offshore oil and gas industry in the North Sea suffered significant loss of life in two major incidents—the loss of the Alexander Kielland in 1980 and of Piper Alpha in 1988.

Also, the industry suffered considerable embarrassment over the aborted disposal of the Brent Spar.

The Alexander Kjelland (or Kielland) was a five legged "Pentagone" drilling rig being used as a floating accommodation rig in the Edda field. During a storm on the night of 27<sup>th</sup> March 1980, a fatigue crack caused the loss of a bracing member which led to failure of other bracing members, loss of one leg and capsized of the rig with the loss of 123 lives (Ref 8). This incident led to requirements for structural redundancy.

Piper Alpha was one of the earlier oil production platforms in the North Sea (Ref 9). A fire and explosion on the night of 6<sup>th</sup> July 1988 killed 165 of the 226 on board, mostly through inhalation of smoke. The report on the public inquiry (Ref 10) led to new UK regulations for: safety cases; management and administration; design and construction of wells; and prevention of fire explosion and emergency response. The safety case regulations require a demonstration that risks have been reduced to as low as reasonably practicable.



**Fig 9 HSE Offshore Injury Rates (UK) per 100,000 workers**

Over the past twenty years there has been a downward trend in injury rates (Fig 9 and Ref 11). Over half the injuries in 2016 were from slips, trips, falls, handling, lifting, carrying or being struck by a moving object. Over the ten years 2007-2016 there were six fatalities offshore. However, helicopter accidents are logged separately: four fatal crashes since 2000 have killed 38 people. Most crew transfers to offshore wind farms are by boat.

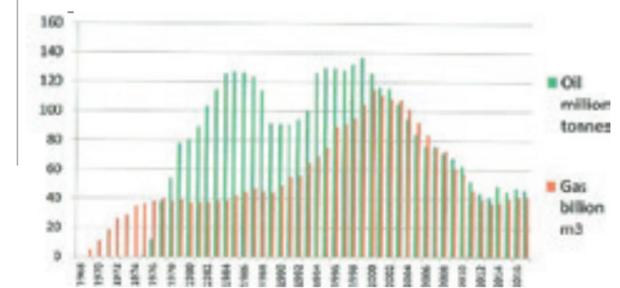
The Brent Spar was used to export oil from the Brent field until a pipeline was commissioned, making the Brent Spar redundant. Plans to dump it in deep water in the Atlantic were halted after Greenpeace occupied it in 1995 (Ref 12). After extensive consultation it was agreed that the Best Practicable Environmental Option was to reuse sections of the main body of the Brent Spar in the extension of a quay at Mejarvik, Stavanger, Norway. The 1998 OSPAR convention agreed that all structures in the North Sea that are less than 10,000 tonnes must be

totally removed. Only the bases of some of the largest installations are to remain in the sea.

The offshore wind industry has had problems with turbine blades, cables, bolts, internal corrosion of transition pieces, and grouted connections between monopiles and transition pieces. Extensive tests on grouted connections in the 1970s (Ref 13) led to the recommendations in the UK Department of Energy guidance notes on offshore structures published in 1990 (Ref 14). After the loss of Piper Alpha, the guidance notes were replaced by a requirement to demonstrate that safety risks were as low as reasonably practicable. Unfortunately a large number of grouted connections between monopiles and transition pieces for wind turbines were designed as plain pipe connections based on a Norwegian standard which in turn was based on guidance in the body of API RP2A (Ref 15), which was known to be unconservative at high ratios of diameter to thickness of the pile and sleeve or transition piece. The more detailed guidance in the UK Department of Energy method was in the commentary to API RP2A but was not used. A large number of grouted connections slipped and needed remedial measures.

## ENERGY PRODUCTION

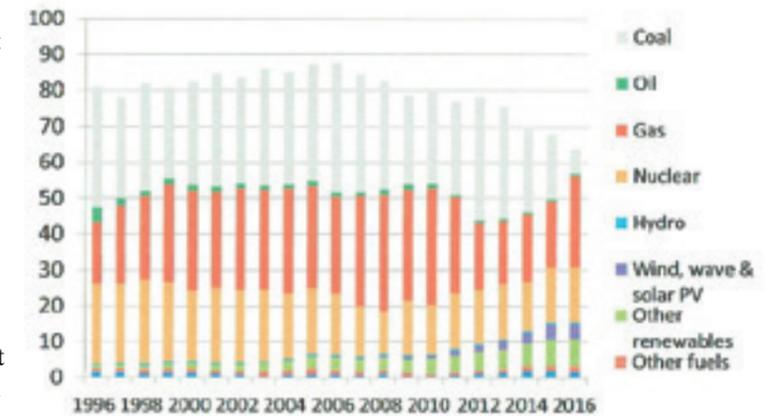
The history of UK oil and gas production in the UK Sector of the North Sea is shown in Fig 10 (data from Refs 16, 17 and 18). Oil is shown in million tonnes, with one tonne having a volume of about seven barrels. Gas is shown in billions of cubic metres, with one cubic metre being about thirty five cubic feet. Oil production fell in the late 1980s because less investment was made in new production facilities after the reduction in oil prices in 1986. UK production of oil and gas peaked in about 2000. UK consumption in 2017 (Ref 17) was 76 million tonnes of oil and 79 billion cubic metres of gas, so the UK, once a net exporter of oil and gas, is now a net importer.



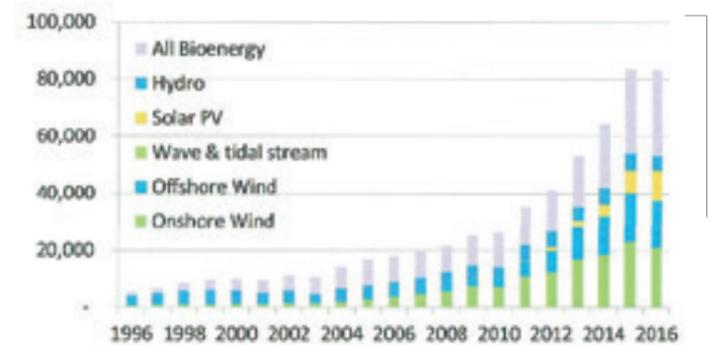
**Fig 10 UK production of oil and natural gas**  
UK electric power production since 1996 is shown in Fig 11, based on Ref 19. Power generation from coal and oil has been significantly reduced in recent years. Data from



the Crown Estate indicate that 6.2% of power was generated by offshore wind in 2017. Also, the overall generation of renewable energy in the UK has increased dramatically since 1996 (see Fig 12 which is based on Ref 20). To date, more power has been generated from bioenergy (landfill gas, sewage gas, biodegradable energy from waste, animal biomass, anaerobic digestion and crop biomass) than from offshore or onshore wind.



**Fig 11 UK electric power production (million tonnes / year of oil equivalent), all generating companies**



**Fig 12 UK renewable electric generation (MWh)**

## CONCLUSION: OFFSHORE STRUCTURES FOR RENEWABLE ENERGY

The histograms above show how the UK is reducing its dependence on fossil fuels (coal, oil and gas) and developing offshore wind and other renewable energy. This synopsis has reviewed some lessons learnt from the offshore oil and gas industry and how the structures used for offshore wind have developed from those used for oil and gas, using predominantly driven monopiles but also some jacket structures and spars further from the shore and a few gravity base structures.



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# MASTER'S INFORMAL LECTURE ON DIGITAL ENGINEERING



On 10 May 2018 in the Worshipful Company of Information Technologists' Hall the Master took the step of delivering the first, of what he hopes will be a programme of informal and inexpensive lectures.

The initiative got off to a good start with a capacity audience eager to learn! The subject matter supported the Master's theme for his year - digital engineering.

After an introduction to binary arithmetic and it being able to model the simple option of 'on' or 'off' afforded by an electrical circuit he highlighted the application to a wide range of everyday appliances.

The Master demonstrated that digital engineering is omnipresent in our everyday lives.

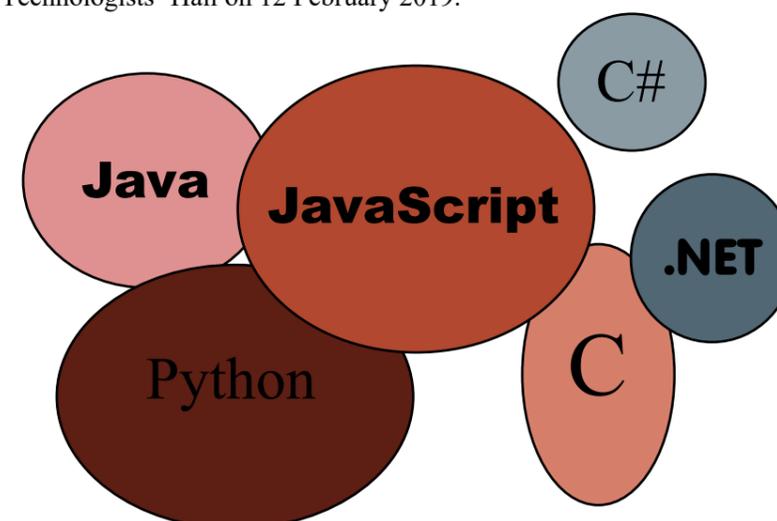
As he moved towards the peroration of his presentation he drew upon his own experience in railway engineering and signalling.

The audience had a diverse background and knowledge of digital engineering which stimulated an interesting discussion on how, we as engineers, cannot avoid the increasing number of applications that are made more efficient by digital engineering. Many young engineers embarking upon their careers will be in the vanguard of firmly establishing the burgeoning branch of digital or software engineering.

One of the issues that caused consternation was the extent to which software applied to safety systems could be rigorously audited to guarantee that the software was itself safe and without any malicious ulterior purpose.

The first informal lecture has been a success measured by the number of members and partners who attended, the quality of the discussion and the socialising that took place before and after.

The next informal lecture will be given by Ian Dyson, Commissioner of the City of London Police, whose responsibilities include a national responsibility for cyber-crime. It will be held at the Information Technologists' Hall on 12 February 2019.



## Mistress Engineer 's Partners' Social Initiative

Marilyn( to use her preferred form of address) arranged an opportunity for partners to get together on the day of the awards dinner to take advantage of being in London and be a way to give partners a chance to get to know each other better, in an informal setting that also provided an interesting and unusual context.

We visited Dennis Severs House in Spitalfields. It is a Georgian house set up as a still life drama by Dennis Severs. This gives an intimate portrait of the lives of a family of Huguenot silk-weavers from 1724 to the dawn of the 20<sup>th</sup> century As you follow their fortunes through the generations, the sights, smells and sounds of the house take you into their lives. Dennis Severs was a painter and it was his intention that as you enter each room it would be as though you have passed through the surface of a painting.

Spitalfields' historic association with the silk industry was established by French Protestant (Huguenot) refugees who settled in the area after the Revocation of the Edict of Nantes in 1685. Interestingly by settling outside the bounds of the City of London, they hoped to avoid the restrictive legislation of the City Guilds.

We enjoyed a light lunch at the Water Poet Pub where we had an opportunity with the curator to discuss the museum and the preservation of important local historic sites amongst the modern developments in the area and engage in some relaxed chatting .

Look out for future informal partner's socials

*Yvonne Joyce*

# TECHNICAL SITE VISIT

## Raspberry Pi at Sony Technology Park, Pencoed. 3 July 2018



On Tuesday, 3<sup>rd</sup> July a group of 17 engineers and partners visited the Sony Technology Park in Pencoed, Wales hosted by Pete Lomas to see the production lines for the Raspberry Pi.

The Raspberry Pi, so named because all successful technology products seem to have a fruit in their name, is a computer – with a difference. At \$35 cost, it is priced affordably (the price of a text book) and with the addition of a commonly available phone charger, television, keyboard, mouse and memory card forms a complete no-frills computer which is part of a community. Raspberry Pi won the joint Royal Academy of Engineering / Engineers Trust MacRobert Award in 2017.

The Raspberry Pi was conceived by Pete Lomas and Alan Mycroft as a mechanism to enable potential computer science students to have an understanding of what goes on inside a computer (i.e. learn to program and control hardware) in a manner afforded to lucky school children in the 1960's and 1970's. It aims to stimulate creativity. The team responsible for realising the project included:

- Alan Mycroft
- Jack Lang
- Eben Upton
- Pete Lomas
- David Braben
- Rob Mullins



Our group was hosted by Sony, who run the production lines for Raspberry Pi at their Technology Centre. After an introduction from the Master, explaining the background behind the visit, a presentation by Kevin Edwards, General Manager, explained the ancestry and

evolution of the plant from being the centre of production for Cathode Ray Tube (CRT) televisions in the 1960's to the present day where it is the centre of Sony's top-end broadcast quality video cameras. In essence, transforming a high volume TV production facility into a very successful contract manufacturer.

Established as a result of HRH The Prince of Wales visiting Japan and suggesting that Sony consider moving to Wales, the company has seen changing fortunes with the end of CRT televisions and using the circumstances to develop a modern, profitable business which forms a significant but essentially self-governed part of the worldwide Sony business. Kevin explained the evolution of video cameras, moving through high definition, 4K to the latest 8K technology yet to be released.

Sony demonstrated a huge commitment to education, recognising the engineering skills shortage and being exemplars of initiatives to educate and encourage young people into engineering.

Pete Lomas gave a presentation about the Raspberry Pi – what it is, how it was conceived and how it has now sold more than 20 million units, rather more than the original target of 30,000 units. He then explained how the Raspberry Pi has stimulated huge interest across the world in young people to harness their creativity. The creativity is stimulated by a community of code clubs and other community groups such as Raspberry Jam and CoderDojo. Using relatively simple sensors, members of these communities have undertaken projects such as upper atmosphere photography and even have access to a Raspberry Pi in the International Space Station.

Pete explained that a key message in attracting interest in the technology was the use of the term 'Digital Making'. The term encapsulates the underlying digital engineering, but in a context that appeals to children who know what making things means but who do not identify with the world of engineering as it is portrayed in the media.

The group were then given a short presentation by Jessica Leigh Jones, one of the Sony team who at 24, has already received 20 awards for her contribution to engineering. She gave an inspirational talk about her journey from leaving school at 15, the inspiration of her father as an aircraft electrician in the RAF and her GCSE Electronics teacher, and her career to date. Her 'break' was developing a portable uterine contraction monitor which cut manufacturing costs by 99%!



After lunch, courtesy of our hosts, we were taken in small groups around the plant to see the production lines for the Raspberry Pi (high volume) and Video Camera (specialist) circuit boards, clean room assembly of Charge Coupled Device (CCD) chips for camera image capture and Sony's national repair centre. We were also shown the Academy, dedicated to the education of school children. Of particular note was that the production lines were largely comprised of equipment engineered by Sony at their plant, for which they retain the intellectual property rights. This included the programming of the traditional component insertion machines and newer, robotic component placing – together with humans doing final stage to confirm quality standards and rectify any faults. In particular, it was interesting to see the use of novel methods of using sensory feedback of the 'feel' of component insertion (wiggling multi-legged components)

to replace traditional vision systems which improved insertion success rates.

The company operates a continual improvement process, with one Raspberry Pi now being produced every 3 seconds. Around the plant we saw many screens informing employees (and visitors) of production targets, achievements and company goals.

Following the tour, and the customary 'thank you' the Master presented a Stirling Engine to the Raspberry Pi foundation, challenging them to find a means by which it could be controlled by a Raspberry Pi!

<https://www.raspberrypi.org/>

David Johnson

The Master



Pete Lomas



Photograph of latest model of Raspberry Pi 2



Richard Groome took over from Past Master Graham Skinner as the Company's representative on the board of RedR UK earlier in 2018. The Company is one of RedR's supporters and Richard is keen to raise its profile within the Company's membership.

## Humanitarian Engineers

From drilling boreholes to find water, to the reconstruction of buildings after an earthquake, engineers can make a vital contribution to the response to a humanitarian crisis. Founded by engineer Peter Guthrie OBE in 1980, RedR UK is an international NGO that trains and supports aid workers and humanitarian organisations. RedR UK is proud of its engineering heritage and remains dedicated to working with engineers in the humanitarian sector. Engineers have many values in common: the search for tangible, sustainable and ethical solutions; a commitment to innovation and a belief in the need to share and build skills (technical and otherwise), particularly in parts of the world that are prone to disaster.

RedR UK's Membership programme is made up 1,800 experienced humanitarians, many of whom are engineers by profession. In 2017 RedR UK Members worked in 88 countries worldwide, responding to urgent humanitarian crises including South Sudan conflict response, the Syrian Refugee crisis and the East African Food Crisis. Alongside the Membership programme, RedR UK runs a successful Affiliates scheme, designed for junior humanitarians who are looking at developing their skills and experience in humanitarian response.



Earthquake response, Nepal. Photo: RedR UK

In 2017, RedR UK trained 8,050 people in 44 countries worldwide. Every year, many of those who are trained are engineers involved in humanitarian work: the purpose of the training is to help them better understand the humanitarian system, sector-specific principles and processes, and the environment in which they are operating.



WASH Training, Sudan. Photo: RedR UK

RedR works closely with engineers on some of its key projects, including Ready to Respond; a project focused on urban emergencies, KnowledgePoint; a free, online technical support service for aid workers in the field, and building WASH (Water Sanitation And Hygiene) capacity in Sudan. More recently RedR UK's Africa Catalyst project sees it working to strengthen the Federation of African Engineering Organisations in Nigeria. This enhanced capacity will contribute to the longer-term objective of this project; to support other African Professional Engineering Institutions throughout the region.

The support of the Company allows RedR to continue to build the skills of aid workers in the UK and in crisis-affected countries around the world.

Richard Groome



In a humanitarian crisis, groundwater is one of the first water supply options you consider. Borehole drilling is important, but it's costly: it's essential to get it right. RedR UK's Groundwater Drilling course delivers practical, hands-on training in groundwater development to frontline aid workers. Through a mixture of theoretical / classroom sessions and on-site workshops, participants acquire a practical understanding of borehole siting, drilling supervision, pump testing, and water quality testing.

Biserka Pop-Stefanija, Water and Sanitation Advisor with Médecins Sans Frontières (MSF) Holland, has been working in water and sanitation since 1999 and attended RedR UK's Groundwater Drilling course.



Groundwater Drilling Course, UK. Photo: RedR UK

Following the RedR UK training, Biserka put her new skills into practice during a deployment to South Sudan, where groundwater is the principal source of drinking water. Although very little information is available on its distribution, or its extraction, it is estimated that 59% of people in South Sudan do not have access to safe drinking water.

[http://reliefweb.int/sites/reliefweb.int/files/resources/2016\\_HNO\\_South%20Sudan.pdf](http://reliefweb.int/sites/reliefweb.int/files/resources/2016_HNO_South%20Sudan.pdf).

Access to water and sanitation is one of many challenges South Sudan has faced since it gained independence in 2011. The ongoing conflict there has only made life in the world's newest country more difficult and dangerous.

"Simply gaining access to crisis-affected communities in remote areas can be a huge obstacle" explains Biserka. "In places like Mankien, Unity State - which is at the heart of the conflict - the first challenge we face is the soil, which is black cotton soil. During the dry season, it's like rock. But as soon as it starts raining, this kind of

soil turns to mud. It has a gluey texture and is impossible to work with. The siting of boreholes and the timing of drilling are therefore crucial."

Thanks to RedR UK's training, I was able to guide MSF staff as to what to look out for, how to check the profiles of each layer of soil, how to finalise the development of the borehole, and how to test the quality of the water. As a result, we had a well-placed borehole working really nicely, and we were able to supply the IDPs and host communities in Mankien with water that was safe to drink."

The generous support of the Worshipful Company of Engineers and others has allowed us to continue to build the skills of aid workers like Biskera, in the UK and in crisis-affected countries around the world. Thanks to our supporters we continue to equip aid workers responding to the world's most acute humanitarian crises with the skills they need to save and improve lives

You can find out more at [www.redr.org.uk](http://www.redr.org.uk)

Cherry Franklin of RedR

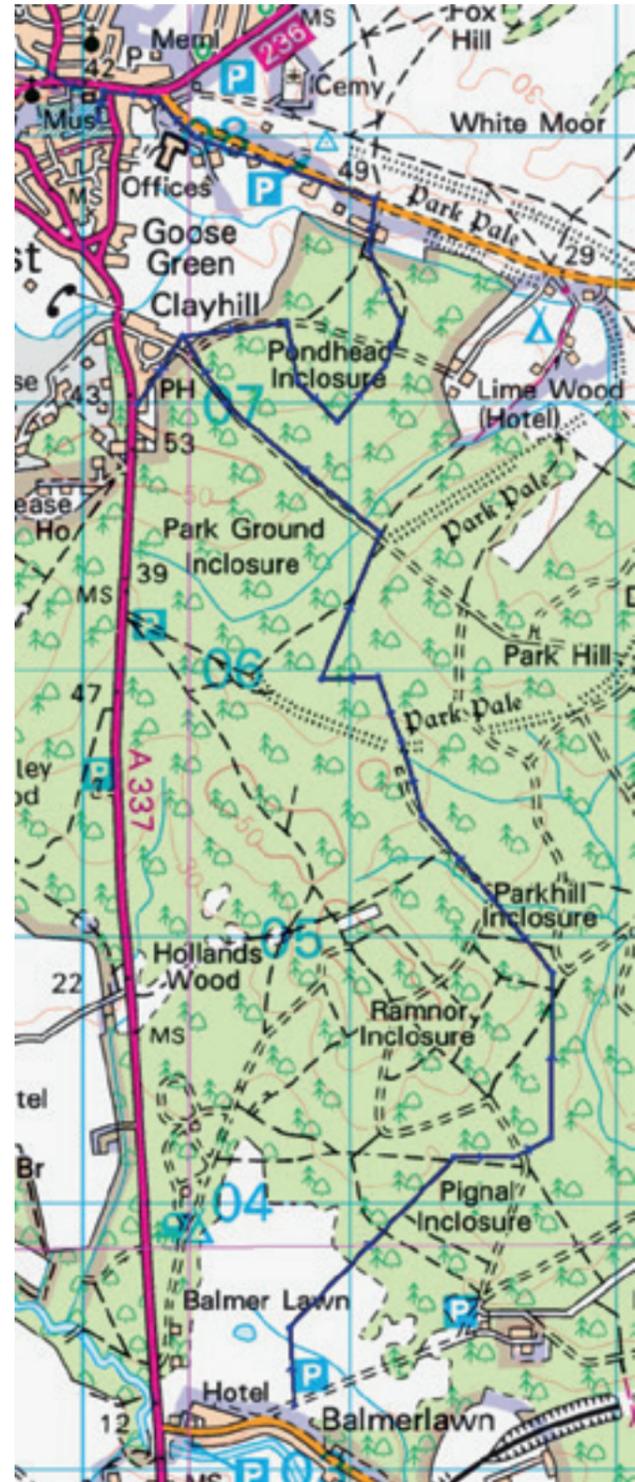


WASH Training, Sudan. Photo: RedR UK

# RAMBLING REPORTS

## New Forest Walk 19 May 2018

The rest of the world might have been transfixed by the Royal Wedding, but the Livery Company's spring walk was the other big event of the day that went exactly to plan.



A map of the route shown in blue

We gathered at the home of Jane Forrest, a 'friend' of the Company overlooking one of the open areas of the New Forest. Jane volunteers as a New Forest Warden, so she gave us short accounts of the history and economy of the New Forest as she guided us across the open heath and through the wooded parts of the forest.



Jane Forrest in full flow!

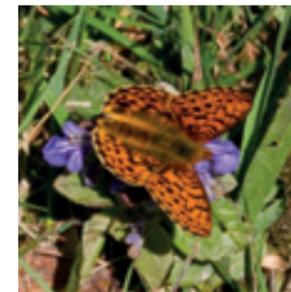
The New Forest was originally a hunting park for King William I, and still has thriving populations of five kinds of deer, as well as the familiar ponies and donkeys that roam the roads and heaths of the forest. The function of the forest changed from hunting to timber production in the 15<sup>th</sup> Century, supplying the nearby shipbuilding yards in Bucklers Hard. The trees were managed through pollarding up until the 1800s, and after all this time some of the ancient trees still show evidence of this practice. The deer damage young tree shoots, so the trees are still protected in about 100 Inclosures (as was the spelling at that time). The Inclosures were surrounded by a ditch, a hedge of oak and a higher hedge of thorns, which deterred the deer from breaking through to the newly established trees. We also learned that there are about 800 properties that have ancient 'estover' rights, which means that they are entitled to receive lengths of wood, 8' by 4' by 4'.



We saw piles of tree trunks set by the side of the tracks, just some of the 50,000 tonnes of timber produced by the

working forest each year. We learned about the lengthy cycle of up to 150 years of planting and thinning trees, principally oak, beech and silver birch, with some Scots pine soft wood as well.

In Victorian times, the New Forest was well known as a place to see many species of butterflies. Despite habitat loss elsewhere, parts of the New Forest have become a sanctuary for some rare butterflies. We walked through the Frohawk Ride, which had been established in 1996, and were lucky enough to see several pearl-bordered fritillaries, one of the rarer species.



Jane introduced us to Jack, a New Forest woodsman, who walked us through the woods to show us the old marl pits which had been used to provide lime-rich clay that could be used as a fertiliser. He showed us the new environmentally efficient oven that converts wood to charcoal, involving a process of reflux that feeds back the resins that boil off the heated wood to provide further fuel to sustain the burning process.



Homeward bound

There was time for a visit to the New Forest Centre, and a presentation by their education officer. We had a quick look at the exhibits, that includes a magnificent embroidery on the history of the forest.

The walk through the New Forest was a stunning day out, walking through beautiful, dense woodland, listening to the cuckoo, and spotting the wildlife by our feet and in the air. We thank Audrey Canning again for coming up with this fantastic visit, and for organising it so meticulously. And there was even time to see something of the Royal Wedding just before the pub lunch. Perfect!

Janet Smart (Guest)



There was no escape from the Royal wedding!

# TECHNICAL VISIT TO HMS ANSON AT BAE SYSTEMS BARROW SHIPYARD



11 June 2018

A group of 20 Liverymen and partners visited BAE Systems at Barrow-in-Furness, by kind arrangement of Lieutenant Commander Mark Moulding, Senior Naval Officer HMS ANSON (the Company's affiliated submarine) and BAE Systems.

At an informal dinner the night before the visit, the delegates entertained Lt Cdr Mark Moulding, Warrant Officer Rob Blaney and Mr Rupert Prichard (MOD Project Manager, HMS ANSON build). Master Engineer David Johnson presented a Company wall shield for eventual display on the submarine.

The visit started with presentations by Brian Benn BAE Systems Visits officer, and WO Rob Blaney. HMS ANSON is Boat 5 in the Astute Class nuclear powered submarines (SSN) being built by BAE Systems. We learnt that the boats are built from several hull sections and ~400 modules of varying sizes. The modules are built outside the boat - quicker, easier and cheaper than assembling the equipment in the boat. Once a module is complete, it is slid into a hull section. As sections are completed, they are welded together, a very complex and skilled job providing a perfect weld without distorting the hull.

SSNs are attack submarines whose aim is to remain undetected while undertaking anti-submarine, surveillance or land attack missions. Life on board is cramped and even with modern facilities, hot bunking is used when extra personnel are carried. Once qualified through training ashore and onboard, and qualifying in their technical and submarine safety roles, submariners wear their submarine badges ("dolphins") with pride.

The highlight of the visit was the tour of Devonshire Dock Hall in which up to three submarines can be built at one time. ANSON's hull is complete and she is now being fitted out. It was impressive to see her up close: out of the water she is HUGE!

On completion of the tour, LtCdr Moulding invited Senior Warden Commodore Barry Brooks to perform a Naval duty, presenting clasps to the Long Service and Good Conduct Medals of Warrant Officers Clelland and Jones. The Master Engineer presented a Stirling Engine for the submarine to add to their trophy cabinet to mark the connection with the Engineers Livery Company.

## Facts and Figures:

- Astute submarines typically carry a mix of Spearfish heavy torpedoes and Tomahawk cruise missiles.
- According to Wikipedia Anson is 97 m in length with a beam of 11.3 m.
- 11 years to build a submarine on a 3 year "drum" beat (the length of time between the start of each new boat). Design life 30 years.
- BAE Systems and its forerunners have been building submarines since 1862 (when they were building for the Russian and Turkish navies).
- Everything is weighed to ensure that the centre of balance ends up where designed, but when the boat is first lowered into the water it often needs slabs of lead to fine trim it (rather like wheel balancing on your car).
- HMS ANSON will carry a crew at sea of 90 and all the stores and food needed to enable her to stay submerged for a considerable time.
- Submarines can break through Arctic Ice, see <https://binged.it/2t4axzJ>
- Submarines are not launched, they are lowered into the water: see <https://youtu.be/byBKVkY75sk>



## Notes:

1. There are no photographs of HMS ANSON as she is incomplete. However, the photograph above is of HMS AUDACIOUS, her immediate predecessor.
2. All photographs are courtesy of BAE Systems Submarines

Suzanne Flynn and Barry Brooks

# TECHNICAL VISIT TO THORP AT SELLAFIELD 13 June 2018

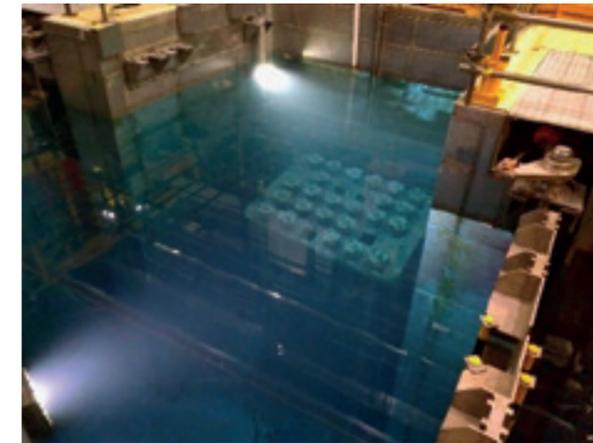


A party of 14 Liverymen and Freeman and 6 partners visited Sellafield by kind arrangement of Freeman Michael McLoughlin.

At an informal dinner the night before the visit, 23 members of the Company and their partners entertained two guests from Sellafield Ltd: Chris Raeburn (Systems Engineer) and our visit host Paul Adamson (Head of Plant Facing Design Office), to whom the Master presented a Stirling Engine to thank him for the tour.

We first toured THORP (the THERMAL OXIDE Reprocessing Plant), which separates plutonium and uranium from other highly-radioactive waste in spent fuel. Commissioned in the 1990s, THORP will cease fuel reprocessing this year, but will subsequently support waste management activities.

After distribution of radiation-monitoring badges and belts, our Sellafield hosts Steve Stagg and Haylee McCarron gave an overview of plant operation from the viewing gallery of the Fuel Storage Pond, where incoming fuel rods cool underwater for several years.



One of the cooling ponds

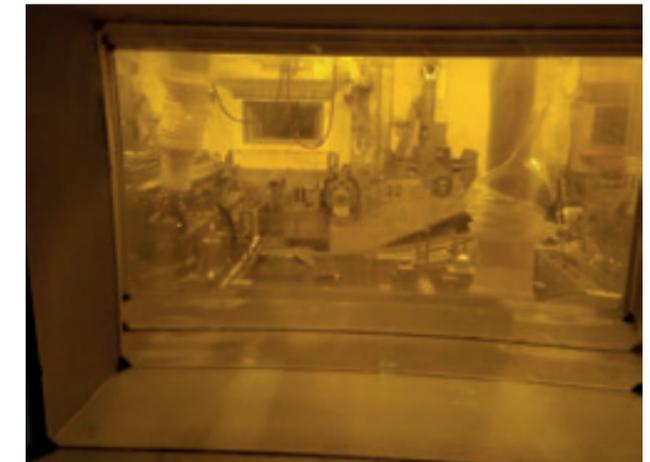
We then moved to the Feed Pond, where fuel rods are extracted from containers, and the Shear Cell – a concrete vault with very thick leaded glass windows, where a hydraulic press chops fuel prior to chemical processing.

After lunch, the group visited the Fuel Handling Plant (FHP), where spent fuel is first received from power stations in transport flasks and dismantled before being sent for reprocessing. Operations

take place in "hot cells" – heavily-shielded enclosures with thick windows – and staff work from outside using remote manipulator arms. Our group donned coveralls and orange socks, and athletically swung across a barrier before putting on site footwear!

In the FHP, incoming flasks are checked for damage, fuel is removed, and the flasks are then monitored for contamination. Around seventeen shipments arrive each week, power stations have limited storage and must shut down if spent fuel is not removed.

Finally, we visited the MAGNOX decanning cell, where aluminium cladding is peeled from spent fuel rods, and a maintenance team gained an interested audience as they fixed a problem inside the cell with manipulator arms.



Looking through a very thick glass window at a decanner cell

After careful checks with a Geiger counter to ensure that we had not picked up contamination, we thanked our hosts for a most interesting visit.

Freeman Mike McLoughlin and James Dickaty (two of the growing number of Sellafield engineers joining the Company) have offered us another visit to other parts of Sellafield, in due course.

## Notes:

1. Photographs with permission of Sellafield Ltd and Barry Brooks
2. Report approved by Sellafield Ltd

Andy Ward and Barry Brooks

# OUT OF TOWN 2018 VISIT TO DERBYSHIRE

20 - 23 September 2018



Armed with an authoritative guide book to Derbyshire and the places planned for the OOT, all self published by the Master and his Mistress Engineer, the journey of discovery was fuelled by good food and drink, curiosity and humour that comes from good company. What follows are the highlights and memorable moments of a selected few, nominated by the Editor.

## KELHAM ISLAND

Two minutes ahead of schedule, our coach arrived just as the first rain drops from Storm Bronagh fell. The Bessemer Converter had to be photographed before the drenching began.



*The Bessemer Converter*

Fashionably, the museum delivers its message through the display of the most beautiful items of its collection, rather than the story-boards of chronological developments. Its “wow” factor comes from the variety, quality and scale of its prize exhibits.

It is in the developments of the special steels industries that Sheffield has its rightful claim to fame and in the displays of tools, machine making and cutlery that the museum excels. The highlights from the Hawley Collection, built up from tools salvaged from businesses

as they closed or were relocated are beautifully showcased.

The production of forged steel armaments and steel plate in Sheffield is represented by armour plate from battleships of the 19<sup>th</sup> Century, Dreadnaughts of the First World War, and Barnes Wallace’s Grandslam (earthquake) Bomb.

The star of the show has to be the River Don Engine, built in 1905 by Davey Brothers to roll armour plate at Grimethorpe rolling mill. After 50 years it was moved to the British Steel Corporation River Don Works rolling plate for nuclear reactors and off-shore-rigs. In 1978 it was purchased at a scrap value of £20,000 and eventually installed at Kelham. It was run for us: with three cylinders, 40 inches diameter, and a stroke of 48 inches it runs at 12,000 horsepower using steam at 160 psi: it is a very big, fast, loud machine. Its most surprising feature was its spectacular ability to reverse direction almost without apparent loss of speed. It could reduce 26 inch plate to 2¼ inches in 9 minutes and only 33 passes.

There were beautiful displays of pre 1930 cars and motor cycles including Sheffield Simplex, Richardson and Charron Laycock and much more!

*David Shillito*

## DINNER IN SHEFFIELD CATHEDRAL

“There are no tarts here” was the slightly arresting introduction to the Bakewell Silver Band by its Musical Director Andy Davey who was, it turned out, taking the baton for the very first time. There’s confidence in a new job! You would never have guessed it as the Band turned out a superb, beautifully executed set, capturing our undivided attention as the finale of the Dinner marking the opening of an amazing Out of Town marked at every point by personal connections with our Master and Mistress Engineers.



The Thursday evening is always a welcome affair as old friends catch up, the epitome of the fellowship of the Company. But what a special occasion this turned out to be. We dined in the Nave of Sheffield Cathedral, a site of Christian worship since the 9<sup>th</sup> Century. With ancient walls incorporating stones dating back to the 12<sup>th</sup> Century melded with (harmoniously) a light modern extension with beautiful abstract-design stained glass, it was a perfect metaphor of Marilyn and David’s theme for the weekend, “Celebrating the Past and Creating the Future”.



*Left - Lord Blunkett in full voice*

We were welcomed by Dean Peter Bradley who emphasised the Cathedral’s modern charitable role. Helping local citizens with essential life skills such as adult literacy and English language workshops as well as supporting people without homes, it was placing the Church at the heart of today’s community. We had time to admire the many treasures of this Grade 1 listed building including, the very affecting St George Chapel which commemorates the York’s and Lancs Regiment with its wall decorated with regimental pennants and screen fashioned from the officers, swords and bayonets.

Following a meal of exceptional quality and a short welcome from the Master, we were treated to a speech from guest of honour Rt Hon the Lord Blunkett PC, accompanied by his wife Margaret and his latest faithful Guide Dog. Witty and serious by turn, David regaled us with the glorious history of the City of Steel he had represented in Parliament for 28 years. Charting the challenges of its late 20<sup>th</sup> Century decline he ended with its exciting rebirth through higher education, engineering apprenticeships and new industries leading in such fields as AI, robotics and bio-engineering. Remarkably, David



*Sheffield Cathedral full of Company members and guests*

and Margaret had travelled especially from London just for our dinner and exited to travel that night for Europe.

And so into the wet and windy night, warmed to the marrow by our Johnson welcome evening and fired up for their punishing schedule the morning would bring!

*Andrew McNaughton*



*Bakewell Silver Band in full flow*

Friday 21 September 2018

On the Friday morning there was a choice of three destinations

**ROYAL CROWN DERBY**

Royal Crown Derby, was founded in 1750. In 1773 George III permitted the royal crown to be used on the backstamp and Queen Victoria granted permission for the title “Royal.”

We arrived at the “new” factory founded in 1878 at Osmaston Road and went straight to the Museum to see samples of designs since 1750. We are probably all familiar with the ornate and gilded Crown Derby china, of which the Japanese inspired “Imari” design is a well known example.

It takes two years to fully train staff but, rather nerve wrackingly, novices start on the production line from day one. We saw the clay being cut and hand-pressed into the moulds and then the slip being poured into plaster moulds to make handles. After many firings and much smoothing, including alarmingly being tossed into the Rumbler filled with silicate balls, lithograph transfers are applied, replacing the time-consuming hand painting of the past. After glazing, 22-carat gilding is applied by hand. The atmosphere was calm and friendly and the staff are free to organise themselves as long as they meet their quota. Most of them have been there for over 20 years.



There is something for everyone but we loved the exquisitely hand painted plates made today by just two artists. An ex-member of staff kindly came in at lunch time, to show us her mother’s farewell autograph book signed in beautiful pictures by the artists at the time.



Crown Derby made china for the Titanic and today’s customers include the Dorchester Hotel and Betty’s Tea Shop. Now we understand why Crown Derby justifies its high price.

Shop. Now we understand why Crown Derby justifies its high price.

*Elizabeth Chandler*

**SHEFFIELD UNIVERSITY ADVANCED MANUFACTURING RESEARCH CENTRE (AMRC)**

The University of Sheffield AMRC with Boeing was founded in 2001 and now has over 100 industrial partners including Boeing, Rolls-Royce, BAE Systems and Airbus and a range of small companies. It is part of the High Value Manufacturing Catapult, an alliance of seven manufacturing research centres backed by Innovate UK. Its members can access the national network of manufacturing research excellence.

The group has specialist expertise in machining, automation, robotics, digitally assisted assembly, casting, welding, additive manufacturing, composites, designing for manufacturing and testing. It also includes the Nuclear AMRC which helps UK companies win work in the Civil Nuclear sector and the AMRC Training Centre which provides training from apprenticeship through to Doctorate and MBA level. We visited four areas.

**The Machining Group**

This group develops innovative techniques and optimised processes for machining high performance materials. For example, the time for machining the curved dovetails of a Rolls-Royce Fan disc has been halved.



*Rolls-Royce Fan disc*

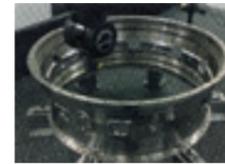
We were shown an example of an aero engine casing which had been machined with improved accuracy and reduced time by applying a damping material on its inner diameter supported by a compressed air bag. This reduced both deflection and vibration that can occur when machining thin casings. The group also works on novel means of manufacturing aerofoils for gas turbines, machining of large structures such as aircraft landing gear and novel techniques for work holding and automation.

**Integrated Manufacturing Group and Metrology Groups**

The Integrated Manufacturing Group, located in ‘Factory 2050’ develops new ways of automatically assembling complex products using advanced technologies such as robotics, augmented reality and large volume metrology, for the assembly of complex structures. The research themes are AI and machine learning, robotics and automation, digitally assisted assembly, integrated large volume metrology and automated process monitoring and data analytics, augmented and virtual reality and digital twins.



*Advanced Robotics High precision metrology*



*High precision metrology*

**Composite Centre**

The AMRC Composite Centre leads the UK in lightweighting with a focus on producing composite and hybrid parts which combine high-performance metals and composites in a single structure, whilst providing significant weight savings.

We saw examples of panels for motorsport and a composite strut for an aircraft under-carriage. The centre has its own weaving machine and the largest state of the art High Pressure Resin Transfer Moulding system in the UK. This system allows the use of highly reactive resins to reduce curing times to as little as three minutes.



*Weaving machine for preforms*



*High Pressure Transform moulding system*



*Using Virtual Reality (Immersive Technologies) to facilitate the assembly of a sports car suspension*

**AMRC Training centre**

The training centre provides training options covering four different pathways into engineering apprenticeships with the opportunity to convert to degree apprenticeships and chartered engineer status. After four years in excess of 300 manufacturers in the Sheffield City region have asked the school to train more than 1000 apprentices.

The training centre has been designed as a real manufacturing environment replicating the feel of an actual place of work whilst using cutting-edge technology including virtual reality welding machines and robotics.

We were all impressed by the size and achievements of the AMRC in 17 years and found the visit most informative and enjoyable. Unfortunately, time prevented our visiting some areas including the Structural Testing Centre, the National Metals Technology Centre, The Design and Prototyping Group and the Medical AMRC.

*Photographs and images courtesy of AMRC Sheffield.*

*Philip Ruffles*

**BOMBARDIER VISIT**

Our journey to Bombardier in Derby was lit up by a magnificent rainbow – perhaps an omen!

The Bombardier Works is located amongst the buildings that have seen many previous owners, including British Rail (their Carriage & Wagon Works), before them the LMS Railway, before them, and originally, the Midland Railway (late 19<sup>th</sup> century). Now it is a hive of high-tech railway carriage engineering, being the only remaining site





in the UK that builds new electrically-powered passenger railway carriages.

The company employs around 2600 staff. Although the majority of these are engaged on carriage assembly and maintenance, there is also a significant design capability. In the last 3 years, the Company has taken on over 90 new apprentices and 56 graduate engineers.

Until recently, 2017, Bombardier have used their ELECTROSTAR design to provide new trains for London Overground, Southern and South Africa's Gautrain. Their most recent development uses the AVENTRA platform which is the basis of the train currently building for Crossrail – a complex train set with significant signalling and control systems. The AVENTRA platform is flexible in length and in passenger capacity.



The new look livery for a train on the Elizabeth Line

We were treated to a close-up visit of Crossrail trains under construction. The process is a 5-stage integrated assembly line with the initial main parts of these aluminium vehicles coming in flat-pack format which are then painted on site. Cabs, floors, doors and roofs of the new carriages are built by UK engineering companies, many being local, body sides are made in China, bogies come from Bombardier's plant in Germany. All components, except cabs, come fully wired up ready for bolted

assembly; Bombardier install all of the 'innards' of the cabs – mainly the complex control systems – on site. The 5-stage process through the assembly shop is ergonomically-designed to reduce manual labour, and hence risk, to a minimum. Each assembly line target is to produce 4-5 completed vehicles per week. Upon assembly, each car is subjected to a water test before being placed on its bogies. A particular feature of the Crossrail trains is the need to have 3 different signalling/control systems installed, as the trains will operate on Network Rail tracks as well as on dedicated TfL tracks through the centre of London. The designs are by Bombardier in Derby.

The Company also has several depots around the UK to provide day-day and heavy maintenance of the existing fleet of Bombardier vehicles; the vehicles can be monitored remotely with the control centre analysing the condition and performance of units so as to anticipate potential mechanical and system failures.

The new Crossrail (now "Elizabeth Line") vehicles will be expected to do 80,000 miles between maintenance visits; each train is tested on the test track at Old Dalby for 10,000 miles fault-free running before delivery to the customer.

The highlight of the visit, for the Master, was driving a new Elizabeth Line train along the short test track at the Works; the rest of us just enjoyed the short ride – he was a quick learner! And on the way home, another rainbow! All in all, an invigorating and stimulating day.

Thank you, Bombardier! *Peter Hartley*



## CRICH TRAMWAY VILLAGE

All the various contingents converged on the Crich Tramway village in the afternoon. The cold bite in the air made the village tea rooms very appealing!



The period village scene is the backdrop for a tramway along a mile long track. The main attractions (after the tea shop) were the workshops the exhibition of trams and the tram ride.



All the trams are kept in working order and the workshop undertakes routine maintenance and total restoration.

## CUTLER'S HALL COMPANY DINNER

The Livery Dinner on Friday evening is always the formal highlight of any Out of Town meeting and this year fully lived up to our expectations. It was held at the Cutlers' Hall, just five minutes walk from our hotel.

We were welcomed and introduced to our magnificent surroundings by Kenneth Cooke, the current Master Cutler. The Company is a trade guild of metalworkers that is almost 400 years old. The current hall is Grade II listed and is regarded as one of the finest Livery halls in the country. It displays an awe-inspiring collection of silver ware from across the ages.

Our dinner amply matched the quality of our surroundings, as we sat under the Company motto:

*Pour Y Parvenir a Bonne Foi.*



The wines that accompanied our food had been personally imported by the Master from near his French retreat in Cote de Roussillon - an example of the meticulous planning that he and Marilyn had brought to the entire weekend. All three wines were very good; the Vin Doux Naturel was exceptional.

The Master introduced his guest, Doug Liversidge CBE, who

has, for decades, played a leading role in incubating and nurturing successful spin-out companies from the university. Both the Master's and Doug's speeches celebrated Sheffield in entertaining and different ways, showing their great enthusiasm for the city. It is indeed remarkable how Sheffield has thrown off its 'Full Monty' image of the 70's to become the modern, vibrant, wealth-creating, power house that it is today. Both speakers are closely associated with the Cutlers' Company and are a living embodiment of how we may 'succeed through honest endeavour.'

It was a wonderful evening!

*Graham Owen*

PRE-DINNER DRINKS AT CUTLER'S HALL



Saturday 22 September

VISIT TO UPPER DERWENT RESERVOIRS AND DAMS

This enthusiastic early rising group amazingly, within 10 minutes from our hotel, were in countryside and 5 minutes later onto the Hallam gritstone moors, 1200 feet above sea level! Good weather allowed brilliant views of the Dark Peak area below Stanage, the largest and most impressive gritstone edge, 3.5 miles long, which we followed. The peaceful bleak moors which are hardly inhabited and crossed with long stone walls were a world away from the bustling, urban landscape of our hotel base. We then descended from Yorkshire to Derbyshire into a different world, through beautiful tree-lined roads to the limestone region of the Derwent valley passing a dam which produced the Ladybower reservoir, beneath whose surface is the drowned Derwent village. The water level was low and some parts of the village were visible. Built from 1935-1943 it mainly serves Sheffield and was the largest reservoir in the UK.

We then travelled to the Upper Derwent Valley to see the reservoir created by Derwent Dam, where the 617 Dam Buster Squadron practiced in WW2 and where the film was made. We alighted and had a great time walking around. No one went for a swim!



Under the Master's strict instruction, we left on time and we then followed the beautiful wooded Derwent Valley past the Howden reservoir and Birchlee, the village originally built for dam construction workers, and Yorkshire Bridge, a village built for those who had to leave the flooded Derwent village, and Bamford, which in the 18<sup>th</sup> century was a corn and later

cotton mill, village. We followed the Derwent river as we drove through Hathersage where they made needles and pins. Little John, the giant outlaw of Robin Hood fame, came from here. We passed the David Mellor cutlery factory but we did not stop to buy. We then proceeded to Chatsworth through Grindleford, Baslow and Calver and then to Edinsor a village moved to give the 6<sup>th</sup> Duke an interrupted view from Chatsworth! We arrived at Chatsworth after a brilliant visit to the eastern Peak District and all grabbed a coffee!

Ken Gray



The 'early risers' at Derwent Dam



## CHATSWORTH

Arriving for an early tour, we had untrammelled views of Chatsworth after its 10 year, £32m restoration.

The house stands on land bought by Sir William Cavendish, second husband of Bess of Hardwick, who after his death installed her son as her heir and purchased for him the earldom of Devonshire for 10,000 guineas. The 4<sup>th</sup> Earl rebuilt and remodelled Chatsworth over 20 years, and the 6<sup>th</sup> Duke built the North Wing.

Our tour, of some thirty rooms, highlighted just some of Chatsworth's treasures: an exquisite marble statue of a veiled vestal virgin just off the Painted Hall. In the late 17<sup>th</sup> century Chapel stands St Bartholomew in front of the carved alabaster altarpiece holding his entire skin in outstretched hand—a Damian Hearst sculpture, covered in gold (all the gold at Chatsworth is real).

We marvelled at a *trompe l'oeil* painting of a violin hanging on a connecting door in the State Apartments and galleries lined with 18<sup>th</sup> century oil paintings and more recent works by Lucian Freud. The magnificent Library contains the scientific manuscripts of Henry Cavendish, and the Dining Room, now set with

silverware and cranberry glass from Bohemia, was first used by Princess Victoria at her first adult dinner.

The narrative history of the restoration has been recorded too in restorers' own "words on windowpanes."

A brief view of the theatre and the estate from the belvedere completed the tour, before lunch in the imposing stables and the scenic tour to Sheffield past the Ladybower reservoir.

*Diana Blair-Fish*



*The library at Chatsworth*



*A general view of Chatsworth House*



## DINNER DANCE AT THE BUXTON DOME

And so, all too quickly, to the final major item on our programme: a dinner dance at the dome in Buxton. On the way there I was slightly disturbed to read that the Devonshire Dome was unsupported and, moreover, reckoned to be the largest of its kind in Europe. I quietly hoped that it – all 560 tons of it – would not realize the fact whilst we were there. But I need not have been concerned because I soon saw that 44 massive circumferential columns were doing their stuff as they had since completed by the 5<sup>th</sup> Duke of Devonshire in 1789. Those strong, silent sentinels had seen much in this imposing and atmospheric space – horses prancing in the centre when it was stables, "sick poor" patients when it was a hospital and now students as part of the University of Derby. Like us, they listened attentively to a warm welcome by Professor Kathryn Mitchell, Vice Chancellor of Derby University who explained that the Buxton campus covers degrees in Events, Hospitality, Tourism, Spa and Outdoor. It was evident that Professor Mitchell is passionate about providing relevant training for the real world. Indeed, following our welcome, our

excellent dinner was served by students on Hospitality courses.

After coffee, and following the silent auction again so capably organized by Audrey and John Canning, the live group struck up. Function Fever played an enjoyable medley of old hits that got the dance floor full. A frisson of excitement rippled through the hall when, with a loud bang, a missile radar-decoy chaff dispenser was fired and the dancers were showered with metallic strips. I had just begun to measure the strip lengths to estimate the jamming frequency when I realized that the lead singer had actually discharged a very large and impressive party popper. So dancing continued unabated. I fancied that those 44 columns were nodding to the beat and musing that, with all the prancing going on, the Dome had come full circle. No, it wasn't *Strictly Dancing* but it was great fun and a very enjoyable conclusion to a wonderful Out of Town in the Peak District.

*Peter Liddell*



SUNDAY 23 September 2018

### MAM TOR AND THE BEAUTIFUL HOPE VALLEY

Sunday saw the walking group having a lovely 'lie in' (until around 7:00, after the 6:00 starts of the other days!). After breakfast, we fought our way out through the thousands of runners gathering for the Yorkshire 10k run, down to the NCP car park and followed the required rather circuitous route out of Sheffield to Castleton.

All went well until a crisis of confidence at the bottom of the very narrow Winnats Pass led to our having to telephone organiser Audrey for directions, but eventually Susan, David, Jane and I met up with the others in the car park and we set off up the hill to Mam Tor.

After the heavy rain on Thursday and the dull cloudy days of Friday and Saturday we now got to see Derbyshire at its best. The limestone paved path to the summit was well worth the climb, leading to stunning views of the Hope Valley bathed in brilliant sunshine. We proceeded down along the ridge and then diagonally back down the hillside to the Blue John Cavern via the old A625 which we can still remember driving on before it slipped down the hillside for the final time, being abandoned in 1979.

Across the fields back to the car park then down to Castleton for a well-deserved pub lunch. Unfortunately, the sunshine had brought out many others: parking therefore proved a bit of a drama and lunch was rather slow, but nothing could dull the enjoyment of those majestic views of the Derbyshire hills and dales.

Rod Muttram



Ambling along what's left of the A625



Even from the Top of Mam Tor, Derbyshire's industrial heritage was apparent



## The End

*PS. Put next year's dates in your diary for the OOT at Plymouth -*

*13-16 June 2019*

# COMPANY NEWS

## From the MASTER

The Court has agreed that the Company should participate in a Pan Livery Initiative endeavour to present the Livery movement at large in a favourable manner, given press suggestions that it contributed little to society following assertions by HM Government's opposition. We agreed to offer members' participation in a number of surveys



to establish the size of the Livery movement, its level of support to society and its role in the 21<sup>st</sup> century. The Court were not supportive of a common charitable fund, as we wished to ensure our members' contributions went to further the engineering causes that members had expressed their support of. Members would be advised how to participate through the normal communication channels.

The Engineers' Trust fund has now reached £2M. Dave Cooper and David Hughes have become Trustees, replacing PM Isobel Pollock Hulf and Malcolm Vincent. Following the review of investments by Dan Diggins, our independent Trustee, the Trust is looking to reduce risk in its portfolio and will be producing a revised investment strategy in the near future. The Trust continues to review its awards for relevance to the communities that it seeks to reward, encourage and support.

The Court approved the concept of Associates of the Company – not a membership grade which would require changes to regulations and

possibly the Royal Charter – for those prize winners who had the potential to become Freemen in the future, in order to maintain a connection with the Company until then. An Associate would have a nominal 'quarterage' of £50, which might be waived initially as part of

an Award, and would be given certain benefits to encourage their participation along their journey.

It was agreed to appoint a Liveryman or Freeman to oversee this on behalf of the Membership Committee, and to identify suitable candidates retrospectively from our most recent Awards cohort.

A Companion of the Company was also being 'worked-up' by the membership committee to provide a more formal connection to, for example, widows or widowers of Company members who remained engaged with the Company until their demise.

The Court discussed, at length, the nature of military affiliations with a view to ensuring that those entered into by the Company were relevant, manageable, realistic and had understood obligations and objectives from both parties.

The Company continues in its search for an archivist, and anyone who might be interested is encouraged to contact the Clerk.

The Company's financial position is sound, albeit understanding that position is challenging as a result of slow progress in developing the required management accounts through our new book-keeping service.

*The Master*

## News from the Almoner

Another successful luncheon was held at the RAF Club on 14 May 2018 attended by widows of past members.



The Almoner and Hon. Chaplain, Barry Gasper and Peter Hartley respectively are very pleased that the Court has recognised that widows/widowers of members who have passed away will be entitled to be known as Associates of the Company in recognition of their past connection with the Company.

## Military affiliations

### HMS PRINCE OF WALES

Senior Warden Cdre Brooks represented the Company at the affiliates day in HM Dockyard Rosyth, hosted by HMS PRINCE OF WALES on 16 May 2018. Over 40+ people attended from London Livery Companies, affiliated service units (army and RAF).

The two awards were made of which the second award was presented by the Senior Warden. The Senior Warden also presented certificates to both the Admiral Wildish Engineering Innovation and the Commander

Marine Engineering Operational Engineering winners..

The senior warden gave a short speech about how the Engineers Company and IMarEST are pleased to be co-sponsors for these engineering awards as we encourage and support engineering excellence.

### The Institution of Royal Engineers

Liveryman Yuli (Chaido) Doulala-Rigby has been made the first civilian fellow of the Institution of Royal Engineers.

### Company Announcements

### Recently clothed Liverymen

Ross Smith



I am a Scotsman, born in Edinburgh with an engineering science graduate from Edinburgh University. I worked most of my life in the automotive industry - involved in brakes, tyres, electronics, switchgear and lubricants/engine testing. With the BP aquiline of Castrol, I was VP

Engineering Standards in BP Group Engineering prior to my retirement in 2013.

I have been involved in Scouting since joining Cubs as a seven year old and have been an Assistant Scout Leader, Group Scout Leader and Group Chairman over the years.

In my retirement I keep bees (normally 2 hives) in my garden and this year had over 15 Kg from one hive. I still have a keen interest in cars - particularly those of the 70s and 80s - and have a 1980 Reliant Scimitar GTC. (The convertible of which only about 440 were ever made). It only tends to get out of the garage on nice sunny summer days. After 2-4 years of occasional work on it, the car jointly took the local club concourse trophy this year.

Finally I am a very keen 'DIY'er and in the last year have completely refurbished our en-suite bathroom with a walk-in shower and refurbished all our house windows with the latest thermally efficient glass units - however I did have to get the professionals in to provide some very necessary scaffolding.

I am looking forward to participating in as many of the Company's events as possible but with a daughter ( and first grandchild) living in Western Australia, I may not always be in the UK!!

### Matthew Waterhouse

From a very early age - 10 or thereabouts - I have always had an interest in cars and in particular in keeping older cars on the road. So, it was natural to apply for a thick sandwich course at university. They were very popular in 1969. I started at Roll-Royce Ltd in Derby with the intention of going to Crewe and into the car division.

At Crewe, I worked on engines and engine testing, emissions testing, vehicle dynamics and refinement, and I project managed some special individual vehicles for a worldwide selection of customers. I remained at Crewe until 2001, completing my career there as Head of Whole Vehicle Engineering, a position that reported directly to the Engineering Director.



After leaving RR&B in 2001 I worked, as a consultant with Pininfarina. I got involved in several production cars for both Jaguar and Volvo before working in the USA on amphibious vehicles.

Finally, I returned to working in Coventry where I became involved with several very low volume special car projects with individual vehicles selling at over half million pounds.

Now, I am President of the Daimler & Lanchester Owners' Club (I have a Daimler SP250), I scrutineer for the MSA at some motor sports events, I am also a member of the IMechE Professional Review Committee, and I am Chairman of my local Parish Council.

Never a dull moment!

### Eur Ing James Richard Dickaty



I started my engineering career in 1995 when I cut my teeth on the preserved steam ship SS Shieldhall, maintaining and operating the steering gear which was powered by a beautiful brass and bronze compound steam engine. I joined the Royal Navy as a marine engineering mechanic in 1997. Looking forward to seeing the world on an aircraft carrier (or some other large and comfortable vessel), the Navy with its unique sense of humour drafted me to the submarine service where I spent the next 15 years not seeing the world. But it was a wonderful job where they let a 17 year old play with nuclear reactors.

Sadly for me, my career submerged was cut short when I permanently injured my spine during an operational deployment. I spent the next three years teaching young engineers in HMS Sultan, until I volunteered to be medically discharged. On my very last day in the Navy I became Incorporated with the IMechE.

In 2012 I joined BAE Systems Submarines Division as a Commissioning and Business Capability Manager. As a civilian I was allowed to go to sea and helped to successfully deliver HMS Ambush's sea trials. I also worked with our American colleagues to develop the manufacturing and commissioning processes for the Dreadnought Programme. In 2014 I was recruited into Sellafield Ltd. I commissioned the Calder Hall reactors so they could defuel safely in 2015. I was then transferred to my current role as the Senior Commissioning Programme Manager for the Pile Fuel Cladding Silo, which is a 1950s legacy waste store from the Nuclear Weapons programme. My team and I will soon be withdrawing the first box of waste during our active commissioning of the waste retrievals plant. I feel greatly honoured that a dyslexic former mechanic will be the one leading this operation.

My Grandfather, an Incorporated Engineer with a career spanning 60 years, said that one should always use engineering as a means to philanthropy, and since then I have been involved in our profession through voluntary causes such as being an active STEM Ambassador to schools in socially deprived areas, an IEng and CEng mentor to Sellafield graduates and Armed Forces leavers, working as an advocate for the charity 'Engineers Without Borders', as an Industrial Advisor and PRI Assessor for the IMechE.

I live with my wife, two young aspiring engineer daughters and a menagerie of animals on a croft in the middle of the Cumbrian countryside. We enjoy spending time cruising our narrowboat "Bluebell" on the Lancaster Canal, which is a shared family hobby.

### The company has been informed about the recent deaths of the following members.

Liveryman Professor Kenneth Slater FREng FIET passed away on 24 June 2018, just before his 93<sup>rd</sup> birthday

Past Master Dr Cadzow Smith CBE FREng FRSE passed away on 10th July 2018 he had been unwell for a while. Dr Cadzow Smith joined the Livery on 1<sup>st</sup> July 1984, became a Court Assistant on 1 April 1991 and was Master of the Company 1997-1998.

Liveryman Professor John Coldwell CEng FIET FRAeS who passed away on 11 July 2018.

Liveryman Robert Richie passed away on 10 September 2018.

Freeman Lieutenant Colonel Harry Malthouse passed away on 14 September.

Liveryman Peter Neill Blair who passed away on 29 September 2018.



## Members' Announcements

Dave Cooper FCGI

Dave Cooper attended Imperial College on 15 June where he was presented with his Fellowship of the City & Guilds London Institute. The presentation was made by Chairman of the City & Guilds of London Institute Council and former Chairman of the Olympic Delivery Authority, Sir John Armitt.

The Fellowship, which requires nomination by at least two existing Fellows was awarded to Dave for his "unswerving commitment to the training of young engineers and his work for the UK lift industry".



**Congratulations** to Malcolm and Linda Vincent who celebrated their golden wedding anniversary on Friday 29 June , As part of the celebrations they travelled to the Everest Base Camp in Tibet via Nepal, one of the most challenging destinations on their bucket list !



## Yuli (Chaido) Doulala-Rigby

Yuli has been honoured with being the first civilian fellow of the The Institution of Royal Engineers with membership number C001. The Editor wanted to know more and asked Yuli to explain what she had done to be so honoured.

Yuli said that she did not apply for this recognition. It started with supporting a STEM event for 900 female school girls at the Sandhurst Military Academy organised by WISE and supported by the Royal Engineers. At the VIP lunch reception Yuli made a speech about how to attract and inspire young people, and in particular females, into engineering. She has also supported the Army, by volunteering her free time and many weekends as well as her employer's (Tensor) time, in various workshops about the innovative use of Tensor's geogrids in civil engineering including various declassified projects that Tensor has delivered with the Army over the past 35+ years, including the foundations

for the temporary Bailey bridge in Workington after the floods of the early 2010s where a policeman was killed.

Yuli continues to support the Royal Engineers in its STEM events and this past summer was the guest industry speaker and led a panel discussion at a 150 all-female Cadet event.

In view of Yuli's enthusiasm and being a role model General Urch, President of the IRE invited her to become a Fellow of the IRE as she fulfilled the newly established conditions for a civilian, to qualify for the first Fellow of the InstRE (FInstRE).

Yuli is used to 'firsts'. She was the first female Fellow of the ICE NW region and the first female Chair of the International Geosynthetics Society UK Chapter.



Yuli surrounded by a contingent of female cadets

# THE ENGINEERING AWARDS

## PART 1

### THE SERVICES ENGINEERING AWARDS

#### THE SERVICES ENGINEERING UNDERGRADUATE AWARD

*Awarded to an officer graduating from the Defence Technical Undergraduate Scheme (DTUS) who has achieved outstanding academic performance and demonstrated clear leadership and commitment to a professional engineering career in the Armed Forces.*

**Midshipman Henry Trutch RN.** Henry Trutch was an exemplary scholar and bursar throughout his 5 year Defence Sixth Form College and Defence Technical University Squadron career. He went to the University of Southampton and through hard work and commitment gained a 2:1 BEng in Electronic Engineering. A natural leader and keen sportsman he won consistent praise for his commitment and inspirational example. He qualified as an Endurance Training Leader and was selected as 'Squadron Cadet', a distinction awarded to the bursar who displays the best leadership qualities in the unit.

He achieved an excellent balance between his University studies, to DTUS Thunderer Squadron and to future career networking. Above all he maintained constant enthusiasm for his professional engineering career and, having made a very positive mark at the University, at Britannia Royal Naval College and within the RN Engineering community, he has a very bright future in the Armed Forces.

#### THE SERVICES ENGINEERING POSTGRADUATE AWARD

*Awarded to an officer completing a postgraduate technical degree who has achieved overall academic excellence and contributed most to the advancement of technical knowledge or its application through a research project.*

**Sub Lieutenant Daniel Jinks RN.** The Nuclear Reactor Course is a postgraduate diploma course and forms part of the Marine Engineer (Submarines) training pipeline. The course is a key stage in the process of training Royal Naval personnel to supervise nuclear reactors, and is academically rigorous, as appropriate for students who will discharge such an onerous responsibility. Highly motivated, S/Lt Jinks produced strong results throughout the NRC, achieving distinctions in all the taught elements of the course. Consistently strong throughout, Jinks helped other students to understand some of the more challenging areas of the course subjects. Jinks gained a highly commendable combined academic and research score of 79%.

S/Lt Jinks was tasked with a computational research project to investigate the use of machine learning for prediction of critical heat flux (CHF), one of the key thermal constraints on the Naval PWR. During the course of the project, he taught himself how to program effectively, and then apply various machine learning libraries to a difficult task. Despite no programming experience prior to the project, he wrote all of his own code to prepare his input data, to interface

with various state of the art machine-learning libraries and to plot and analyse results. He conducted an extensive literature survey to track down the required training data that the algorithms operate on. His work, which made use of tools that have never been tried in this domain, resulted in an impressive advance in performance. Using his methodology, more accurate CHF predictions are obtained more quickly than previously. The quality of his written report and oral presentation were particularly praiseworthy, resulting in an overall mark of 70%.

As well as finding time for his studies and Naval Duties S/Lt Jinks maintains an active lifestyle. A keen and regular footballer he also enjoys attempting to surf when time permits. During this very demanding course, he made time on his annual visit to Polzeath to help a charity providing a surfing weekend to injured Royal Marines.

Based on the way that he has applied himself to his studies and on his enthusiastic commitment to his work, he will be a valuable asset to the nuclear reactor programme and to the wider engineering community.

*Both the Awards above were made on the recommendation of the Operations Director of the Defence Academy of the United Kingdom at Shrivenham, Wiltshire.*



#### THE SERVICES' OPERATIONAL ENGINEERING AWARDS

*Awarded to an officer, from various Service and Corps areas, who has best made the application of professional engineering judgement or technical innovation to contribute significantly to the maintenance or enhancement of operational capability or effectiveness in any theatre of operations, including the UK. The appropriate senior specialist Service authority makes recommendations for the Operational Awards.*

#### ROYAL NAVY OPERATIONAL ENGINEERING AWARD

**Lieutenant Commander Christopher Bowmer RN.** LCdr Bowmer is the Deputy Marine Engineering Officer (DMEO) on one of the UK's attack submarines. During routine maintenance an issue was identified in the submarine's electrical generation system that would necessitate unexpected replacement of part of the generator equipment. Lt Cdr Bowmer had only recently joined the submarine and there was no plan to rectify the fault. However, by successfully managing a repair never before attempted on an In-Service submarine during Fleet Time, Lt Cdr Bowmer led the most challenging maintenance period ever attempted in HMNB Clyde. The work required major systems (including Main Steam) to be cut. There was no standard procedure for this task but his risk analysis enabled the Design Authority to make informed, timely decisions minimising the impact. The addition of a number of other packages added yet more complexity to the maintenance period. This included a first of class Reactor Control and Instrumentation (RC&I) upgrade. The lessons from this will de-risk future upgrades providing a wider

benefit to UK submarine availability. Through all of this Lt Cdr Bowmer has shown exemplary leadership to the ME Department and has been instrumental in maintaining high morale across the submarine in general. The submarine will return to the Fleet in 2018 as the UK's most capable SSN. This success will be testament to the hard work and dedication of Lt Cdr Bowmer.

#### ROYAL ENGINEERS' OPERATIONAL ENGINEERING AWARD

**SSgt Matthew French RE.** SSgt French has been nothing short of excellent during his last 16 months delivering construction supervision to 35 Engineer Regiment as it built towards a Joint Force Enabling Exercise in Cyprus and subsequent deployment on Op SHADER. His impressive supervisory and mentoring achievements are amplified by his relative inexperience, unusually having been assigned direct to Regimental duty from his Clerk of Works course, rather than with the benefit of a formative tour in a Chilwell STRE first. There has been neither the slightest hint of any lack of knowledge nor technical inexperience in his performance throughout force preparation and now deployed in Iraq, he has continued to be exemplary.

He has been instrumental in the organisation of a yearlong artisan and construction-training programme. Its coherence and measured progression has been deeply impressive. It started with low complexity, section and ½ section tasks in the local Paderborn area. Thereafter followed a 3-week exercise at the Defence School of Transport (Leconfield), delivering troop level training through the medium of new and refurbished infrastructure tasks for the School and DIO followed. The year culminated in ambitious construction tasks in Cyprus (Exercise PINESTICK 17/2), which delivered

high quality projects, both on time and within resources. As the only Regimental Clerk of Works involved throughout, SSgt French's stewardship of the whole programme of preparation and delivery in Cyprus was a masterful exposition of both leadership and technical acumen. Despite being junior in his role, he exuded the knowledge and expertise of a highly competent Clerk of Works. He was vital to the quality control programme and his attention to detail, extreme diligence and proactivity ensured successful completion and handovers of all projects - attracting rave reviews from the clients in all cases.

Throughout, he has been a driving force behind delivering structured and suitable opportunities for young soldiers to gain experience in their trades and to gather evidence for competencies towards their vocational qualifications. Designs completed internally to the Regiment were carefully considered to maximise these opportunities. This has added significant value to the development of others. Several soldiers within the Regiment are considering Clerk of Works applications due to the fine example he has set. He takes considerable time to develop and aid individuals in their quest for excellence.

SSgt French is now deployed on Operation SHADER as part of the Military Construction Force and his professionalism has continued to be pervasive. He is a ferocious driving force behind the delivery of operational infrastructure, which is widely noticed across the Coalition for its high quality and comprehensive technical finish. Where previously systems were failing, he has found fixes. Where Coalition relationships were fraught, they are now succeeding. Quite simply he is an excellent ambassador for the British Army and the Corps of Royal Engineers through his work and professionalism.

## ROYAL SIGNALS

### **OPERATIONAL ENGINEERING AWARD**

**Captain B Brown R SIGNALS.** Capt Brown is the Subject Matter Expert for operational support of Electronic Counter Measures for Force Protection (ECM(FP)). This provides mitigation against insurgent improvised explosive devices targeting UK service personnel. The capability was introduced as an Urgent Operational Requirement for operations in Afghanistan in 2012 and has now been funded to deliver a capability to current operations. Hence, the challenge has been to use the capability in many different dynamic electromagnetic environments with a more technologically aware and determined adversary. This has meant that the equipment needs to be constantly improved to achieve far more than it was designed to do.

Captain Brown has been closely involved in the evolution of the capability and in finding innovative ways to improve the levels of protection. This has required him to understand the intricate design details of both the hardware and software and exploit them to maximum effect. Of particular note are the advances made in antenna technology to improve protection close to the platform and the improvements to the system to ensure that the ECM measures do not affect our own communications.

His dedication to this capability has been outstanding. Through his energy, dedication and technical innovation, underpinned by a calm, methodical approach, he has effectively maintained a life-saving capability notwithstanding the constantly evolving threat both at home and abroad.

## ROYAL ELECTRICAL & MECHANICAL ENGINEERS

### **OPERATIONAL ENGINEERING AWARD**

**Major Paul Round-Turner REME.** Maj Round-Turner's engineering excellence, eye for detail and determined approach throughout the inspection phase on Ex PRAIRIE PHOENIX became the catalyst for mission success and higher equipment availability in BATUS during 2017, up by 16% from 2016. This, combined with maintaining a Unit Fleet in Tidworth – when all his deployable manpower was in BATUS – was a considerable challenge. Maj Round-Turner's contribution towards the unit-level estimate was profound: centralising the fleet; placing equipment out of use; advising what risks to take; and refining a specialist trade group centralisation plan all required his analytical mind.

Maj Round-Turner is the Worshipful Company of Engineer's Royal Charter personified: proactive in the evolution of engineering technology and provocative in encouraging debate. His exploits are far-reaching and future-focused. Beyond all this his outstanding engineering competence gives him ambassadorial status within REME. He is a most deserving winner of the Worshipful Company of Engineers Award.

## ROYAL AIR FORCE

### **OPERATIONAL ENGINEERING AWARD**

**Squadron Leader Stuart Rhymer RAF.** Sqn Ldr Rhymer's enhancement of engineering, compliance and safety processes for a globally dispersed array of communications systems has underwritten enduring support to multiple Operational Theatres during

a period of unremittingly high tempo. He identified significant vulnerabilities in system availability and integrity, and through his tenacity and technical expertise he has secured sustainable engineering support to safeguard the capability of MOD, partner and Allied assets worldwide where previously little was guaranteed.

The span and complexity of engineering responsibilities, including on-going projects and international capability development programmes with a value in excess of \$100M, has placed a huge demand on Sqn Ldr Rhymer. Notwithstanding, by dint of unremitting effort, excellent leadership, technical acumen and commitment to quality and safe working practices he has also been instrumental in minimizing risk to life for personnel working in austere and dangerous conditions.

## THE DEFENCE ENGINEERING EQUIPMENT & SUPPORT AWARD

*Awarded to the person who has contributed most, through application of professional engineering judgement including the use of leadership, management and technical acumen, in the acquisition of new capability or to meet materiel availability targets for any of the Armed Forces. The recipient can be an individual of any rank or a team from the regular or reserve Armed Forces, the Royal Fleet Auxiliary, or the MOD civil service serving in the Defence Equipment & Support Organisation with a recommendation by Chief of Defence Materiel.*

**Squadron Leader David Hirst RAF.** Sqn Ldr Hirst has been pivotal in his role in the integration of new weapons on the Typhoon aircraft, thereby helping to ensure the continuity of critical UK combat

air capability following the planned retirement of Tornado GR4 and the assumption of all roles by the Typhoon Force in March 19. Sqn Ldr Hirst played a central role in the timely completion of Brimstone missile test firings, using his

engineering judgement to generate the associated safety assessments while carefully balancing operational, regulatory and technical assurance requirements. Through his leadership, enhanced Typhoon weapons capability will now be

available some 4 months ahead of schedule and in good time to relieve the Tornado GR4s committed to Op SHADER, the operation against the Islamic State terror network



## **THE ENGINEERING AWARDS PART 2**

### ROYAL ACADEMY OF ENGINEERING ENGINEERS TRUST

#### **YOUNG ENGINEER OF THE YEAR**

*The RAEng Engineers Trust Young Engineer of the Year competition, awarded by the Royal Academy of Engineering with support from the Worshipful Company of Engineers, offers five prizes of £3,000 to early career engineers in full time higher education, research or industrial employment whose achievements are recognised as outstanding.*

#### **Winners 2018 (£3,000 Prize):**

**Mr Simon Bowcock** - Corrosion Engineer, BP

**Dr Christopher Donaghy-Spargo** – Assistant Professor of Electrical Engineering, Durham University

**Mr Khoulood El Hakim** - Project Field Engineer, Bechtel Ltd

**Dr Robert Hoye** - Thomas Nevile Junior Research Fellow University of Cambridge

**Mr Chetan Kotur** - Executive Assistant to CEO, Polestar

### ENGINEERING HORIZONS BURSARIES WINNERS

*In 2016 the Engineers Trust supported 5 Horizons Bursaries through the IET, aimed at students or apprentices who may face, or have faced, challenges or personal obstacles and are UK residents. A further 4 Horizon Bursaries were awarded in 2017. The bursaries are for £1,000 per year for the duration of the degree or apprenticeship of up to 4 years. They are:*

**Mr Daniel Breen** – an Advanced Apprenticeship in Engineering at Heathrow Airports

**Ms Marie Isaacs** – a Body Engineer – CAD apprenticeship with Jaguar Land Rover and Warwickshire College

**Mr Samuel Jarvis** – studying electronic engineering at the University of York

**Ms Dilani Selvanathan** – a software engineering apprentice with the British Broadcasting Corporation

### WATER ENGINEERING AWARD

*The Water Engineering award is made jointly with the International Water Association for the best presentation and paper at the annual UK Young Water Professionals Conference.*

**Winner 2018 (Medal) – Dr Katie Smith**

**Dr Katie Smith** graduated from Durham University with a BSc in Natural Sciences in 2010, followed by an MSc by Research in 2012. She then continued her studies with a PhD from Nottingham University, and was appointed as a Drought Analyst and Hydrological Modeller at the Centre for Ecology and Hydrology, Wallingford in 2014.

Katie won the prize for the best paper presented at the International Water Association's UK Young Water Professionals conference 2018, where she described her work as part of the NERC UK Droughts and Water Scarcity Programme, reconstructing flow data from the past 125 years to inform future drought predictions. Both judges and delegates, at the conference, described it as a 'great presentation' and a clear winner.

Katie has regularly presented at conferences, and published widely on hydrological modelling over the last 3 years. This, her studies and career to-date demonstrate her passion for her subject and her concerns for our environment.

## **STEPHENSON AWARD**

*The Award is for those who have been particularly successful in encouraging young people to study engineering with an emphasis, but not exclusively, on mechanical engineering. In 1997, members of the Institution of Mechanical Engineers made donations to fund a Worshipful Company of Engineers Loving Cup to mark the Institution's 150<sup>th</sup> Anniversary. Donations in excess of those needed for the Loving Cup were used to establish the Stephenson Award and further donations were received from members in later years, supplemented by a substantial grant from Rolls-Royce plc. The Engineers' Company acknowledges the assistance of the Institution of Mechanical Engineers and the Engineering Development Trust (EDT) with nominations for this Award.*

**Winner 2018 (Medal & £1000 Prize) – Steve Smith**

**Steve Smith** has been a leading light in promoting STEM throughout South East England. He represents the Regional Institution of Mechanical Engineers (IMechE) and advises and promotes engineering in schools and colleges throughout the area.

He is promoting a program devised by an engineer in the western region where primary school pupils design, build, test and improve fan boat models whilst applying their understanding of electricity, forces and materials. He is successfully working with the Hub for South East of England to bring this program to over 20 schools. In addition, he has helped raise funds to train and equip local engineers and has also arranged training for STEM ambassadors. Steve is involved with Medway Education Business Partnership on

the steering group for an annual competition called Young Eco Engineers. This involves over 20 different schools in the Kent area and is a competition where mixed groups of boys and girls build electric go-karts (called Goblins) purchased from Greenpower. The students work as a team to design and build the bodywork from recycled materials and then race their karts over 2 racing days. A teacher and a STEM ambassador, who is usually an IMechE member, assist each group. Steve has been a leading light in this project for more than 5 years and the competition continues to grow in popularity.

Steve is also an active Project BLOODHOUND ambassador. He has given many presentations and facilitated activities with local students to introduce engineering and to inspire the next generation of engineers. Examples of his initiatives included a rocket car project, other design and make projects and explaining the wide range of opportunities available in the world of engineering.

As a senior manager working for Delphi Technologies, Steve has promoted STEM activities within the company to the mutual benefit of local schools and the company. The initiative has allowed graduate engineers to learn leadership skills and, by working with young engineers they can relate to, has helped local students explore careers in engineering.

Steve has made, and continues to make, a major contribution to the promotion and understanding of STEM in schools to students across a wide age-range within the South Eastern region. His passion for excellence and engineering is an inspiration to professional engineers of all levels.

## **BARONESS PLATT OF WRITTLE AWARD**

*Originally established to recognise engineering excellence amongst those pursuing final year studies leading to academic qualifications for entry to the Engineering Council's Incorporated Engineer grade, this Award was refocused in 2013 to those who achieved registration as Incorporated Engineer in the preceding calendar year. Named for the Late Honorary Liveryman and Court Assistant Emeritus, The Baroness Platt of Writtle CBE FREng in recognition of her work in support of the Engineering profession in general and Incorporated Engineers in particular, the Award was first made in 2002. The Engineers' Company acknowledges the assistance of the Engineering Council and its partner Professional Engineering Institutions in selecting the winner.*

**Winner 2018 (Medal & £1000 Prize) – Matthew Foyle**

**Matthew Foyle** is an excellent role model for career progression from apprentice technician to Incorporated Engineer. Whilst working full time, he has not only completed an ONC, HNC and HND, but has also obtained a 1st Class Honours degree from Aston University in Professional Engineering and is currently studying for a Masters. In the work environment he is responsible for mechanical and electrical design for Wessex Water, showing detailed understanding of the control and safety systems assuring water quality, as well as a good awareness of the environmental and microbiological factors that the process must control. An enthusiastic advocate for innovative technology, Matthew is proactive in introducing new technology to his

organisation, as evidenced by his championing of the development of 3D CAD and Building Information Modelling (BIM). The model covers demolition and reconstruction of buildings, the mechanical and electrical installations and the inventory management for the new equipment all within a tight space or which requires careful planning and phasing of tasks to ensure a safe working environment for all trades. He has co-ordinated cross-disciplinary teams in development of the 3D model, which is expected to support longer term maintenance planning and asset management.

Matthew's career shows rapid progress, recently being appointed Project Manager responsible for multiple projects of up to £16M. He is proactive in encouraging school and college leavers to enter the profession, helped developed his employer's M&E apprenticeship recruitment programme and actively drives closer links between Wessex Water and the IET.

## **HAWLEY AWARD FOR ENGINEERING INNOVATION**

*The Hawley Award, established in 2006, is awarded annually for the most outstanding engineering innovation that delivers demonstrable benefit to the environment, by a resident of the UK who is at an early career stage, holds a graduate or post-graduate degree in engineering or science from a recognised UK university and is a graduate or more senior member of an engineering institution.*

## **HAWLEY AWARD SPONSORS**

*Allis cum Humanitate John Laing plc*

*AMEC plc Keir Group*

*AstraZeneca National Grid*

*BP Nuclear Decommissioning Authority*

*British Energy Nuclear Industry Association*

*BSI Royal Academy of Engineering*

*Carron Energy (Uskmouth power Co Ltd) Royal Society of Chemistry*

*Costains Rutland Fund Management Ltd*

*Deloitte & Touche PLC RWE npower*

*Dr Robert Hawley Scottish Power*

*EDF Energy Shell*

*Engineering & Technology Board Society of Environmental Eng*

*Engineering Council UK Thames Water*

*Engineers' Company Liverymen The Go-Ahead Group Plc*

*Fidelity The Weir Group PLC*

*Hammonds UKAEA*

*HSBC VT Group*

*IACWater Conservators' Company*

*IET World Nuclear Association*

*Institute of Marine Engineering*

**Winner 2018 (Medal & £5000 Prize) – Robert Edwin Rouse**

**Robert Edwin Rouse** is a scientist, engineer and designer. He is currently reading for a PhD at the University of Cambridge having already completed an MSc at Imperial College London and an MA at the Royal College of Art. His first degree was in Mechanical Engineering at Exeter where he gained a first. His passion for engineering combined with his love of the marine environment has brought about a design of a device for assisting in cleaning up the oceans. His invention extracts marine and fluvial plastic pollution through integrated, commensal technologies and is both timely and important with the world currently looking at single use plastics and the damage they cause to the environment. One unit with a processing area of 6m<sup>2</sup> can remove up to **120 tonnes per year**.

## **LEETE PREMIUM AWARD**

*Established in 2012 under the Will of Liveryman Dr David Leete for the purpose of making awards in what Dr Leete called Production Engineering Research but defined sufficiently broadly to encompass the whole field of what is now known as Manufacturing Research, an agreement was made with the Institute for Manufacturing (IfM), University of Cambridge, to provide a "premium" above normal Departmental Training Awards to be awarded to their best new PhD research student in 2013 and in each of the*

following two years. Eligibility is restricted to UK Nationals whose prospective projects do not benefit from CASE awards and the £18,000 total award is staged over 3 years of PhD study subject to sustainment of satisfactory performance.

**Winner (£6000pa for 3 years) – James Macdonald**

*The Leete Premium Award, endowed by the late Liveryman David Leete's half million-pound legacy to the Trust, has now provided 3-year awards of £6000 per annum to 4 production engineering doctoral research students at Cambridge University's Institute for Manufacturing.*

James Macdonald, is in the first year of his PhD study with the Fluids In Advanced Manufacturing research group under the supervision of Dr Ronan Daly.

The focus of James' research is the fabrication of superhydrophobic surfaces through direct laser texturing. This process imparts superhydrophobicity through inherent modification of the surface texture and chemistry to overcome the durability challenges associated with coating approaches. The laser texturing process has proven capable of producing some of the most strongly nonwetting surfaces ever created with key benefits of low cost, scalability and HSE neutrality. Further work will investigate hybrid techniques of laser processing with digitally enabled additive coatings to produce patternable control of surface functionality. Targeted surface functionalities will involve self-cleaning, integrated sensors and electronics.

## **SIR PETER GADSDEN BRITAIN AUSTRALIA AWARD**

*The Sir Peter Gadsden Award is to encourage an exchange between Britain and Australia of engineers undertaking postgraduate studies*

Jay Patel is a Post Graduate at Bath University researching High Temperature Superconductors. Jay is working on a new type of superconducting motor, which could potentially reduce the size of large machines by a factor of 10. It is a technology that could lead to wind turbines exceeding their current 7MW ceiling by a factor of 2. His particular interest is in 'High' temperature superconductors ie those that are superconducting at the temperature of liquid nitrogen (77K). Traditional superconductors require expensive and potentially dangerous liquid helium. The new superconducting material they are using is a Magnesium Diboride (MgB<sub>2</sub>) wire that has similar mechanical characteristics to Copper wire. Whilst Bath are specialising in the application of the technology, with support of the Gadsden, Jay will spend time at the University of Wollongong, New South Wales in order to build coils for his motor. Wollongong are specialists in the mechanical properties of MgB<sub>2</sub> and have developed techniques for its use. The materials aspects of superconductors are significantly different from conventional 'room temperature' materials. The work will be reported in an academic paper.

Ian Pope received the Gadsden award during the second year of his doctoral studies in fire safety engineering at the University of

Queensland's School of Civil Engineering, supporting him to undertake an exchange at the University of Edinburgh. Ian's primary area of research is the fire performance of engineered bamboo buildings, and this award gave him the opportunity to work with specialists at the Building Research Establishment Centre for Fire Safety Engineering in Edinburgh. The collaboration helped him to develop models for evaluating and quantifying common sources of error in fire testing. During his exchange, he has presented his work to researchers at the University of Bath and Imperial College London, building links for future collaborations.

## **MERCIA AWARD**

*The Award is made annually to a student under 30 for a postgraduate paper describing how engineering techniques are being used for the advancement of medical treatment and provides a medal and bursary towards the cost of a taught or research programme of postgraduate studies in Medical Engineering.*

**Winner 2018 (Medal and £500 Bursary) – Dawn Gillies**

Dawn Gillies graduated from the University of Glasgow in 2012 with an MEng in Electronics and Music. This was followed by a PgDip in 2015 from the University of Edinburgh in Signal Processing and Communications, continuing on at Edinburgh as a PhD student in the EPSRC and MRC Centre for Doctoral Training in Optical Medical Imaging where she is now in her 3<sup>rd</sup> year of PhD studies. Her paper entitled 'How Squishy is a Cancer Cell' presents complex work on investigating the stiffness of biological cells, with application to the diagnosis of pancreatic cancer, in a very clear, concise and interesting man-

ner. Her passion for communicating Science and Engineering is clear. Dawn is excelling at this very interdisciplinary project and has presented her work at several conferences and recently published her first paper - excellent progress for a 3<sup>rd</sup> year research student.

Alongside her academic work Dawn is an ambassador for the University engaging in a variety of outreach activities, targeted at a broad range of audiences. She is an excellent role model for students who aspire to study a STEM subject and an active advocate for widening participation.

## **CADZOW SMITH AWARD**

*Established in 1996, the Cadzow Smith Engineering Awards were endowed by the Eastern Group plc in recognition of the outstanding services to engineering of its former Chairman, Dr James C Smith CBE FREng FRSE now a Past Master Engineer. The Awards are for excellence on an accredited undergraduate engineering course conducted at one of eleven universities within London and the Home Counties. Besides academic excellence, the recipients of the Awards must have demonstrated self-confidence, professional awareness, leadership and sound common sense.*

**Winner 2018 (Medal & £2500 Prize) – Kelly Hughes**

Kelly Hughes is in the final year of the BEng Honours Civil Engineering Sandwich programme at The University of Greenwich and is expected to graduate with first-class honours.

During her year in industry she worked with Mott MacDonald and with Osborne, a small

construction firm in Surrey. There she took the role of Site Manager at The Royal Academy of Music in Marylebone. She describes the prospect of working alongside a strong team of predominantly male colleagues as daunting, but she clearly rose to the challenge and has a strong sense of the commercial and business aspects of civil engineering and her sponsor describes her as having proved herself to be a strong leader both in workplace and at university. She has a strong social awareness and following the Grenfell Tower fire chose to do her final year dissertation into the implications of the disaster, working with a local structural engineering consultancy specialising in fire safety. In this, she was determined to make an immediate impact and her work centred on improving the standard of fire risk assessment. The Managing Director of the consultancy was so impressed with her work that she has been offered a graduate position with the company. She has ambitions to become a chartered fire safety engineer.

Whilst working at Mott MacDonald she was part of a scheme called Inspiring Engineers, going into schools and leading design and build projects. This was driven by a recognition that she herself had had little exposure to the opportunities of engineering whilst she was at school. She has worked as a volunteer at a homeless charity and partly finances her university course by working in the mental health-care sector.

The panel sees her as someone who, overwhelmingly, has the skills and ambition to succeed in her career. They also feel that the Cadzow Smith Award will contribute significantly to enable her to achieve her ambitions."

## **ARKWRIGHT SCHOLARSHIPS**

*The Worshipful Company of Engineers currently supports 4 Arkwright Scholars undertaking their Sixth Form studies at schools in Greater London as a potential lead-in to higher engineering studies.*

They are:

2016-18 **Miss Saskia Bustrode** – Putney High School, London SW15 6BH

2016-18 **Mr Nicholas Roberts** – Highgate School, London N6 4AY

2017-19 **Miss Lucy Bell**

2017-19 **Mr Cormac Hardy**



# ROYAL ACADEMY OF ENGINEERING MacROBERT AWARD

*The Royal Academy of Engineering MacRobert Award is the premier prize for UK innovation in engineering. It seeks to demonstrate the importance of engineering and the role of engineers and scientists in contributing to national prosperity and international prestige. It is awarded annually for an outstanding example of innovation and benefit to the community, which has also achieved commercial success. The award honours the winning company with a gold medal and the team members with a prize of £50,000. The Engineers Trust is supporting the Award with £20,000 annually for 10 years.*

## **Winner 2018 (£50,000 Prize) – Owlstone Medical**

The Owlstone Medical team received the 2018 award for the unique Breath Biopsy® platform that has the potential to save hundreds of thousands of lives and \$1.5 billion in healthcare costs globally.

Owlstone Medical’s ReCIVA Breath Sampler has opened up the potential for earlier diagnosis and precision medicine across cancer, inflammatory disease and infectious disease.

Owlstone Medical has created the first platform capable of capturing breath samples and analysing them in a

robust and reproducible way. These samples can be used to identify the unique chemical ‘biomarkers’ of a variety of diseases, also known as volatile organic compounds (VOCs), in human breath. As VOC levels change at the very earliest stages of disease and provide information on the current activity of cells and tissue, the breath samples could lead to earlier diagnosis of diseases such as cancer when treatments are more effective and more lives can be saved. Breath biomarkers also have the potential to revolutionise the way medicine is prescribed, as they could be used to monitor drug effectiveness and match patients to the correct treatment, and cut healthcare costs by lowering drug wastage.



# The Worshipful Company of Engineers' Forthcoming Events

07-Nov-18	MacRobert Award Seminar - Owlstone Medical's ReCIVA	Royal Academy of Engineering
10-Nov-18	Lord Mayor's Show	The City
14-Nov-18	Evening event for potential new members	Information Technologists Hall
10-Dec-18	Carol Services and dinner	Chapel Royal, Tower of London & Clothworkers' Hall
08_Jan-19	Court & Partners Dinner	Salters' Hall
12-Feb-19	Cyber Security Lecture	Information Technologists Hall
01 March 2019	Visit to Brecknell Willis	Chard, Somerset
05-March-19	Election Court, Church service and dinner	St Vedast and Wax Chandlers' Hall
29-March-19	United Guilds Service	St Paul's Cathedral and TBA
30 March 2019	Early Spring walk	Highgate to Hampstead
04-April-19	The Lord Mayor's Big Curry Lunch	Guildhall
09-April-19	Visit to Toshiba Research Europe	Cambridge Science Park
30-April-19	Installation Court and Dinner	Merchant Taylors Hall
01-May-19	Brooch Lunch	Alderman's Dining Room, Guildhall

## PROVISIONAL DATES & LOCATIONS FOR MASTER'S YEAR 2019-20

08-May-19	Master's Lecture	HQS Wellington
13-May-19	Almoner's/Companion's Lunch	RAF Club
21-May-19	Festival of Sons of the Clergy	St Paul's Cathedral and TBA
23-May-19	Submarine Museum Gosport	Gosport & Southampton
	RRS David Attenborough & NERC Laboratories	
13-16 June 19	Out of Town Meeting	Plymouth

*Booking is essential for all events. Members of the Company should use Web Office <http://wcmember.azurewebsites.net/> to book on-line for all main events. Queries for other events should be sent to the organiser.*