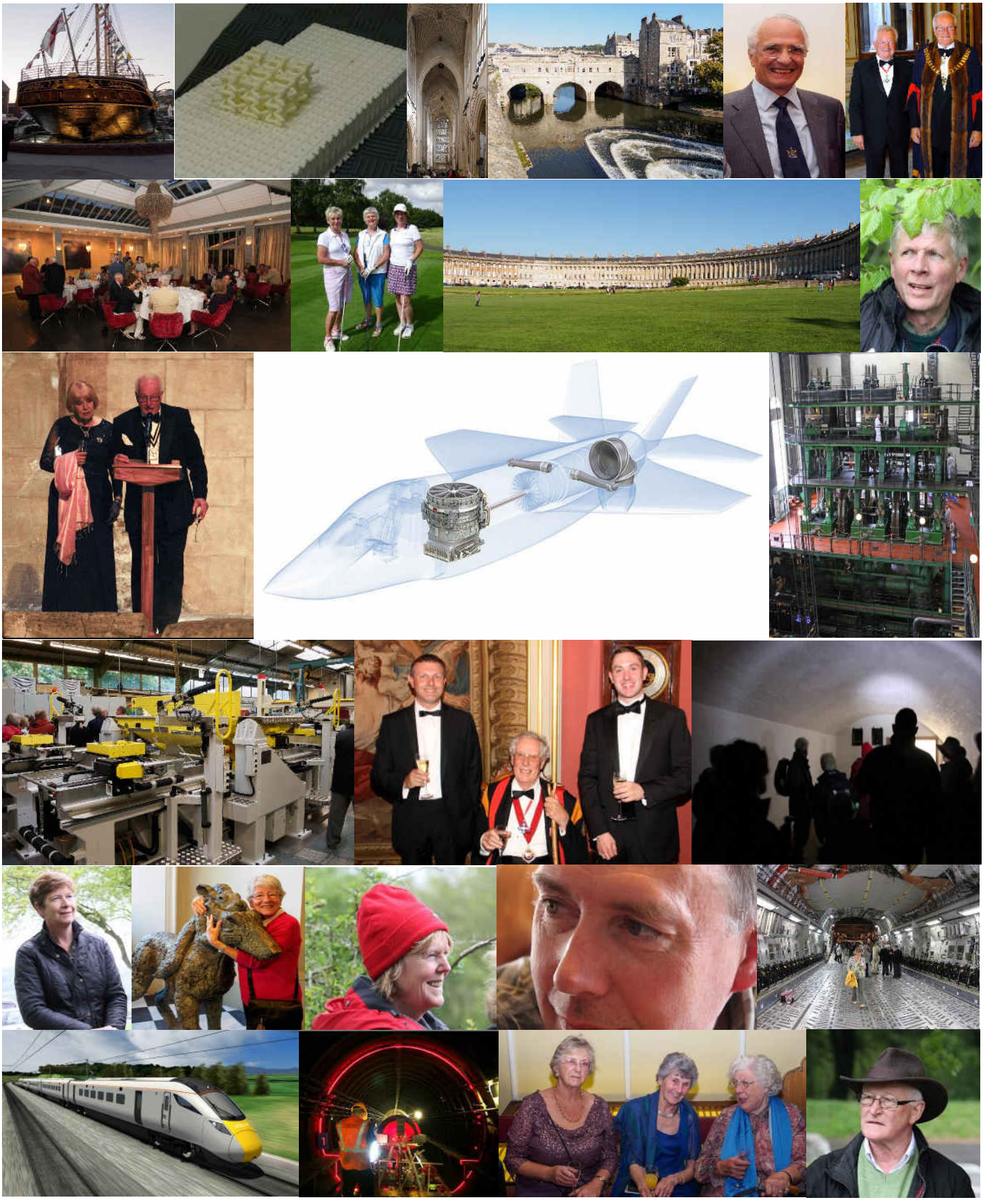
The Worshipful Company of Engineers

(Incorporated by Royal Charter 2004)

THE SWORDSMAN

Issue 35 November 2015



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ET's NOTES

Again I am most grateful to the many contributors to Issue 35 of *The Swordsman*: to the reporters who are individually named in the reports, to Raymond Joyce for summarising the official speeches, to Jon Murrell, the Company photographer, John Canning and John Williams for the many photographs provided.

Whilst all the help is willingly given, I need to stress that John Canning is not *an Official Photographer* because of the fact that he is frequently asked to take individual photographs at functions and is not in a position to provide a formal service. So please don't hassle him :-)

I received some quality feedback following my enquiries in Issue 34 about the future format and forms of publication of *The Swordsman* – six in total! So for the time being The Swordsman will continue in its existing format. – steady as she goes!

FIRST INFORMAL WALK REIGATE AND THE NORTH DOWNS
Saturday 9th May 2015

The first informal livery walking group met on the 9th May to explore Reigate and the North Downs, with a programme designed to include something for every ability and with significant engineering and City links.

Following a prompt start from Reigate station, the 'Walkers', 18 strong in total, including the Master, Past Master David Scahill, the Middle Warden and two four legged friends, enjoyed a walk of just over seven miles through gently ascending terrain, culminating in a steep descent back into Reigate which was safely negotiated by all concerned.

On the way we passed through Gatton Park, with its Capability Brown landscape, and stopped to admire 2000 years of poetry inscribed on the Millennium Stones. The Stones were designed by Richard Kindersley to mark the Year 2000 and located at the confluence of the North Downs, Pilgrims Way and Millennium long distance paths.

On reaching the top of Reigate Hill we were greeted by Marc, the local National Trust Ranger, as well as 3 more members of our group (including the Senior Warden) who had elected for the gentler 'Strollers' programme. Together we admired many fine views, both towards the South Downs and over London, where we could clearly make out the City skyscape. For the Engineers there were some specific points of interest. For the Civils, Reigate Hill Footbridge a 100-year Grade II listed structure and the first re-enforced concrete footbridge, replete with cast iron pierced balustrade. For those interested in military defence history there was Reigate Fort, one of a series of thirteen erected in the 1890s as the last line of defence for London against a French invasion.

Here we were introduced to one of the earliest applications of hazardous area 'zoning', in the design of the munitions building, with its 'clean side' and 'dirty side' segregation. We were further educated in the management of the North Downs landscape, including the introduction of hardy breeds of sheep and cattle able to sustain the exposure to winter in open pasture at heights approaching 250 metres (800 feet) whilst keep the ingress of scrubland under control. All this was explained in detail by the National Trust Ranger, ably assisted by his small son, and to whom go our grateful thanks.

Continuing past Reigate fort we found a striking new sculpture, in keeping with the Master's interests, in the shape of an aircraft's wingtips to commemorate the crew of the US B-17(G), which was lost in fog in March 1945 on its return to base. Another memorial at the end of the track to a local

serviceman gave some shelter, as we admired the spectacular panorama towards Dorking and Leith Hill. From there we proceeded along an unmade road to the first of two Coal Tax posts, erected to mark the boundary within which the coal tax was payable to the City of London.

The City Coat of Arms and a reference to the London Coal and Wine Duties Continuance Act 1861 could clearly be seen, causing one member to remark that this must be the first example of the Congestion Charge tax! At the Coal Tax post our surviving "Stroller", Keith Clarke, elected to return to the car park and then on to the luncheon venue, arriving without difficulty just before the main party. He tells me that he may contemplate promoting himself to "Walker" in the future, but in any event encourages anyone who enjoys only short walks to join in, for he did not feel out of place at all in the group!

For the remainder of the party it was a sudden sharp decent, through bluebell clad hills, before hunger (and some tired legs) convinced us we needed to catch up with our Strollers and waiting Lunchers in Reigate Town centre. We met at a local hostelry, next to the Old Town Hall, for a glass of wine (the red was particularly appreciated) and a very good lunch. Judging by the camaraderie and the stories exchanged, everyone had enjoyed their time on the North Downs, a typical quote being: ''Wonderful walking country, outstanding company, ideal weather and excellent lunch. The icing on the cake was the Ranger who added that extra something.''

For those returning to Reigate Station, the engineering discoveries were not quite at an end. A further opportunity for an Engineering 1st could be seen in the world's first road tunnel, constructed in 1823 by Earl Sommers to divert traffic around his Reigate estate. Sadly, the tunnel boring methods of the day were inadequate to address the gradual incline and successive "rings" can still be seen in the tunnel walls where the brickwork was "stepped back". Those with more artistic interests were able to view the statue of Dame Margot Fonteyn, born in Reigate in 1919, whilst our four legged friends (and their companions) took the opportunity to explore the restored 19th Century landscape, wooded hills and lake of Reigate Priory Park.

From comments received, for many, the North Downs was a previously undiscovered beauty spot, and the day gave an opportunity to appreciate a verdant and distinctive landscape, as well as opportunities to make new friends and spend more time with old. Perhaps the success of the day is best summed up by one who, after extending their stay, declared ''We've had a lovely weekend and in true WCoE MOOT fashion, feel that we have eaten and drunk far too much - but at least we had some exercise to counteract the effects!''

If you would like to get involved in future walking events, or have a special walk to introduce us to, please contact audrey.canning@virkonnen.co.uk who will be pleased to take your suggestions on board, as well as to let you know about upcoming events in the autumn and next spring.

MASTER'S LUNCH FOR WIDOWS OF LIVERYMEN
19th May 2015

In March a letter arrives from the Worshipful Company of Engineers to say that a luncheon was to be held in London in May for the ladies of past Liverymen.

On 19th May the flags were out in the Mall, though not for the Ladies on their way to the RAF Club in Piccadilly. I met Margaret Lines on the doorstep and we were shown upstairs where the lunch guests were gathering. There were so many familiar faces. We were greeted by the Master and Christine O'Reilly and the new Honorary Almoner, Barry Gasper and his wife, Gillian. The Company Chaplain, Peter Hartley and Margaret and Graham Skinner were amongst the guests who had arrived. Margaret had held her Ladies Lunch in the same building only eighteen months previously, which is when I had last seen Doris Mills.

Three of the ladies attending, photographed later on the SS Great Britain: Vida Voles, Rita Hanford and Elizabeth Monk

After a very welcome drink we went into lunch where nineteen of us sat around a large oval table for a delicious meal. The Master welcomed us and Barry spoke and told us that the Worshipful Company of Engineers hoped to plan more events but it was up to us to say what we would like organised. He gave each of us a questionnaire to fill in.

So much chatter over coffee and chocolates and then it was time to depart – many of us to a railway station, though Vida Voles, whose husband had died so recently, had a much shorter journey to Chiswick.

Elizabeth Monk

INTER LIVERY CLAY PIGEON SHOOT
20th May 2015

On 20th May the Engineers Company fielded a team in the annual inter livery clay pigeon competition organised by the Worshipful Company of Environmental Cleaners. This was the third year that the Company had entered the event which is always a great success.

The team representing the Engineers was John Baxter (captain), Margaret Baxter, Richard Groome and Dave Cooper. The annual event is held in the splendid setting of the Holland & Holland shooting ground near Northwood, London. This year 125 livery teams (25 more than 2014) representing about 70 separate livery companies entered, demonstrating the serious nature of the competition in the event. The stands were laid out with two matching courses and ten stands from each of which eight clay pigeons (or birds as they are known) were offered up. The stands were arranged as an English Sporting layout to represent some of the more common birds seen in the UK. In addition, a "flurry" stand of 80 birds was set up where all guns go for anything in the air with rapid reloading by assistants! Possibly due to the additional numbers entering this year's competition all of the stands were arranged as "simultaneous pairs" where both clays leave their traps at the same time rather than "on report" where the second bird doesn't leave its trap until you have discharged your first barrel. Once again our team was consistent with John and Dave hitting 43 each (out of 80 clays), Margaret 41 and Richard 36.

There is some doubt as to Richard's claim that he had never shot before as he turned up with a full kit, a gun and then proceeded to score 36 compared to the rest of the team who have expended good money on lessons and been doing the sport for a number of years! The scores were sufficient for us to hold our heads high and high enough not to qualify us for membership of the pigeon preservation society. The event finished with a superb buffet lunch including two very large pig roasts! Our captain has written to the Master of the Environmental Cleaners on behalf of the Engineers to thank them for such a splendid day and to indicate our interest in entering the competition again next year. If any Liverymen are interested in joining the Engineers' team please contact Dave Cooper - *David Cooper* dc@lecs.co.uk. We might even get some practice shoots in before next year to see if we can do even better in 2016.

VISIT TO AB DYNAMICS
29th May 2015

While Mini Out of Town visits to cutting edge engineering companies are now an established feature of the Worshipful Company of Engineers' annual events, it is rare indeed that such a visit is to a company belonging to one of our own senior liverymen. This was the case when over 30 liverymen and their partners spent the day in the picturesque old wool town of Bradford-on-Avon, being shown round Anthony Best Dynamics by its founder and Executive Chairman, Assistant Emeritus Dr Tony Best.

Impeccably co-ordinated by Assistant Barry Brooks, we fitted a lot into less than 24 hours; we met the evening before at the Widbrook Grange country house hotel, on the outskirts of the town and where some of the group also stayed the night. Over a reception and delicious dinner our guests were the company's MD Tim Rodgers, as well as Tony and Naemi Best, in gratitude for their laying on the visit. This began the next morning with the short journey by coach to ABD's works, based in what was previously Alex Moulton's bicycle factory, in the grounds of the Hall, an historic manor house belonging to the Moulton family. In the mid-19th century Stephen Moulton had developed vulcanisation and established the country's rubber industry in the town, founding Avon Rubber in the old woollen mills.

Here Tony welcomed us all to the factory where over coffee and pastries in an impressive conference room, he introduced his company. Tony established ABD in 1982 to provide a design and consultancy service to the automotive industry, concentrating on noise, vibration and vehicle suspension. He obtained his first project with Volvo, Sweden with whom he had previous connections. One of the other early projects was to develop the suspension for a sustainable car designed for use in Africa. The progress of this was shown as a TV series on Channel 4 in1984. This was followed by work on a low bandwidth active suspension for Jaguar and soon followed by work for Gordon Murray and his team on the McLaren F1 road car. In the early 1990s with much of the design work for the British Motor industry diminishing or moving outside the UK, the company realised they needed to change tack and moved into making test and measurement equipment. A kinematics and compliance test rig which ABD called Suspension Parameter Measurement Machine (SPMM) was created for MIRA in 1995 and was further developed and marketed worldwide. This was joined by a steering system test machine and steering robots, with over 400 systems now sold around the world. Harnessing GPS technology in the early 2000s, path-following technology was developed which led to their driverless car. ABD's range now includes soft crash targets and pedestrian test systems, all sector-leading products and sold world-wide, including to the world's top 20 car manufacturers. The company soon outgrew its original site, and as well as expanding to a site in Holt, nearby, it is about to build a state of the art factory on a new site 400m away.

It floated on the London Alternative Investment Market in May 2013.

In three groups led by Tony, Dr Steve Needs and Matt Hubbard, we toured the factory and saw manufacture and assembly of equipment, including the SPMM, Driverless Test System components and the almost flat propulsion and control bed for Soft Crash Targets. Designed, developed, integrated, tested and packed for export in-house, all this equipment measures to hugely impressive tolerances to meet manufacturers' ever increasing demands. It is vividly illustrated on the company's web site www.abd.uk.com.

We also toured the equally impressive open-plan design, software, administration and accounts area of the factory, where we met many of the clearly highly motivated staff. Some of us were able to thank the MD's PA Hayley Mckeown for her flawless organisation of the visit and transport – which we then boarded for the journey to Grittleton, just north of the M4. There, in the delightful Neeld Arms, Tony and Naemi generously hosted us all for a splendid lunch.

It was then only a short journey to Hullavington, the old RAF airfield, where ABD tests its driverless

cars and soft crash systems. In blustery sunshine, Matt Hubbard introduced the two driverless test cars and, helped by the company's engineers Tom, Karim, Lewis and Mike, gave us all the chance to witness test runs as passengers. While the precision (and quite fast) reversing was impressive enough, the emergency stopping inches from the soft crash target was quite unnerving and the last-minute avoidance of the target from100kph was, we had to admit, mildly terrifying. All immensely impressive, it demonstrated the astonishing accuracy and infinite repeatability of the tests and helped us to appreciate the innumerable applications for car manufacturers world-wide.

Having bidden our grateful farewells to Tony and Naemi and the ABD team, we returned to the Widbrook Grange, both stimulated by our experiences and full of gratitude for such a well organised, generous and impressive day out. We were also bursting with admiration for the extraordinary achievement of our friend and fellow liveryman Tony Best and his company in developing high-tech vehicle testing solutions which are now recognised as world leading - in one of the most demanding of manufacturing sectors.

Malcolm Shirley

THE WARDEN'S LECTURE COVENT GARDEN LONDON TRANSPORT MUSEUM 17th June 2015

The Junior Warden's lecture has always been one of the highlights of the year for me and this year's presentation by Professor David Johnson was no exception. The presentation, to a very full lecture theatre at the Covent Garden London Transport Museum was entitled "The engineering of space".

The subject may have left many wondering about what the content would be about but it soon became apparent! The space David was talking about was the gap between moving trains and their surrounding infrastructure such as tunnels, bridges and overhead lines.

We were all I am sure, intrigued to be informed that the British Railways Board patented a design for a spaceship back in March 1972! But it isn't that type of space we were to hear about. The emphasis with rail travel is primarily about safety, however beyond that, the efficiency in terms of payload and speed is crucial to the movement of people and goods alike. It was intriguing to see that the size of trains has increased over the years whereas in most cases the existing Victorian infrastructure still exists.

This is a situation I have been aware of personally as lift doors on underground metro systems have been affected by the difference in air pressure created by this growth and has been especially prevalent where two trains are approaching the same station from different directions. Over the years, development in technology has seen the introduction of tilting trains designed to trick the passenger into believing they are going slower than they actually are. David has been involved with the development of measuring tools and software which has vastly improved the efficiency and accuracy of measurement of the "gauge" of trains and infrastructure and his passion for the subject could be clearly seen. We have come from the old days of the loading gauge swinging in the breeze to state of the art.

Measurement has developed from the use of a tape measure to the use of lasers despite some union opposition in the early days. The unions initially thought lasers could be detrimental to health (at the time they also objected to single seat driver's cabs on the advanced passenger train APT). Laser measurement is achieved by measuring the flight time of the beam out and back and David's design has developed from a portable type to a vehicle mounted type which can work at speeds up to 75 mph. The combined system of laser and its associated software was even sensitive enough to pick up some miscreants in a railway tunnel that shouldn't have been there!

Historically Brunel and Stephenson led the battle of the gauges. Brunel considered a 7 ft gauge to be more stable and hence the Great Western Railway was initially built at this gauge. Stephenson, the other great railway builder, adopted a gauge of 4 ft 8 ½ in which was based on the distance between rails when horses used to pull carriages. Ruts in Roman roads made of basalt stone provide evidence of the early gauge which essentially means that our railways are built on the basis of the width of a horse's backside!

All of us are familiar with "mind the gap" and "stand behind the yellow line" and David's superb presentation put these common phrases into context.

The presentation was superb and it was no surprise that many varied and interesting questions were asked at the end whilst a picture of a train stuck in a tunnel portal (as it was too big) was shown on the screen. Sadly, I couldn't help but be reminded about an incident I was involved in a few years ago when I tried to get my Dutch barge under Sonning Bridge

the effect of which can be seen below. I still call it Sonning Bridge, or something similar!

Dave Cooper

The Engineering of Space
David Johnson's Summary

The subject of my lecture is the engineering of the space between trains, structures and other trains. It is something that most people take for granted, few noticing that the trains that they travel in are of different sizes which largely relate to the historic origins of the individual railway companies that formed the basis of what is now a national network.

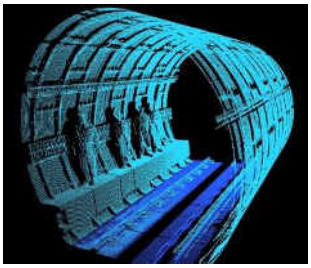
The topic is generally known as gauging and started out to be checking that structures complied with structure gauges and trains complied with vehicle gauges. This was a basic safety process and was done using drawing office tools – pens, paper and compasses. Measurements were taken with wooden gauges, transferred to a paper plot, clearances measured and action taken if the clearance was less than that required due to track movement.

Following a spell working in the USA, at the start of the PC revolution, I decided to set up my own business developing the 'computerised drawing office' which included gauging and was an instant success. Within four years, the UK rail industry had adopted this approach in all of their drawing offices and I was looking for my next challenge.

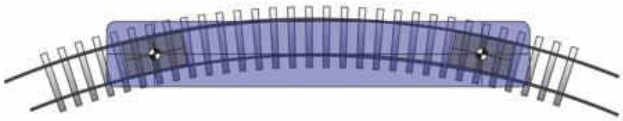
It was not long before I found it – privatisation of British Rail had created a business culture where capacity was a key measure. An integral part of this was the physical space utilised by trains, which changed the nature of gauging from a boring, safety-related activity into an exciting business opportunity. It enabled us to work out just how big the trains could be that we could operate within our existing, essentially Victorian, infrastructure. We called this "Route Opportunity" – it provided the mechanism to run tilting trains on the West Coast Main Line and to run large containerised freight trains. All of this was based upon the basic principles established earlier of measuring the infrastructure and trains, modelling the behaviour of the system and seeing if there was a safe space left.

Early measuring systems were largely gauges. The emerging laser technologies allowed new systems to be developed. These started as small, hand-held measuring systems which were slow, but very accurate. With the challenge of measuring the 250,000 bridges and tunnels on the national network a number of high speed systems were

developed, ultimately to be used on trains running at 70mph whilst capturing data to an accuracy of better than 15mm. Gradually, a complete picture of the rail network was built in digital form and is currently the core resource used in managing the gauging of our rail network.



Simultaneously, much work was done to accurately model trains, looking at how they behaved geometrically when moving around curves – a phenomenon known as overthrow – and also looking at how they behaved dynamically in response to the forces acting on them through speed.

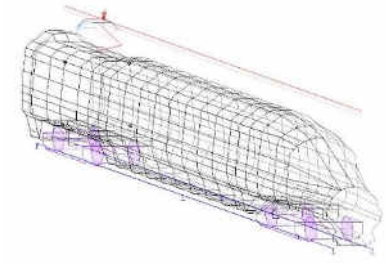


These techniques enabled us to understand how train length, suspension softness etc. affected the swept envelope occupied by the train in motion. From this, a new industry tool known as ClearRoute was developed. It enabled engineers to manage an increasing space-conscious railway system in safety.

After 18 years, with mature technology and a staff of 85 engineers and technicians, the Company was acquired by a large plc with a view to stable commercialisation away from the hands of someone seeking constant change and I was destined for a quieter life.

However, my constant quest for greater understanding of the interface that had ruled my life for significant part of it led me into a research environment where I was able to indulge my passion amongst academicians. My quest was to remove yet more of the conservatism that was left in the modelling; largely allowances for unknown parameters. I was able to develop a new analysis tool based upon mechanistic modelling methods and statistical analysis of clearance where many of the previous 'unknowns' were replaced by recently established behaviours.

The greater accuracy of calculation generally indicated more space to be available than was thought, although not always. But the modelling opened up new ways of determining the space available, using vehicle models that adapted their size in response to the tunnels and bridges that it passed through, so that, at the end, the resulting shape was one that just fitted through the route.

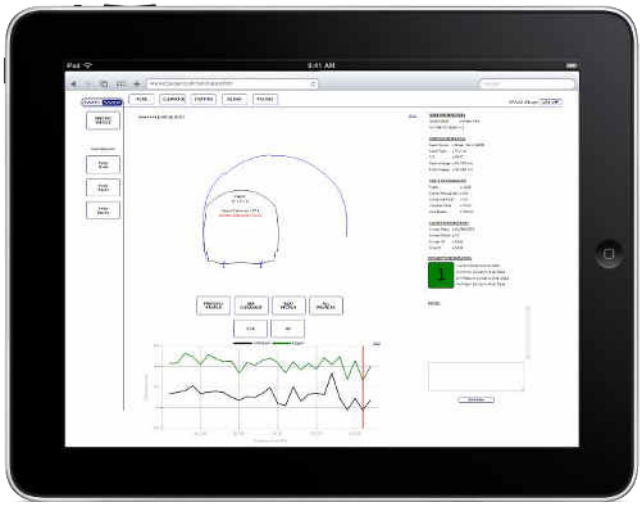


But it also provided the opportunity to understand many of today's problems with clarity. In particular, it allows us to balance the size of the gap between a train and a platform. The gap is needed to provide a safe clearance to trains that pass, but should not be so large that it becomes a hazard. Allowing for the overthrows on curved track and dynamic movements due to speed, a better compromise can be achieved with better modelling. Given the sheer number of platforms,

train types and stopping positions, it is only with such computerised methods that we can generate an optimised gap where the risks to all are understood and which can then be managed.

Another 'topic of the day' is electrification. Britain's railways are undergoing a huge program of electrification, driven largely through uncertainty in future oil prices and the ability to consume renewable energy. But the railway

network was not designed to allow a 25kV wire to be strung above it, together with all of the other paraphernalia that electrification involves. In many cases, there is simply not enough space for the current collecting pantograph to fit. The conventional approach has been to lower track to accommodate electrification using a 'pantograph gauge'. A typical lowering may cost about £1M to lower a 100m section of twin track by 100mm. To achieve electrification usually requires 200mm – 300mm of track lowering. But by using the principles of modelling to the pantograph and contact wire and working out exactly how much space is required rather than simply using 'rules of thumb' it is possible to reduce the requirement for track lowering by about 100mm, which can easily save £1M for each bridge affected.



But technology moves on. I have described how computers moved gauging from a paper exercise into a virtual one. Today's challenge is that the measurements of railway infrastructure are much more detailed and our train models are more complicated. The quick calculations of ten years ago have become laborious and the challenges of working with large client IT systems means that, ironically, it is now more difficult to perform rapid calculations than it used to be. However, whilst media studies has often been cited as not being a real subject, the rise of digital services like Spotify, where music is streamed to your phone, show just how we can adapt the technology of gauging to the modern age. We are moving to on-demand systems, where computation is done on the Cloud and results made available almost instantly. Tomorrow, I will only need an iPad to determine whether a container train can physically run from Exeter to Reading, via an optimal route.

For engineering, this is significant. The disciplines associated with delivering this service cover traditional engineering disciplines and principles. But increasingly those associated with computer gaming, for example, are becoming more mainstream. These are new skills, associated with young people. We will need to engage with a new era. But we can also expect the profession to become more widely attractive as a result.

A full, illustrated version of the Junior Warden's lecture is available on www.dgauge.co.uk on the Innovation page.

David Johnson, Junior Warden

VISIT TO KEMPTON STEAM MUSEUM SATURDAY 20th JUNE 2015

Wow! This was the universal reaction of the Livery men and their partners on entering the Kempton Steam Museum pumping engine hall for the first time. Before

them were two steam driven pumps standing 62 feet above turbine hall level. A small apology here for the use of imperial units, it is the practice at Kempton and helps to convey the era in which the engine and pumps operated.

In summary we were facing the world's two largest triple expansion steam engines. Only one is in operation, the other has been partly opened up so that visitors are better able to understand the way in which steam engines operated.

Nostalgia was in the air with that familiar smell of steam integral to the DNA of those whose childhood interface with engineering was with steam locomotives or marine engines. Whilst enjoying our coffee, we were also able to observe the sheer majesty of this brick built Grade 2 pumping house with its tile clad internal walls.

Liveryman Simon Watts had arranged for John Barnes, the museum manager and one of several white boiler-suited enthusiasts on hand to operate the engine and guide visitors, to provide an introduction. He took us through the history of the site, acquired in 1897 by the New River Company which built the first pumping station; abstracting water from the Thames to pump it 14 miles to Cricklewood. The first of the two impressive octagonal chimneys that flank the pumping station were built when this pumping station, Lilleshall, was constructed in 1903. It was tied in with the new matching pumping station chimney which was added when the later building was erected.

In 1904 the Metropolitan Water Board was formed taking over the site and in 1927 commissioned the building of the new pumping station under the direction of its Chairman Sir William Prescott and Chief Engineer Henry Stilgoe (grandfather of songwriter Richard Stilgoe). The engine under steam is named after him and the other after his wife Lady Bessie. The MWB's impressive coat of arms is prominently displayed for all to see on entry to the engine hall.

In the background, as John Barnes set out the interesting history of the station, we were aware of the barring motor slowly turning over the engine to warm it through as the operating team prepared for starting. He explained that the engines were installed in 1928. They were too big to test at Worthington and Simpson's works and rail system capacity limited the largest components to 16 tons. The engines and pumps therefore only came together for the first time when they were delivered to the Kempton site. At the conclusion of his presentation we were introduced to our two

excellent volunteer guides Jerry Scholefield (the museum's head of engineering) and David Seager. Here are a few facts:

Engine Builder:	Worthington and Simpson
Original Cost (Both engines)	£94,000
Pump Horse Power	1,008hp
Cylinders:	HP 29in, IP 54in, LP 86in
Pumps:	3 Single acting compound plungers 25.5 in and 26.5in
Stroke:	5ft 5in
Flywheel:	32 tons
Weight:	1000 tons
Capacity:	12 million gallons/day against head of 400ft. 16 million gallons/day against head of 300ft. 19 million gallons/day against head of 300ft.
Steam rating:	9.875lb steam per pump horsepower
Speed:	18.5 – 25.4 rpm.

It was originally planned to install a third engine between the existing two triple expansion steam engines. Instead, shortly after the engines were installed it was decided to install two David Brown impulse reaction steam turbines to drive pumps each with a capacity of 12 million gallons per day. The steam was generated by two Babcock & Wilcox moving grate boilers later supplemented by two John Thompson water tube boilers, but decommissioned when the pumping station was shut down in 1980. The B&W boiler doors remain and are on display. When the Kempton Great Engines Trust began their restoration programme in 1995 it was decided to install an oil fired boiler. The coal was brought to the site by a narrow gauge railway. This has now been partly restored and was also operating on the day of the visit.

The restored engine was restarted by the Prince of Wales in 2002. This was commemorated by a plaque, alongside which is an Institution of Mechanical Engineers Heritage plaque presented to them in 2010. *(…by the then President if the IMechE – one Keith Millard! ET)*

As our tour started the operating staff were opening the steam inlet valve to the engine. It slowly, but impressively gathered speed up to 20rpm pumping recirculated water, allowing all to see it in its full glory under steam. Touring the second engine, Lady Bessie, we were able to gain a much greater appreciation of the scale of the equipment and its many heavy castings and forgings. Each cylinder was lubricated through a distribution system with 40 lubricating points, each controlled by a needle valve that had to be adjusted manually. Our tour was accompanied by the shushing of the inlet and exhaust valves as they opened and shut during each revolution of the mighty crank shaft.

Standing below the engines you could see the reciprocating pump plungers operating in rotation. The 120° setting of the cranks ensure a relatively smooth flow of water to the system, which did connect to the Cricklewood system. It was also explained how the change from the 25.5in plunger, now in use, to the 26.5 in plunger would be done in earlier times when peak water demands were being met.

Continuing our tour of the turbine floor we arrived at the very ancient looking Metropolitan Vickers switch board and the adjacent mercury arc rectifiers with their wonderful, eerie flickering violet lights in the vacuum flask. These are not the originals; they had been scrapped in 1980.

In the mid-nineties the Trust learned that the Royal Opera House was about to dispose of their rectifiers, but instead donated them to Kempton. They convert the incoming 415v ac supply to 200v dc, which supplies the station.

We also saw some striking instrumentation including this George Kent venturi flowmeter and an operating centrifugal governor, although this was not from the engines, which are not governed. There was also a range of pre-digital age pressure gauges.

As our tour neared its end we had been conscious of the magnificent engine rotating, almost serenely, with a sense that it could continue for ever. Economics determine that it doesn't; only doing so occasionally as listed on www.kemptonsteam.org.

The Master thanked our guides and enthusiastic volunteers for all they had done to make the visit such a success.

Lunch was at the Flower Pot in Sunbury, a few strides from the River Thames, where an excellent Hampton Court buffet had been arranged. An enjoyable lunch and chatter brought a successful day to its conclusion. Although as you will observe from the adjacent photograph the discussion became learned as Past Master Graham Skinner, Liveryman Keith Millard and guest Graham Gibson discussed the merits of the Chateau Haut Canteloupe.

The Master thanked Simon for all his efforts and the day came to a close.

Keith Millard

THE SHRIEVAL ELECTIONS 24th June 2015

I always try to attend the election of the Sheriffs and Lord Mayor, as it is an opportunity to enjoy a unique and ancient pageant that still has contemporary importance. The public are not admitted, indeed they must leave the Guildhall on pain of imprisonment, and the proceedings are not televised, so attendance is a privilege as well as a duty (since 1475) for Liverymen.

This year I had supported Dr Christine Rigden, for Non-Aldermanic Sheriff. (The Non- Aldermanic Sherriff serves for one year and is without ambition to progress to Lord Mayor). I was her 450th supporter on her web based petition, and many of those above me were either Masters or past Masters of various Companies (*including me! ET)*. I recount this to show that the election process, although ancient and somewhat complex, is not as undemocratic as is sometimes alleged.

The election, or hustings, held on 24th June in the Guildhall, involves a procession of dignitaries, robed and wearing swords and chains of office, carrying maces and posies of flowers. Their measured steps echo in the Great Hall and testify to the military background of many of the officials involved. This year Dr Rigden and Alderman Charles Bowman were elected by the acclamation of Liverymen, as were the City's Bridge Masters, Ale Conners, and other officials.

After the election I joined our Master Engineer and Liverymen from 10 other Companies for an excellent luncheon in the Stationers' splendid Hall.

We held our own in the competitive cheering that accompanied the welcome of each company, but reinforcements would be welcome on future occasions. The two new Sheriffs made brief appearance to thank us, completing a pleasant and worthwhile event.

Keith Clarke

VISIT TO RAF BRIZE NORTON
8th July 2015

Brize Norton is home to the RAF's Strategic and Tactical Air Transport and Air-to-Air Refueling Forces as well as other lodger units such as the parachute training school for all the UK Forces. Stationed at the base are over 8,500 people, 5,800 of who are service personnel, 20% of the total RAF, and the rest civilians.

The visiting WCE group held a dinner the night before our visit at which we were delighted to very warmly welcome Group Captain Simon Edwards, the Commander of the base, the largest in the Royal Air Force and his wife.

Also equally welcome were Keith Filby of Air Tanker and his wife and Squadron Leader Alexandra Hyatt, who not only was our visit project officer but the following week received the RAF Operational Engineering Award at Drapers Hall from the WCE.

To deliver their transportation tasks for troops and associated equipment we learnt the Force use four types of planes:

The familiar Hercules C130J of which there are 17, whose engineering team is commanded by our host Squadron Leader Alex Hyatt. Notably her combined service and civilian team has increased the operational availability by an incredible 50%.

The massive air transporter Boeing C-17 Globemaster of which the RAF has 8 (the US have 220 of them!). To avoid enemy firepower this huge plane can dive at 45° with full load to the airfield.

The Hercules replacement Airbus 400M Atlas, of which there are presently 3 but rising to 22 by the end of the decade.

The refueling and troop transport plane Airbus A330-200 Voyager of which there are 10, 2 of which are primarily for civilian use. Interestingly the purchase and maintenance of the Voyager is outsourced using a most novel and controversial organization, Air Tanker, which created much heated discussion. Air Tanker is a privately funded company that uses a joint team of RAF and civilian staff to perform operational functions of refueling or alternatively troop transportation.

We visited the immensely enthusiastic and dedicated engineering teams of the latter of these three planes who are each totally committed to keeping their aircraft operational, worldwide, 24/7, 365 days a year. A herculean task! Unanimously we were exceptionally impressed with everything we saw.

A different aspect of RAF Brize Norton equally impressed us during a visit to the Tactical Medical Wing, which provides support and supply of medical services to all RAF personnel worldwide and others, in all theatres.

We saw the testing and calibration of myriad, special medical equipment and also the special tents used to air transport and treat highly contagious people that, due to the Ebola outbreak in West Africa, were of recent topical interest.

After an absolutely fascinating and enjoyable visit we all concluded that Brize Norton should be immensely proud of their world-class personnel and equipment. Our defence is in good hands!

Many more culturally inclined partners had a most enjoyable alternative visit. They visited the beautiful towns, villages and countryside of the Cotswolds where they relaxed, wined, dined and had great fun. Which visit was best??

Ken Gray

AWARDS AND LIVERY DINNER DRAPERS' HALL 14th JULY 2015

The Drapers is a resplendent Hall in which to host the Annual Awards ceremony and a magnificent opportunity to celebrate the best in engineering. The award recipients themselves were as enthusiastic as ever about the practical application of science in their respective fields, each bristling with engineering tales of daring do when exceeding the stringent operational demands. From conversations throughout the evening clearly the mood among all three Services was particularly buoyant given the Chancellor's Budget announcement last week that the Government will match other NATO nations in spending 2% of GDP on Defence. In real terms this equates to a 9%increase in spending on National Security by

2020. This will go a long way to providing the much needed people and equipment required to ensure that the United Kingdom remains a respected 'force for good' on the world stage. Engineers are key to enabling the delivery of such important capability. Long may it continue. *Mark Hunt*

THE ENGINEERING AWARDS

HAWLEY AWARD FOR ENGINEERING INNOVATION

The Hawley Award, established in 2006, is made 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.

Winner 2015 (Medal & £5000 Prize) – Alister Smith

Alister Smith is a PhD researcher in Geotechnical Engineering at Loughborough University. His work, on acoustic emission monitoring for landslide early warning, has produced a means of early warning of landslides through detecting accelerations of slope movement, continuously and in real-time, by quantifying slope deformation behaviour using acoustic emission monitoring. Field trials in the UK, Italy and Canada have demonstrated proof of concept and discussions have started to commercialise the approach.

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 2015 (Medal & £1000 Prize) – Tom Moore

Tom Moore has worked for BAM Nuttall since 2001 on a wide range of construction projects, rising from a junior technical role to senior site agent responsible for construction works. After successful leadership of his section of works on the Crossrail Western Tunnels project, he is now responsible

for construction of the Eastern Ticket Hall at Farringdon Station upgrade for Crossrail.

He developed a change to the construction sequence including planning and implementation of the largest single structural concrete pour on the Crossrail project to date. He also developed initiatives on health & safety and led negotiations on commercial issues. After achieving EngTech, he used his experience to encourage and support others and is a company ambassador for the EngTechNow campaign; he progressed to IEng in 2014. Tom has also worked to develop, facilitate and actively encourage training, including apprenticeships, to enable the workforce to progress from "the tools" up to foreman and supervisory level, providing opportunities that were not previously available.

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 150th 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 2015 (Medal & £1000 Prize)
Rachael Hoyle

Rachael Hoyle served an Advanced Apprenticeship in Aerospace Engineering at BAE Systems and is still employed by them. She graduated with first class honours in Mechanical Engineering through part time study supported by BAE Systems and a Whitworth scholarship. Since completing her apprenticeship in 2007, Rachael has been active in promoting engineering careers to young people. She is an Ambassador for skills and apprenticeships, promoting STEM and apprenticeships via schools' interactive workshops and the media, the latter involving live broadcasting on a BBC breakfast programme. She has also spoken at many high profile engineering events, on one occasion alongside the Minister of for Skills and Enterprise. Employment with BAE Systems has given Rachael the opportunity to promote engineering to universities and schools in the Middle East, notably Qatar and Abu Dhabi. She also designed and ran a number of engineering workshops across the region engaging young people, both boys and girls, in the mechanics and physics associated with the theory of flight. Rachael was elected a Whitworth Scholar in 2013.

WATER ENGINEERING AWARD

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

Winner 2015 (Medal) – Adrian Moore

Adrian Moore is a Marine Scientist at the Scottish Environment Protection Agency (SEPA) working in the Marine Ecology unit, responsible for the Water Framework Directive (WFD) ecological monitoring of Scotland's coast. He was made responsible for leading a trial and test of the Multibeam Echo Sonar system which had been installed on the SEPA survey vessel, the Sir John Murray, in early 2013. Adrian won the prize for

the best paper presented at the IWA UK Young Water Professionals conference, describing the use of the WASSP Multibeam Echo sonar system in conjunction with an underwater camera to understand the reasons for Loch Linnhe being designated with 'failing' status for an aspect of the WFD. His presentation was full of enthusiasm, innovative ideas and infectious passion explaining the use of this equipment to create a broad sediment map which showed that the majority of monitoring sites were in areas of ultra-fine mud, which led to misleading WFD outcomes. A change in monitoring sites meant that SEPA could monitor the loch for real trends, thus avoiding false WFD downgrades.

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 2015 (Medal and £500 Bursary) Rebecca East

Rebecca East graduated with an MEng in Mechanical Engineering from Durham University in 2012 where she was active in a number of sports, representing both College and University, and took a lead in organising and fund raising. She now studies part time for an MSc in Clinical Science (Engineering) at King's College London and is a trainee Clinical Engineer in King's College Hospital NHS Foundation Trust, being one of only 12 selected from some 2000 candidates for this position. Making excellent progress, having passed core and specialist examinations with high distinction, she now specialises in Rehabilitation Engineering. Her paper described the potential for a low cost gaming tool to be used as a motion capture system for monitoring the physical manifestations of neurological impairments. Rebecca has wide experience from a variety of placements and extra-curricular activities and is passionate about her chosen career.

SIR PETER GADSDEN BRITAIN AUSTRALIA BICENTENNIAL AWARD

Established in 1991 by a donation from the Britain Australia Bicentennial Trust, the fund is used to encourage the study of engineering by UK and Australian nationals in the other country. The late Alderman and Lord Mayor Sir Peter Gadsden GBE AC FREng was Chairman of the Britain Australia Bicentennial Committee and Founding Master of the Worshipful Company of Engineers.

Winner 2014 (£400 Bursary) – Dhiren Mistry

Although no award had been made in recent years due to insufficient funds, a third-year doctoral student in the University of Cambridge, Department of Engineering, was supported in 2014 through a contribution to his joint research with the University of Melbourne. **Dhiren Mistry** was investigating 'Entrainment Processes in a Turbulent Jet' and undertook a research exchange to the Walter Bassett Aerodynamics laboratory at the University of Melbourne, supported by the David Crichton Fellowship and the Sir Peter Gadsden Fund. He was able to interact with other researchers in the turbulent wall-bounded flow area and attend two important fluid mechanics conferences. As a result of his presentation to the Australasian Fluid Mechanics Society he was also awarded the David Wilkinson Prize for an outstanding research paper.

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 2015 (Medal & £2500 Prize)
David Lines

David Lines is in his final year of study for an MEng degree in Aerospace Engineering at the University of Surrey. He is a focused visionary with huge enthusiasm in the field of space research. The judges were impressed by his involvement in the development of a Reconfigurable Space Telescope and his wide knowledge of propulsion systems and aircraft design. He is a natural leader and, in addition to his studies, acts as a STEM ambassador and maths mentor. Driven to succeed, he is clearly someone prepared to work outside his comfort zone and achieve difficult objectives.

Highly Commended (Medal & £500 Prize)
Zaibaa Patel

Zaibaa Patel is a full-time final year student on City University's 4-year MEng(Hons) course in Biomedical Engineering. The judges were impressed by Zaibaa's maturity and presentation skills, enjoying the description of her work on a new 'front end' interface for the da Vinci surgical robot and in providing support in theatre. Particularly impressive was the fact that she worked in the analogue electronics area when so much work now concentrates on digital processing.

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, 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 Academic Year 2014-2015 (£6000 pa for 3 years) – Jonathan Waite

Jonny proved an exceptionally keen and hardworking student during his 3D printing project as part of his MEng course at the University of Cambridge, gaining Merit after achieving a First in his BEng. He assembled a 3D printer for his project during the Christmas vacation and then built another for himself, ingeniously from basic components, in his college room. On his application to study for a PhD, researching advanced 3D printing, he was identified as best student and selected for the Leete award, gaining a place to undertake his research at the Inkjet Research Centre within the University of

Cambridge Institute for Manufacturing, supervised by Prof Ian Hutchings FREng.

From an initial proposal to research improvement to Additive Manufacturing of components made from metal powders by using an inkjet printed binder, his project has developed and is now titled **Robocasting with Active Sintering: 3D printing in multiple material classes.** He describes it like this: Additive manufacture has made large advances in recent years and is now able to use a huge range of materials. Ceramics form a minor portion of this, despite having useful properties such as very high working temperatures and unbeatable hardness. There is also very limited ability to combine truly different materials, such as a metal and a polymer, into one printed object. This would enable printed circuitry and composite structures that achieve unprecedented durability in the same way as mammalian teeth support an enamel shell with protein. We are developing a process that is novel in two ways. First, it is capable of handling different material classes through the use of gel slurries, allowing any powder to be handled in the same manner. Second, it is able to place materials that require very different heat treatments next to each other by using laser sintering on the deposited material after each layer of printing. This can provide the energy to fuse metal or ceramic powder into a solid without destroying an adjacent area of polymer. So far we have produced an aluminium oxide slurry, 3D printed objects with it and laser sintered it.

The winner of the 2013-2014 Leete Premium Award, Jonathon Parkins, made excellent progress in his first year's research into laser improvement to Additive Manufacturing, also at IfM, and received his second annual £6000 from the Leete award fund.

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.

This is the second year that the Trust has supported the Award and because the winner was not due to be announced until two days later the three companies in contention were introduced: Artemis Intelligent Power, represented by Dr Wil Rampen Chairman; Endomag represented by its founder Prof Quentin Pankhurst and Victrex, represented by Mr Mike Percy Global Technical Manager.
You can read more about the finalists on the RAEng website www.raeng.org.uk/prizes/macrobert

Winner 2015 (£50,000 Prize) – Artemis Intelligent Power

Dr Wil Rampen

Edinburgh-based Artemis Intelligent Power has developed a digital hydraulic power system that unlocks the ability to generate much greater levels of power from offshore wind turbines. As well as dramatically improving power capacity, the smart, modular system has been designed to overcome the significant reliability issues associated with existing turbines. Artemis is already developing world-leading systems, dramatically improving turbine efficiency and with it the prospects for future exploitation of wind power.

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.

Officer Cadet Mike Franklin, a Royal Engineers sponsored bursar in the DTUS, graduated from the University of Birmingham in July 2014 with a First class honours degree in Mechanical Engineering. His degree classification is an accurate reflection of his academic ability, the hard work that he put into all 3 years of his university education and his determination to do the best that he possibly could throughout the course. Furthermore, he took a similar approach to all aspects of his life within DTUS, proving himself to be a genuinely outstanding potential officer.

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.

Building on a first class degree in mechanical engineering at Cambridge University, prior to joining the Royal Navy, **Lieutenant Peter Whiteley RN** excelled in initial officer training at Dartmouth winning the "Queen's Sword" for best officer cadet in 2012/13, before joining the submarine service as a marine engineer. Subsequently, as the exemplary student of his Nuclear Reactor course, achieving top marks in all exams and attaining the highest aggregate score (90.8%) ever recorded, he earned his Cranfield University accredited postgraduate diploma. He displayed an enthusiastic appetite for all subject areas and was very well respected by his peers, whom he also mentored. In the project phase he investigated zinc retention onto resins to identify key input parameters for a holistic primary chemistry model under development by Rolls Royce. Able to generate quality experimental data, fully supported by theoretical analysis, he was awarded the "Silver Jubilee Trophy" for best overall performance in the project phase with a paper being compiled for submission to a technical journal for publication.

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. Recommendations for the Operational Awards are made by the Senior Specialist Services Authority appropriate.

ROYAL ENGINEERS OPERATIONAL ENGINEERING AWARD

Major Nick Francis RE led a Specialist Team Royal Engineers as a key part of the UK Government's response to fighting Ebola in Sierra Leone. Responsible for the design and construction of a series of Ebola Treatment Units across Eastern Sierra Leone, he led his team with outstanding drive and commitment. Against a punishing schedule he and

his team delivered exceptional results in challenging conditions under every growing time pressure and world attention. His leadership, drive and astute engineering skills shone through in extremely challenging conditions.

ROYAL SIGNALS OPERATIONAL ENGINEERING AWARD

30 Signal Regiment is one of the Army's highest readiness units, delivering communications and information systems in support of some 20 global operational deployments in the last two years alone whilst concurrently replacing or upgrading the majority of its core equipment. **Captain James Healy R Signals** is the Regiment's senior engineer; he has relished this turbulent time, seeing opportunity at every turn and reinvigorating a spirit of engineering excellence. Instinctively understanding that the technical ability of his soldiers and the preparedness of equipment are critical to maintaining and improving capability, he has been unwavering in his desire to improve both. In doing so, he has delivered unprecedented levels of equipment serviceability and training currency at the same time as leading a wider programme of professionalization which has resulted in many of his subordinates pursuing Engineering Council accreditation through the IET. Captain Healy is an outstanding engineer.

ROYAL ELECTRICAL & MECHANICAL ENGINEERS OPERATIONAL ENGINEERING AWARD

As the principal engineer for the Lead Armoured Battle Group, **Captain Rob Ashton REME** has maintained operational tempo through measured and informed technical acumen combined with swift action during an unrelenting period. Deploying in direct support of the Lead Armoured Battle Group on exercise to Canada and subsequently on a very short notice deployment to Poland, with high stakes in both scenarios, due to his engineering prowess exceptional levels of equipment availability were maintained throughout, never wavering below 90%. The UK and Polish Forces alike benefitted from the professionalism, expertise and dynamism shown by Captain Ashton. He is truly a professional operational engineer and well respected as such within the King's Royal Hussars; he holds gravitas with the command team and his engineering opinion is sacrosanct.

ROYAL AIR FORCE OPERATIONAL ENGINEERING AWARD

Facing the immense challenge of a Hercules aircraft fleet which was struggling to meet the huge operational demands placed on it, **Squadron Leader Alexandra Hyatt RAF** led the transformation of all aspects of in-Service support. She consolidated all planning activity, seamlessly integrated Service and Industry engineers into a "Whole Force" team, drove closer integration with the Flying Squadrons, then established and led a technical support team able to rapidly resolve emerging airworthiness issues. Driven by her outstanding vision, energy, leadership and professional judgement, Hercules Fleet availability has increased by 50% across both deployed and Main Base operations, significantly enhancing Operational delivery.

(Alex's award was made extra special as she was the Officer-in-Charge of the Livery's visit to RAF Brize Norton 6 days previously. ET)

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.

Mr Stephen Westwood led his engineering team to deliver electronic countermeasures, directly leading to saving the lives of those deployed in Afghanistan from the lethal effects of improvised explosive devices. Utilising his skills as an outstanding engineer and leader he has driven the design and overcome a myriad of complex engineering challenges to ensure successful installation of electronic countermeasures into over 1200 deployed vehicles and nearly 50 unique vehicle platform types. His engineering decision making in balancing design issues against the operational imperative was exemplary and ensured a lifesaving system was in place to exceptionally demanding timescales.

ARKWRIGHT SCHOLARSHIPS

The Worshipful Company of Engineers currently supports two Arkwright Scholars undertaking their Sixth Form studies at schools in Greater London as a potential lead-in to higher engineering studies. This year's winners were from schools in Mill Hill and Dulwich.

2013-15 **Miss Laminn McLay** – Mill Hill School, London NW7

2014-16 **Mr Yousef Bennaceur** – Alleyne's School, Dulwich, London SE22

From this year the number of Scholars supported will increase to 3, then rise again to 4 in 2016.

LONDON LIVERY COMPANIES IN THE 21ST CENTURY

There are presently some 26,500 liverymen represented by 110 Livery Companies, of which 33 are known as 'modern', being those formed in the 20th century and later. All livery companies have charitable objectives and presently give £42 million to charitable causes, broadly split as 51% to education, 31% to welfare and relief in need, 2% to churches, 3% to the environment and the arts, 7% to trade and 6% to other good causes.

THE ENGINEERS TRUST

The dinner is a celebration of the success of our award and prize winners which are funded through the generosity of our Liverymen, past and present, whose charitable contributions have built a fund of over £1.5 million – a real achievement in 32 years of existence. From members' regular giving and some of the income generated from the fund, last year we distributed approximately £65,000 to our charitable causes, some represented at the Awards Ceremony in addition to number of charitable activities within the City of London and more generally through RedR.

We hope that those contributing will feel justifiably proud to see their donations being put to good use and know that they will make a real difference to engineering, to engineers starting their careers, to those engaged in moving the profession forward or those who have simply fallen on hard times. They will also be pleased to learn that the trust recovers income tax paid on these donations in the form of gift aid, which substantially adds to the value of their donations. We hope this may also encourage other members to support their own charity and enable the trustees to do even more.

The speeches by the Master and the Principal Guest

The Master made references to the milestones of Draper's Hall since 1543 when the Drapers Company purchased the house and its gardens from King Henry VIII having originally belonged to Thomas Cromwell. Draper's Hall was a location in the Wolf Hall series as the site of Austin Friars. Other film credits included 'The King's Speech', the James Bond film "Goldeneye" and the Great British Menu.

The Master explained that the Hall was destroyed by fire in 1666, and again a century later, although the present structure of the Hall dates back to the late 18th century. The ceiling paintings in the Livery Hall, by Herbert James Draper, completed in 1910 depict scenes from two of Shakespeare's plays – the Tempest and Midsummer Night's Dream which prompted the Master, a self-confessed a great romantic, to mention that he was taking his Lady to a performance of Romeo and Juliet the next day, starring Annabel O'Reilly – aged eleven.

After regaling the audience with the vicissitudes of conquering Reigate Hill in May the Master thanked Audrey Canning for organising the first of a series of walks, and other liverymen for picking up the gauntlet from the Members' Survey of possible future activities and for continuing to run successful events such as the visits to AB Dynamics and the Kempton Steam Museum.

Among the other thanks and welcomes to new liverymen, guests and visiting Masters and Prime Wardens the Master specially picked out the award winners and the MacRobert Award finalists who were waiting until the Royal Academy of Engineering Awards Dinner when they would learn who has won.

The Master quoted Alan Turing's headmaster who wrote *"I hope he will not fall between 2 stools. If he is to stay at public school and go up to university, he must aim at becoming "educated". If he is to be solely a scientific specialist, he will be wasting his time and mine"*. The Master offered his opinion that the winners were contributing to a modest but steady increase in the public's understanding of what an engineer is and the importance of the contribution of our profession to society.

The efforts of the sponsors to select and put forward the right candidates for the awards and all those on the Engineers Awards Committee under the leadership of our Charitable Trust Fund were thanked by the Master for their hard work, together with our Clerk.

The Company had visited Royal Air Force Brize Norton the week before and the Master drew attention to the significance of over 2,000 combat sorties flown over Iraq and how that achievement is lightly dismissed in the media as is the importance of the intelligence, surveillance and reconnaissance operations. Brize Norton operates four large aircraft types, including the Voyager, undoubtedly the most effective air-to-air refuelling aircraft in the world. Apart from keeping the RAF's aircraft in the air, they are refuelling the aircraft of four allied nations including those operating from the American carriers. Notwithstanding the unusual political constraints within which our forces are operating, the Master said they are taking the battle to our enemies in a highly professional response that, although not sufficient of itself, is crucial.

The principal guest was Dr Paul Golby CBE and a liveryman of the Company. At this point and as a graduate from Aston University the Master was compelled to observe that, like so many of our best engineers, Paul was also a graduate of Aston University where he took a first degree in mechanical engineering before going on to gain a PhD as a result of research into offshore oil structures whilst training as a graduate engineer with Dunlop. Since when he has been awarded honorary degrees from Aston in 2007, and Cranfield in 2008, and in 2009 was appointed Pro-Chancellor and Chair of the Council of Aston University. A Fellow and Council Member of the Royal Academy of Engineering he is also a Fellow of the Institution of Engineering and Technology, the Institution of Mechanical Engineers, and the Energy Institute. The Master remarked that some Aston graduates become more eminent than others!

Paul's career included becoming Chief Executive of E.ON UK (formerly PowerGen) in 2002. He built the business through a series of major acquisitions to become one of the UK's leading energy companies. He retired from E.ON in December 2011 and became a Non-Executive Director of the National Grid in February 2012.
Paul became Chairman of Engineering UK in September 2010, an independent organisation that promotes the vital contribution of engineers, engineering and technology in our society. He was appointed as a Member of the Prime Minister's Council for Science and Technology in June 2011 and as Chairman of the Engineering and Physical Sciences Research Council in April 2012. Resonating a little more with the Master's own background, his most recent appointment was as Chairman of the National Air Traffic Service in for which he became responsible in October 2014.

The Master's invitation to toast the Company's guests brought those liverymen and freemen present to their feet, glass in hand before Dr Golby responded.

Dr Golby put the need for engineering expertise into perspective by stating that UK engineering companies will need 182,000 people per year with engineering skills in the decade to 2022 but there is a current annual shortfall of 55,000 skilled workers each year. Without inspiring more young people to continue with maths and science and to become engineers the skills gap will not narrow and the UK's prosperity will suffer. Failure to meet that demand would mean the UK economy losing £27bn a year from 2022.

He illustrated how engineering can be life changing by reference to his own working class background and how it all started with an inspirational engineering & technology teacher at school. Since he had studied at Aston University nearly 15,000 engineering students had graduated from Aston in the intervening period. 40% of Aston students were from a disadvantaged background.

If engineering in the UK is to continue to thrive he said that more needs to be done to build the talent pipeline. To do that, more breadth and depth in the talent pool was needed, which brought him back to the question of inspiration.

He emphasised the need for working collaboratively and more effectively to reach and inspire more young people. He referred to 'Tomorrow's Engineers' which is a programme of coordinated schools outreach and careers inspiration. It seeks to create the next generation of engineers by helping young people from all backgrounds understand the variety, excitement and opportunity presented by a career in engineering.

Dr Golby suggested that offering work experience beyond friends and family was an effective way of showcasing engineering.

Through its national network of companies involved in coordinated local activity, Tomorrow's Engineers was giving more young people the chance to hear directly from employers about careers in the engineering. He hoped that all companies employing engineers would become part of that network: to think about how they could connect with local schools or get involved in

'Tomorrow's Engineers Week', now a National event that takes place during the first week in November.

Continuing with STEM subjects at school which keeps career options open was an important message. A message heard by tens of thousands of school children at Big Bang Fairs across the country where young people can try out hands-on activities run by employers, go to workshops and (often explosive) theatre shows and showcase their science and engineering projects.

The national Big Bang Fair fills the vast halls of the NEC and has become the largest youth event in the UK.

Dr Golby highlighted the range of engineering disciplines and roles but reminded us that there will be roles in the future that do not exist yet and will be defined by future advances in technology.

The Engineering and Physical Sciences Research Council, of which Dr Golby is Chairman, invests £800m per year in research that saves lives, creates prosperity, protects the environment and inspires future generations. Such investment was essential as is the need to inspire the next generation.

Dr Golby said that those receiving awards at the dinner should be proud of the role they are already playing and that he was proud to celebrate with them.

HAMPTON MANOR DINNER
17th July 2015

Back in 2005, when a young liveryman found some of the formal Livery Dinners were rather difficult to get to and daunting to enter, she decided to organise a less formal event and Informal Sunday Lunches in the Cotswolds were born.

The venue was The Mill House Hotel, Kingham near Stow-on-the-Wold and a number of the livery made a weekend of it – long before 'MOOT's' were invented. Fortunately, each of these three events was blessed with a sunny day, allowing for the use of classic and sports cars for those driving out of London, drinks on the terrace overlooking the beautiful countryside and plenty of chat to get to know people better.

After three years of these events the liveryman was sent abroad for work and so, whilst it was hoped that someone else would pick up and carry on with the Informal dinners, the tradition died.

When Past Master Scahill was installed in 2012, he announced that the theme of his year was to be 'Friendship and Fraternity', and he wanted to organise a number of MOOT's – the first of which was to be an informal dinner. At very short notice, a dinner was organised at Hampton Manor in Hampton-in-Arden in the Midlands which attracted 18 attendees.

Each of the last four years have seen a further informal dinner at the same hotel, but in different parts of the building, and with increasing numbers. This year there were 32 people booked to attend; of which three were potential new liverymen.

This year's informal dinner was held in the beautiful venue of Elizabeth's *Court* – the old stable block of the house, which has a huge glass atrium roof over the courtyard to make a light and airy function room that will seat up to 100.

The food, conversation and service were excellent but for those of us who were looking for taxis to get home, we had reckoned without Eid!! The taxi companies warned that they would be short of drivers on the 17th July, as they would all be at home celebrating Eid with their families and in the event it took over 2 hours to get a taxi to come to the hotel. However, whilst waiting, the staff did a great job of providing us with tea and biscuits and chivvying up the taxi company, so again 'Well done to Hampton Manor!'

The young liveryman of the start of my story is now not so young; definitely not daunted by attending livery events, but still keen on informal, sociable dinners and enjoys the livery for the people she meets, the friends she has made and the interesting conversations that come about over a good dinner. Dear Readers – that young liveryman was me!

Penny Taylor

ENGINEERS' AND FRIENDS ANNUAL GOLF COMPETITION 22nd July 2015

The Engineers' annual golf competition 2015 was held at the Beaconsfield Golf Club on Wednesday 22 July. This year we had planned to play again at Mentmore, but the unexpected closure of that course meant a late change of venue to Beaconsfield, the local course of our Past Master Graham Skinner - many thanks to Graham.

The weather was better than forecast, with warm sunshine for the start, mild temperatures, and a gradually increasing breeze accompanied by a couple of showers late in the afternoon when most of our golfers were finishing their round.

The course, dating back to 1902, has evolved from 'Harry' Colt's original design from 1913 and has many of his trademark features. The course was beautifully maintained with consistently good quality fairways. It offers a challenge to the better players whilst not causing undue difficulties for high-handicappers. We particularly enjoyed (!) the

many bunkers….and the large, fast and sloping greens. The occasional rumble of the Thameslink trains crossing the course through a cutting was the only disruption to a tranquil golfing environment.

There were 12 golfers this year, 9 men and 3 ladies, and despite the non-availability of a number of regular attenders a rather disappointingly small number. We would encourage more Liverymen and their guests to play next year - it is a very friendly and informal occasion. Anyone who plays golf, including high handicappers, would find this an enjoyable and social occasion. The winner of the Engineer's Prize trophy was (Sir) Rob Walmsley (35 Stableford points), and the runner-up was Alan Grant (30 points). The ladies prize was won for the second year in succession by Jenny Kay (32 points). Nearest the pin prizes of shiny new golf balls were won by Rob Walmsley and Alan Grant.

We were delighted to be joined at our well deserved - and delicious - lunch by Master Pat O'Reilly and the Master's Lady Christine O'Reilly, as well as Past Master Gerald Clerehugh and Joan. Pat awarded the prizes and warmly thanked Graham Skinner for hosting the event at Beaconsfield, and John Ferrie for his outstanding organisational skills.

Lunch guests were intrigued by a long gap in the names engraved on the trophy, between Richard Rooley in 1991, and M C Hassall in 1996. Unfortunately, our collective memory failed to recall the names of the winners during those years. Maybe one of our readers will be able to solve the mystery? Or maybe there were no competitions during this period? Answers please to the Swordsman Editor, Past Master David Scahill.

Alan Grant & Jenny Kay (aka runner-up man & winning lady golfers)

MASTER'S OUT OF TOWN MEETING BATH / BRISTOL 24th to 27th September 2015

Informal Dinner Hilton Bath City Hotel Thursday 24th September 2015

Record numbers of Liverymen and their Partners converged on the Hilton Hotel in Bath on Thursday afternoon for the Master's Away Weekend. Bath, a beautiful City famous for its Regency buildings constructed in the soft pale yellow local sandstone was most welcoming. The Master's efforts over the prior months with rain gods paid off handsomely since we were blessed with perfect weather for the entire weekend.

Our weekend began with Lucilla and Caroline who were Bath Blue Badge Guides. They explained that under the Romans, Bath was known as Aquae Sulis, and its later history includes the Crowning of Edgar I as the first King of England, in Bath Abbey over 1000 years ago; an event commemorated by the Queen and the Duke of Edinburgh's visit earlier this year. Bath enjoyed much prosperity in the middle ages as an important Wool Weaving Town as part of the Cotswolds Wool Industry.

The focus of their briefing was about Bath in its heyday beginning when Queen Anne came to Bath for the Waters in the early 1700's, and brought the great and the good with her. Thus Bath became notably one of the Regency Period's most fashionable and also popular towns.

Being called to Dinner we enjoyed an excellent buffet meal with a truly prodigious range of dining options. Judging by their conversation around the many tables the Liverymen were catching up on all the affairs of state since their last meet. The Master rose and dealt with the Parish Notices and then introduced Audrey Canning.

Audrey ably assisted by her husband John had invested much time in organising the Charity

Sweepstake and the Raffle in aid of the Livery's Trust Fund. Audrey did stalwart work in outlining what she had done in rounding up the donors and describing the prizes offered for the Silent Auction, which she illustrated on a large presentation board which John managed to carry around with all the polish of a long time Pickford's Scene Shifter.

The Dinner concluded with the stalwarts adjourning to the Bar, and those who had made long journeys or explored Bath during the afternoon, retiring for an early start the next morning. All in all, an excellent start to Pat and Chris' Out of Town Weekend.

Keith Williams

Cultural Visit
Friday 25th September 2015

The Best of British/the World - that's what we saw today.

Stunning countryside, glorious weather, friendship, laughter, a delicious lunch, and fantastic guides in beautiful homes - a great day!

Stephen our bus driver sped us to our first stop - the home of Amanda and Stephen Clark in the village of Seend. There, the walled garden was divided into places dear to their hearts. Following the English Rose Garden, we visited a straw hut in Kenya, a Pavilion in China, a Pagoda in Italy, all with their corresponding plants and trees.

Friendships were renewed, peals of laughter heard, gasps at the views, and the cheer joy of seeing such a beautifully designed and maintained garden.

Coffee and loos were high on the list when we arrived at Bowood House. Feeling refreshed, our tours started.

Bowood House, a 2,000 acre estate belonging to the Lansdowne Family since 1754. The family fortunes changed many times, the grand house was knocked down, and it was used by the RAF during the second world war. It was then left empty and fell into disrepair. The 9th Marquis, then Lord Shelburne took over its management in 1972, and transformed it into what we saw today.

The sky was blue and almost cloudless, the air was still, the trees were tinged with Autumn colour, and the views and gardens stunning. The garden was landscaped by Capability Brown in the 1760's so there were the traditionally sloping lawns and lake.

Enough of facts and figures - what about us? We loved it, though there were a few aching knees and feet by the end of the tour.

We were divided into 3 groups, and our guide Jophy showed us the 4 acre walled garden.

Colourful beds, vines, vegetables, herbs, orchards, and immaculately mowed lawns and edges make up the walled garden. Unusual plants abound, such is the beauty of the garden that it has won the HHA/Christies Garden of the Year in 2014 and David the Head Gardener has won gardener of the Year.

Before arriving back at the house for lunch we had a little adventure in a cave! At the bottom of the park by the lake is a cascade - a small waterfall. By this cascade is a cave. Jophy warned us it was dark and narrow, but nevertheless some of us brave souls decided to walk through it. It was fine if your

mobile phone/torch worked, but if they didn't - trouble!

Those ahead with light walked ahead with no difficulty. I was stuck! My phone - I couldn't work out the light, and John Canning and others behind me - absolutely pitch black, narrow and thick walls. With much mirth and giggles, and despite John telling me to go right into the wall with a hole the size of a 6d, we emerged, triumphant to the relief of those ahead who could not work out what had happened. Unfortunately, it took a few minutes to regain our composure, so I forgot to take a photo of the exit, only the entrance!

After a delicious lunch, we were free to look around the house; a treasure chest of memorabilia. Flemish tapestries, period rooms and costumes, jewels from India (the 5th Marquis was Viceroy from 1880-1884.) Queen Victoria's Wedding Chair, British Watercolour paintings, Napoleon's Death Mask, the sadness of sons lost in the war. - all reflecting the colourful history of the family.

We had a truly wonderful day. Our thanks go to the Marquis and Marchioness of Lansdowne for sharing their home with us, and the guides who gave us brilliant tours and interesting information.

Huge thanks to Christine O'Reilly for planning it all, and looking after us so well. Thanks also to John for coming along and taking masses of photos, and also issuing useless advice in a cave! You are forgiven, and we are glad you were with us!

Jane Forrest, Ann Gale

Rolls-Royce, Filton
Friday 25th September 2015

Security restrictions meant photography was not allowed inside the company except in the Heritage Trust Museum. However, Ric Parker has painted an excellent pen-picture for us in his article. ET)

We had a fascinating day at Rolls-Royce featuring their earliest ventures into aero-engines, an insight into the workings of the gas-turbine and its technology, modern operations: both manufacturing and digital, and the future of combat air systems and their power-plants.

The day was hosted by Dr Ian Ritchey, Engineering Director Defence Aerospace. He and his team put on a wonderful show for us. He first gave us an introduction to the Company and its history: a daunting prospect with four previous and one current Rolls-Royce directors in the audience (no pressure then!); we all behaved ourselves. We also learnt about one of Rolls-Royce's latest products, the LiftSystem® for the American F35 Lightning II, Joint Strike Fighter. A shaft-driven lift fan, rear swivel nozzle and stabilizer side posts all help this incredible aircraft to take off and land vertically on the deck of an aircraft carrier. A series of four tours was then organised looking at various aspects of the site activities:

The Rolls-Royce Heritage Trust put on a wonderful show, led by Bryan Williams (retired) and his colleagues. From the earliest history of the Bristol Aeroplane Company Engine Division, later Bristol Aero Engines, right through to the amalgamation with Rolls-Royce in 1968? Many notable names from aviation history were on show including Hercules reciprocating engine which powered, amongst others the Bristol Beaufighter, the Short Stirling and Handley Page Halifax; the Olympus Engine from the Vulcan Bomber, a derivative of which went on to power the supersonic jet-liner, Concorde; and the Pegasus engine which powered the Harrier Jump Jet.

Today's manufacturing operations were expertly explained by Jerry Fussel and colleagues in the new engine assembly and maintenance centre on the Gypsy Patch Site. In the last five years, all of the Rolls-Royce old operations, many in second-world-war buildings, have been relocated to brand new factories on the site, with the old site, across the road, cleared and awaiting redevelopment. We saw a clean, modern factory environment. The engines that go through this facility include the EJ200 engine from the Eurofighter Typhoon and the very latest engine: the TP400, powering the Airbus military transport aircraft, A400M. Whilst the fantastic engineering technology on show was all too apparent, the local team were equally keen to direct our attention to the quality system and associated metrics which ensure the quality and safety of products leaving the shop. They were also proud of their skills development and self-directed teams. Great care is taken to segregate new build engines from those in for repair so that parts do not get mixed.

In sharp contrast to the assembly and maintenance area, we saw the latest Operations Centre. This is the hub of "digital operations". One wall is lined with video screens showing latest event status and news from around the world. Today, over 50% of Rolls-Royce revenues comes from providing services to customers. Harvey Cartledge told us that, for European and non-US military engines, this centre is the nerve-centre for supporting and protecting the military customer. It is manned 24/7 with service personnel, and with technical experts constantly on call. Clearly, real-time monitoring of all military engines is not possible, as this would give away operational secrets. The team access and decipher vast amounts of data from the engines, transmitted when safe and available. They are also in real-time contact with service representatives in the field. An instant response to any customer problem is assured, and many times the problem is identified and a fix prescribed even before the customer is aware.

The Bristol technology exhibition gave Roy Pentecost for and his colleagues an opportunity to talk us through the modern military gas turbine engine with the aid of a beautifully prepared, cut-away Adour engine. He also showed us some of the amazing technology: how do you make a turbine blade survive in a gas stream 300 degrees hotter than the melting point of the metal it is made of? Roy gave a clear and entertaining explanation of the engine and technology in a manner that even the non-engineers present could fully grasp. Fan blades and low pressure compressors were a case in point. Early blades were narrow and made from solid titanium, these were slotted into gaps in the discs which held them in place at frightening rotational speeds. The latest fan blades on the Joint Strike Fighter LiftSystem® are diffusion-bonded and super-plastically formed, hollow titanium constructions, friction-welded to the discs and saving 50% of the weight compared to earlier technology. For the future, ceramic fibres could be used to strengthen the discs allowing a further 20% weight reduction.

Finally, back in the lecture hall with Ian and colleagues. Conrad Banks provided a wonderful vison of the combat air systems of the future (to the extent that national security allowed). He described combat planes which would be autonomous (no pilot and self-determining in routine operation, but still having a "man in the loop" on the ground in case critical military decisions were required). Stealth would be increasingly important, and clever devices and coatings, combined with installation tricks, would render the engine and aircraft invisible to radar and infra-red detectors. The first development version of a UCAS (Unmanned Combat Air Vehicle) called Taranis, with its Rolls-Royce engine, had recently undergone flight testing in Australia. Future power systems would have an innovative mix of current mechanical, gas-turbine technology, with novel electrical systems satisfying the ever-increasing electrical demands of the platforms for radar and guide beam weapons, and also powering electrical actuators which will replace many of the mechanically or hydraulically-activated aircraft systems.

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We received excellent hospitality, and a sandwich lunch and soft drinks. For me, it was a bit of a "busman's holiday", but I was very proud to see the team put on an excellent show for our visitors. For Jenette, it was a real eye-opener: "For the first time I get to see what he does at work all day" she said!

Ric Parker

The Roman Baths and Dinner in the Pump Room Friday 25th September 2015

It is a truth universally acknowledged, that a single company in possession of a good appetite must be in want of a meal. Hence, Friday evening saw the Company need little persuasion to set forth for the short walk from the hotel in Bath past the Abbey to the Roman Baths and Pump Room. We gathered for a Champagne reception around the Roman Baths and had chance to look at the museum and appreciate the Roman engineering – a man's field then. The ladies had the sense to wear suitable shoes as the floor at the Roman Baths was uneven and slippery. The Master could rightly take pride in the assembled company. No one took an unscheduled bath, despite repeated encouragement when taking photos in front of the Great Bath for people to just 'take one step backwards'

For dinner, we adjourned upstairs to the Pump Rooms and enjoyed a fine dinner with a main course of sea bass with the excellent company of friends and guests. The trio of musicians accompanied us during the meal, right through to the trio of desserts. There was a wonderful atmosphere that somehow brought Jane Austen to mind and the Georgian times in Bath. Heading back to the hotel, we were brought back to the present day passing some slightly younger people enjoying Freshers' week in the City.

Jean Billingsley

For Saturday's tours we were split into two parties each visiting the American Museum for half a day and then a half day experiencing the beauties of Bath lead by group guides. So for 50% of the attendees, the next two reports are in reverse order! ET)

The American Museum
Saturday 26th September 2015

Our visit to the American Museum was well supported, and we all enjoyed a truly delightful and informative experience. The weather was exceptionally fine, enabling us to see the wonderful Avon Valley scenery at its best on the short journeys out to and back from the museum in Claverton Manor.

This Museum is the only one of its kind outside the USA. It tells the very important story of the settlers from Europe, how they lived, and the role they played in laying down some sound foundations for modern America with its high work ethic and fairness.

Through their combined passion for American history, and their wealth, four outstanding people brought together a very fine collection of art and artefacts, showing the lives of the early settlers, and later arrivals through the centuries. This has been built upon by more recent management, resulting in a unique record, presented in an easy style for all to see.

A progression of room settings revealed how these pioneer settlers lived, and the furniture they made and used, complete with tools to support their everyday living, and their crafts and works of art. A wide range of these was expertly displayed in a way that allowed close inspection of fine detail. This was especially true of the large collection of beautiful quilts. The very tiny stitches placed with precision, often in very low light levels, enhanced the beauty and variety of artistic content. Wood carvings and furniture made to classical contemporary European designs, helped emphasise the time span covered by the successive generations of settlers looking for a better life, with more freedom to benefit from their work and chosen way of living.

Whilst the exhibits told much of the stories, the enthusiastic museum hosts enriched them with clear explanations. Most room displays contained more exhibits than would have been present in a typical home. This was done to show the variations between homes, and the breadth of skills.

The native American Indians are also represented well in the house. Stories of tensions between the indigenous American Indians and the settlers were represented, adding to an understanding of the harshness of everyday life.

Although the settlers came from many countries and in great numbers, The American Museum illustrates the great closeness of America and the UK through generations.

Claverton Manor, beautiful in its own right, was built in the early 19th Century and is set in 125 acres of the most beautiful Avon Valley countryside. The gardens reflect the plant species and settings typical of the regions where settlers chose to build their new lives.

With such a day of glorious sunshine, coffee, then a light lunch on the patio, with wonderful views, rounded off a memorable visit, and one many of us may choose to repeat, in order to learn more about the self-reliant people who broke away from problems in their home countries to start new lives. As we live now with heavy dependence upon the State, a return to a greater degree of self-reliance may well help us afford the things we treasure, that now only the State can provide.

John and Jean Coplin

Walking Tour of Bath
Saturday 26th September 2015

Saturday morning began bright and sunny as forecast, ideal for a walking tour of Bath's city centre and visit to the Art Gallery. Our Blue Badge guides, Caroline Franklyn and Belinda Gornall, each took charge of a quarter of our party leaving 10 minutes apart. In the afternoon the two other groups did a similar tour with Caroline Franklyn and another Blue Badge Guide, Lucilla Shirley, wife of Assistant Emeritus Malcolm. The morning groups had the good fortune to be ahead of the Saturday crowds of morning shoppers and tourists. The first two groups passed the Parade Gardens which still retain the ground level of Roman times.

With each step we were given a very full history of Bath's development and attractions over the over the ages leading to it being put on UNESCO World Heritage List in 1987, a place that it justly deserves.

We started out from outside the Art Gallery looking across to the Pulteney Bridge that was opened in1789. We were told it was commissioned by Sir

William Pulteney, and designed by the architect Thomas Baldwin. The Corporation of Bath wanted to expand the boundaries of the City, and Sir William's estate was conveniently situated just over the other side of the River Avon. At over 1,000 feet long and 100 feet wide, the road itself is the widest and the grandest in Bath. However, the architect, Baldwin, designed only the façades of buildings. A variety of owners acquired plots of land along the new street and built the actual structures behind the façades, so that while the street has a visual unity, the buildings have different internal features, some having been designed as private houses and others as hotels.

From the River Avon the bridge is reminiscent of the Ponte Vecchio in Italy. It was foreseen that, along with the access provided by Pulteney Bridge, the eastern side of the Avon would become popular with speculators and developers. This appears not to have been the case, and in the event no further developments were made on this scale. Indeed, one of the side streets off Great Pulteney Street, called Sunderland Street, is the shortest street in the city, with only one address. The guide said that after 1789, the financial climate did not encourage further building. The 'Panic of 1797' related to a period of deflation between 1793 and 1800, which was followed by the Depression of 1807 and the Napoleonic Wars. Bath was also affected by a serious flood in 1809, which would have inundated the basements in Great Pulteney Street as well as the surrounding fields.

Flooding continued to be a problem over the years until the eventual completion of the new weir which we saw as we moved to the side of the river.

The guide explained that Frank Greenhalgh was appointed Engineer to the River Avon (Bristol) Catchment Board in 1953 and he started to tackle the problem systematically.

Another disastrous flood in 1960 increased the urgency and over the ten-year period 1963-1972 the river was dredged, banks were raised and reinforced by sheet-piling. Pulteney Weir was redesigned and new sluice gates were installed. The work received a Civic Trust Award in 1972 and we were shown a commemorative plaque that is set into the parapet of Grand Parade overlooking the weir.

Pulteney Weir featured in the film of Les Misérables. Part of the scene where Inspector Javert commits suicide by jumping into the River Seine was filmed here in October 2012.

Moving on towards the Abbey we learnt that virtually every aspect of Bath's evolution has stemmed from the existence of the naturally occurring hot springs. The guide said that there is a story about an outcast Celtic prince Bladud. He was said to have so serious a skin condition that he was demoted to swine herding. The story goes that his pigs, who also had a skin problem, wandered into steaming swampy ground. A while later he noticed that the skins of the animals were without blemish so he decided to see

what the waters might do for him. Presto! Normal princely duties could be resumed. The Romans much later discovered the place and couldn't resist making a feature of it with their plumbing wizardry. After all the battles and marching, a good hot plunge was too good an opportunity to miss.

Standing in the courtyards around the Abbey, we were told how the Dark Ages did not maintain the City's Roman image, though the three Baths continued to be used. It was the construction of an Anglo-Saxon Abbey Church in 757 on the back of the wealth from the wool trade that became a new focus of interest. This was associated with the important monastery begun in 781 in which King Edgar was crowned in 973. The Normans redeveloped it into a vast Cathedral in 1090 which later became too large for a shrinking population. The Abbey that exists today is the third redevelopment for the Church and has a much

shorter nave. The guide indicated the delicacy of the design with 60% of its facades glazed. It was built at the instigation of Bishop Oliver King in 1499. He had ladders representing stairways to Heaven, carved either side of the 'Lantern of the West' stained glass window. Since the access is meant to be two-way an angel is shown descending upside-down. The guide said she was asked by a Japanese tourist 'Why? Since the angels have wings couldn't they just fly down?'

The Abbey is fortunate in regard to having escaped plunder by Henry XIII. In its early days, however, the lack of an external burial ground meant that the dead were buried under the nave, causing a reputation for experiencing unpleasant odours.

Passing the Pump Room complex one was reminded of what Samuel Pepys wrote in 1668 "it cannot be clean to get so many bodies in the same water." However, we heard that at the beginning of the 18thC Queen Anne thought her succession of failed pregnancies might be helped by taking 'The Waters'.

Thus a Society fashion was established. Knowing a good legend could be sold to anyone plus the addition of some hot smelly water made for a good marketing opportunity it seemed. Three entrepreneurs then set about the creation of Bath as it is known today. Richard "Beau" Nash set the tone and introduced rules of etiquette, so pushing aside previous lawlessness and bad behaviour amongst the foppish society rich. He had a reputation for having a considerable following amongst the ladies even though he was described as having an ugly appearance. One quote said "with his frippery and flattery, he could debauch a whole nunnery!". It was pointed out that his house was in the building which is now the Theatre Royal.

We were escorted on to Queen Square and told how Ralph Allen from Cornwall created a postal network that was not centred on London. It earned him a fortune and notably the first Penny Black stamp was posted from Bath. He used his wealth to buy a local stone quarry at Combe Down and with help of architects John Wood and later his son, John 'the younger', transformed the city. Although neither of the Woods had visited Italy they were drawn to the style of Andrea Palladin. Queen (Anne) Square was the first development in 1728 for Allen. It was noted that the visual intentions of the design are now obscured by the very large trees in the centre. Our attention was drawn to the comparison of the two sides of the houses. Only the front facades where designed by John Wood. Because owners' contractors built to various house plans, the backs

are notably uncoordinated. This was followed by Prior Park in 1735, all to show off the merits of Allen's Bath stone.

From there we walked up the 18thC fashionable path, passed along the backs of terrace of houses which had been harmoniously designed 'so as not to offend the eye'.

This led us to the end of the Royal Crescent where our tour included a visit to the visit the museum, in house No.1. Here our tour guides handed over to 'Mrs Russell' house keeper to Mr Sandford who came from Ireland in 1773 and rented the property for 20 years.

She gave us an over-view of the history of the house in the 18thC. She explained how the fashionable Season 'to being in Bath' at that time was September to May, as a means of finding entertainment during winter. By the 19thC, however, when the gambling laws had changed and the Prince Regent built the Brighton Pavilion, high society moved in pursuit. Bath remained a Spa town and the properties continued to be rented largely by the elderly and the sick. No.1 went through changing fortunes until after WW2 when it was divided up into Council flats. It was acquired in 1967 for restoration as a museum and opened in 1970 to the public. The original 18thC developer's office attached became known as 1A and was incorporated into the main building in 2013. The museum has a large and important collection of dolls' houses but tour time did not permit us to visit it. However, an example was on show in the servant's hall on entry to the room displays. One item of fascination seen was the Nairn's Electrical Machine made for medicinal purposes. We couldn't see any merits of being connected across the terminals of a variant of a Van de Graaff generator! As we toured the various rooms the obsession of the 18thC for symmetry was pointed out with many dummy door sets opening on to solid walls.

Moving outside, we saw how the curve of the famous façade of the Royal Crescent could be appreciated from the large grass lawn. This is open to the public for picnics and is a quiet lunchtime getaway for locals. It is known as the Royal Victoria Park, an area of parkland that covers some 57 acres of land. It contains Bath's 9 acre botanical garden; a duck pond and a child's play area. We learned that it is one of the first British public parks outside London and it was opened in 1830 by Princess Victoria (before becoming Queen Victoria). During the opening, a gust of wind blew up Princess Victoria's skirt. It is said she did not take kindly to the comments that she had chubby ankles and vowed never to visit Bath again due to the humiliation she felt. She would even shut the curtain if her train passed through Bath. The front lawns of the Royal Crescent houses are separated from the Royal Victoria Park by a turf ha-ha. Our guide said this was a near impossible description to translate and convey to Japanese tourists!

The long terrace of 18thC houses that were constructed beyond the west end of the Royal Crescent, were purposely located to screen the strong winds from the west. It was pointed out that all the houses had their original windows made with lattices of glazing bars to take the small panes only available in the 18thC. But in the Victorian era the development of plate glass caused owners to remove the glazing bars thus changing the character of the architecture. We were told that this is the subject of continuing controversial debate. Also, the rules of the listing state that all the paintwork should be white. In recent times, one

lady owner of a particularly determined disposition, however, painted hers yellow. This was in protest to the painting of yellow lines on roads. A legal battle ensued of such intensity that a land mark case eventually went to the House of Lords. Amazingly, she won her case so the yellow door remains and has now become a tourist feature.

The tour continued into the Circus. John Wood drew up plans for the Circus (complete with roof ornaments of acorns to link back to the pig stories) besides the Royal Crescent. But it was left to his son to actually realise these magnificent projects. Our guides pointed out the very wide front doors of the houses in the Circus. Apparently ladies having 'taken the waters' did not want to be seen unkempt by all at large, so they were taken straight 'in doors' still in their sedan chairs. Many famous people have lived in these houses from Thomas Gainsborough, William Pitt and Dr David Livingstone to name but a few. Time did not allow us to see inside the Assembly rooms but the guide mentioned that the tea room walls were turned pink due to the heating of the iron content of the stone during fire resulting from the Baedeker Blitz raids of WW2.

The walk continued down the smart shopping area in Milsom Street brushing past the only project on which Allen and the Woods collaborated which was the Royal Mineral Hospital in 1737. This was closed in 2015. The Pump Room by Baldwin (completed by John Palmer), Assembly Rooms and Guildhall, decorated in the Adam style, were not built until after their deaths.

The guide explained that the architectural heritage has become something the City of Bath cherishes and it does not give high regard to modern intrusions like the University's new buildings, in particular. The campus is safely screened behind the surrounding hills. We were told that each year a formal ceremony takes place when the University's Vice Chancellor comes down to the City bearing a small box containing two peppercorns in payment of rent. This could only happen in the UK!

The last call of the tour was to the Art Gallery. A Jane Austen exhibition was on display that gave life to the experiences she had when living in Bath. It showed how the City featured in her famous novels, particularly in Northanger Abbey and Persuasion. The publicity her work created for Bath is still growing in value. Amongst one of the items on display we saw her remark that the brightness of the Bath stone caused her discomfort as she wrote in 'Persuasion' - "the white glare of Bath". This was before the days when poor quality Somerset coal was extensively used in Bath, turning the whole City literally jet black. Only very recent careful 'dribble' washing has restored the buildings to near original colour. We were shown one wall beside the Abbey which has not yet been cleaned and it illustrated what a grim place Bath became during the greater parts of the 19th and 20thCs. The 18thC life described in the Jane Austen gallery was less glamorous than often supposed, with ladies arrested for shop-lifting. Also "The worst of Bath was the number of plain women. He did not mean today that there were no pretty women but the number of plain was out of all proportion" a quotation from Jane Austen's 'Persuasion'.

As the tours ended we were left with the feeling of wanting more from the very competent guides who brought so much alive during the walk. Doubtless it has left many of us with the desire to return at a future date.

Henri Pageot

Dinner aboard SS Great Britain 28th September 2015

After a smooth coach trip from Bath to Bristol, we boarded the ship at exactly 7 o'clock as planned.

She was a magnificent sight with her single funnel and six masts decorated with bunting. We boarded on the weather deck and "Weather" was a very appropriate word as it had been excellent for the whole weekend. Drinks were served on the promenade deck and we were invited to take them back up to the weather deck.

Few did so, probably because there was so much to see on the lower decks but possibly also to avoid spilling their champagne on the way back up the steep nautical stairs.

Brunel's SS Great Britain is berthed in the original Great Western Dockyard where she was built, alongside a huge workshop which we entered first

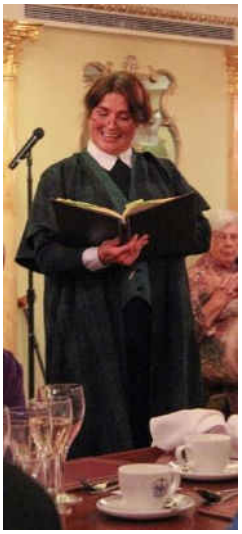
and which contained exhibits from the original ship including a huge metal propeller and a massive wooden rudder somewhat worse for wear. The restored ship lives in the dry dock where she started life, with an artificial waterline constructed above the dry dock to show the level at which she would have floated. We were offered a brief tour of the dry dock but the attractions aboard were so many and varied that few, if any, visited it. In 1845 the first class fare was 26 guineas, which probably inflates to the cost of our whole weekend.

During the reception drinks, we had an hour to sample the ship's atmosphere, with lifelike models of the crew depicting scenes aboard, together with furnished cabins and working spaces. One small room was obviously a toilet, but opening the door slightly resulted in a recorded voice from inside instructing you to go away. The crew cabins and bunks were small, possibly because larger men joined the fearsome "press-gangs" and "persuaded" their smaller colleagues to join the Navy. The first class lounges had comfortable settees with games of cards, chess and cribbage to pass the time at sea. The engines should have been turning for us (although we were going nowhere) but were stationary for maintenance work. However, we could see their immense size and imagine what they would have looked like in operation. Animals had obviously been stabled in the bows and one voyage in 1864 listed 252 passengers, accompanied by 500 chickens, 400 ducks, 150 sheep, 100 geese, 50 turkeys, 3 bullocks and 1 cow with enough feed to keep them fat for the table. Which is a good introduction to our dinner.

We stood for the Chaplain to say grace in spite of Rear Admiral David Bawtree's assertion we should sit for grace on board ship. However, since she was not a military vessel, he was overruled. Our dinner menu was excellent and fully sufficient but could not compete with a first class menu for 1852 of soup, grouse, pigeon and veal pies, pork ham and other meat dishes, sundry puddings, tarts, jelly, blancmange, cheese and celery.

During dinner, we enjoyed an informative potted history of the ship. She was launched in 1843 by Prince Albert and was 332 feet long, weighing 3500 tons. She was a passenger liner for almost 40 years but ran aground for 11 months on an early voyage. She left Liverpool for New York with 1200 tons of coal aboard but only 100 tons reached New York - no global warming and green energy in those days! She carried 1500 troops to fight the

Crimean War and in 1861 carried the English cricket team to fight and beat Australia. She was later converted to a cargo ship but was badly damaged in a storm off Cape Horn and limped to the Falkland Islands, where she was used as a floating warehouse for almost 50 years, finally being scuttled near Port William. A rescue mission was eventually mounted and, after her hull had been patched up with timber and using mattresses donated by the Falkland Islanders, she was towed 7,500 miles back to the UK, arriving on 19th July 1970 to the same Bristol dock in which she had been built, exactly 127 years to the day after her launch.



For further entertainment, we had two talks based on letters and diaries from early passengers. The speaker accompanied these with violent actions illustrating the movement of the ship at sea. The Bristol String Quartet also played manfully during the evening in spite of the intensity of the conversation at the tables.

Towards the end of the dinner, Audrey Canning presented 12 raffle prizes and the results of the silent auction. Together these had raised approximately £3,500 for the Company's charities - an excellent effort by all concerned, including those who gave prizes and donations. There were two raffle prizes on our table, but the champagne winner refused an

invitation to exchange it with the Blue Tooth Selfie Stick winner.

Finally, the Master cut short his planned speech in view of the late hour, briefly but sincerely thanking our hosts for a most interesting and memorable evening.

Glenys and Ken Hambleton

AFFILIATED LIVERY COMPANIES VISIT TO HMS SULTAN
8th October 2015

Liverymen RAdm (Retd) Peter Hammersley and Keith Millard joined liverymen from the Blacksmiths, Shipwrights and Turners at this long established military training establishment located at the Gosport.

Military training has been brought together for all three services under the umbrella of the Defence College of Technical Training. The training is delivered across a number of sites of which HMS Sultan is one.

Having negotiated our way south along the Gosport peninsular we were warmly welcomed by Captain Trevor Gulley, Commanding Officer, and his team. The Defence Schools of Marine Engineering together with the Royal Navy Air Engineering and Survival Equipment are located on the site. HMS Sultan has 1150 trainees on site at any one time and

delivers 220,000 training days per year. Most trainees are accommodated on the site.

He introduced Commander David Elford who is coming towards the end of his duty as Commanding Officer of the Defence College of Technical Training. He provided us with an overview of the college and the reorganisation that had taken place since 2013 to bring military training together within one college. In addition to the two Schools already noted. it also has responsibility for the Schools of Communication and Information Systems and Electronic and Mechanical Engineering**.**

Captain Gulley went on to introduce the work of the Marine Engineering School, which takes raw recruits, immediately following their initial induction into the military and provides them with basic technical skills training, followed by further courses as they progress through their particular service.

He was followed by Commander Jim McNair who is responsible Royal Navy Air Engineering and Survival Equipment School. The whole breadth of technical skills required for supporting and maintaining Royal Naval aircraft from engines to avionics and fighter jets to helicopters are provided by him and his team at HMS Sultan.

We were brought up to date with the Royal Navy in 2015 by a very professional presentation team led by Commander Colin Williams, who was speaking to us on the first day of his new job. He was supported by Lt Alex Head and one of her colleagues. The breadth of their operations very quickly became apparent. It ranged from front line action through to its widely publicised recent role addressing the migrant crisis in the Mediterranean. They said they would be very pleased to make similar presentations to community organisations interested in the Navy's work.

We were given a very enjoyable lunch in the Wardroom, where we again had an opportunity to speak to all those making the presentations and a number of their colleagues who are tutors at HMS Sultan.

After lunch three tours had been organised. In the Watt Hangar we saw a wide range of power units from diesel engines to gas turbines, pumps and other ancillary equipment. Several of the engines were operational. In the Machine Shop we were struck by the large numbers of lathes, drilling and milling machines. Whilst well past their 'sell by date' they are adequate for teaching and understanding how to effectively use these tools. Modern technology has also made its mark with 3D printing equipment. The final stop was at the 764 Squadron Newcomen Hangar. A fleet of about a dozen helicopters that have reached the end of their flying service are all put to good use as trainees learn the skills and processes needed to keep them flying safely.

Considerable distances were involved getting from one point to another. Being conscious that some present had cut their engineering teeth in earlier times we were treated to transport from an earlier era, a Super Sentinel steam driven lorry under a full head of steam, smuts and all. It was built in the late 1920s and has been at HMS Sultan until 1960.

As we came to depart Prime Warden Nigel Warden of the Blacksmiths thanked all concerned for a truly interesting and enjoyable day. Captain Gulley was presented with a model anvil. This proved very appropriate as his father had been a blacksmith.

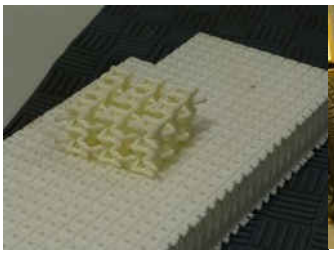
Keith Millard

ROYAL BRITISH LEGION CENTRE FOR BLAST INJURY STUDIES IMPERIAL COLLEGE LONDON Wednesday 14 th October 2015

Imperial College has a long history of military medical research. Sir Alfred Keogh, who was Rector of the college in 1914, became Director General of the Army Medical Services during the Great War, and realized early on the importance of scientific method in the protection of fighting personnel and the treatment of blast injury. Thus Imperial College became a major centre for military medical research and the study of the effects of explosive blasts on the human body.

Blast injuries remain among the most common injuries in warfare, and the use of Improvised Explosive Devices (IEDs) has resulted in stubbornly high rates of lower limb damage and amputation. The Royal British Legion Centre for Blast Injury Studies at Imperial College London (CBIS) has evolved from Imperial Blast which was established in 2008. Its purpose is to research the science of blast injuries and to develop methods to protect personnel and limit injury. CBIS is about 40 strong, including academic and support staff and research students.

During our visit, we were given a wide-ranging introduction to CBIS and associated military medical support. Vital to successful treatment of severe injuries is rapid first aid and evacuation of injured personnel to safety and medical attention. This is achieved by the Medical Emergency Response Team (MERT) which retrieves casualties using Chinook aircraft equipped with paramedic and medical facilities and staff. The high-profile and often hazardous nature of this work was explained by a former commanding officer of MERT, and founder of the charity 'Turn to Starboard.' This charity helps service veterans, particularly those who have been affected by military operations, adapt to civilian life through the medium of sailing.



3D printed 'blast mats' fitted to the floor of military vehicles to reduce the transferred impulse in order to reduce the risk of injury

A blast mat deployed to Afghanistan after recommendations from research in the Centre

Several presentations on CBIS followed. After a résumé of the history of military medicine and the pioneering role of Imperial College, a series of technical lectures enlightened us on the application of science to understanding the characteristics of blast injury and to the development of ways to mitigate the effects of a blast on the human body.

A demonstration of the shock tube.

The eblast lab which houses AnUBIS - the Centre's Anti-vehicle Underbelly Blast Injury Simulator

In parallel with the inorganic materials with which many of us are familiar, bone and soft tissue exhibit strain rate sensitivity which influences the nature of injury according to the characteristics of the blast. Thus a fast loading rate leads to bone fractures while a slower loading rate results in ligament

damage. Injuries may be primary: resulting directly from the blast wave itself, secondary: damage caused by fragments propelled by the blast, or tertiary: caused by the body being thrown against other objects. An improved understanding of these mechanisms of blast injury has informed the development of improved clothing, equipment and vehicles to include protective features.

The final lecture introduced the group to the newly formed Dyson School of Design Engineering, established to promote improved design over a wide range of engineering applications.

The visit concluded with a tour of the laboratory facilities, in which experiments on the effects of blast stresses on biological tissue are conducted using a specially designed "shock tube", and protective features in vehicles are tested in the Anti-Vehicle Underbelly Blast Injury Simulator.

Edmund Morgan-Warren

COMPANY NEWS

Welcome to four new Liverymen who were clothed at the Court Meeting held on 14th July 2015

Louise Hardy
BSc CEng FICE CMgr FCMI

Louise is a programme manager whose most notable role was as Infrastructure Director for the Delivery Partner to the ODA for the design and construction of the London 2012 Olympic Park. In her Olympics role Louise managed the delivery of 2million cubic metres of earthwork remediation, 50 bridges, 12km of highways, tunnelling to accommodate power lines below the park, installation of over 300km of utilities plus the park landscaping, all worth a combined total of £2billion.

A passionate civil engineer Louise has specialised for most of her career in the delivery of complex infrastructure projects (Olympics; High Speed 1; Transylvanian motorway project; Jubilee Line Extension) with an excellent performance record in delivering commercially successful and high quality results.

Louise undertakes voluntary work in the industry through panel and committee activity for the Institution of Civil Engineers and as a Stemnet ambassador. She speaks regularly at schools, universities and institutions giving presentations on engineering and programme management to inspire and encourage the next generation of engineers.

Louise now undertakes a portfolio of non executive director positions, providing strategic input and advice to businesses and clients on managing projects effectively. Specifically she is part of the newly formed Ebbsfleet Development Corporation that is creating a new garden city at Ebbsfleet. And, has been recently appointed to the Defence Infrastructure Organisation that drives for efficiency in the delivery and management of Ministry of Defence infrastructure assets.

Louise combines her professional activities with her other major role, as mother to her three year old twin daughters, Claire and Hannah. Her twins arrived in time to accompany Louise to the Olympic Park during the Games!

Michael John Simms
BSc(Hons) CEng FIET

Mike trained as a Radio Officer in the Merchant Navy, before going on to complete a degree in Electrical and Electronic Engineering. A former sponsored student of Standard Telephones and Cables, he spent several years in their defence division, designing and implementing secure

communication systems. Following the company's acquisition by Northern Telecom, he worked on a wide range of telecommunication projects around the world. This culminated in a 6 year period in Asia Pacific where he was instrumental in launching a new telephony service in Tokyo and managing a variety of complex telecommunication networks for large multi nationals from an operations centre in Singapore. On returning to the UK in 2001, Mike joined EADS (now Airbus), where he bid and won a number of multi-year managed service contracts. In 2012, Mike was appointed the UK CEO for Altran, a leading global engineering consultancy company. A Fellow of the IET, he is passionate about encouraging students to follow a career in engineering. Mike is married with 2 adult sons and an avid rugby fan (although his playing days are well behind him).

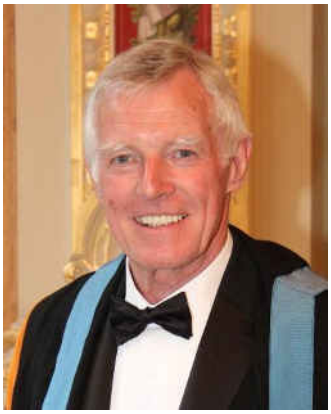
Tim Lohmann
CEng FICE MIStructE

Tim is a chartered civil and structural engineer. He started work in the construction industry as a labourer with O'Rourke (now Laing O'Rourke) in 1989. During his time with O'Rourke he studied for his degree part time and worked on the construction of a number of concrete sub and superstructures both in the UK and Europe.

After leaving O'Rourke he has worked mainly for contractors in concrete and demolition. The majority of his work has been on schemes in central London. A highlight of this was project managing the construction of the concrete frame of the Olympic Velodrome. Throughout his early career he developed an interest in temporary works for civil and structural work and for the last six years he has led consultancies specialising in the design and testing of these. During this period he has been actively involved in the Temporary Works Forum and is currently a director of this. As part of this work he has been involved in establishing a centre of excellence for temporary works and construction method engineering at City University, London. Along with this he has been involved with developing guidance both for the TWF and allied organisations. He has been associated with the institute of demolition engineers and has delivered several papers to their conferences. He is currently working with Wentworth House Partnership specialising in temporary works in dense urban environments.

Away from work he was heavily involved in rowing and maintains a supporting role in this, he is also an enthusiastic golfer.

Frank Shed
BSc MSc CEng FIMechE



Frank trained as an engineer with GEC/ Parsons, and was subsequently employed on design, construction and commissioning on major power plant projects.
He was awarded a "James Clayton Fellowship" from the I.Mech.E. and undertook full-time studies for his M.Sc, following which he joined GEC Turbine Generators Ltd, as Senior Site Operations Engineer.

Frank moved to the CEGB as Engineering Manager at Grain Power Station, and was subsequently appointed Power Station Manager at Dungeness "B" AGR Nuclear Power Station, which became part of Nuclear Electric. During this period he undertook a London University External B.Sc. degree in Economics, undertaken by evening class study.

In the early 1990s, during the period of UK Power Industry privatisation, he was a senior member of the Nuclear Electric negotiating team, seconded into H.M.G. Department of Energy structure. This team was tasked with developing contractual and procedural/regulatory arrangements, for

implementation of competitive market operations, within the power industry.

Following the privatisations and implementation of new power market arrangements, Frank returned into Nuclear Electric, becoming Director of Generation (Magnox & P.W.R.)

On leaving Nuclear Electric he became Senior Power Industry Adviser to KPMG before becoming COO/Executive Director, Welsh Power Group Ltd and Joint CEO of Severn Power Ltd.

OBITUARIES

Prof Roger Voles

BSc MTech DTech DSc(Eng) FREng FIET FInstP FIMA FIEEE

1930 – 2015

Issue 34 of The Swordsman carried the sad news of the death of Prof Roger Voles (Livery No 67, clothed in June 1984) and said that an obituary would be included in this Issue.

The following piece has been written by his close friend and colleague Prof Simon Watts, MBE FREng, with contributions from Prof Hugh Griffiths, FREng

I first met Roger in 1971 when he took me on as a young research engineer in his department at EMI Electronics and I subsequently worked for him for the following 18 years. At that time he was Chief Scientist of the EMI Electronics radar business in Hayes, Middlesex. He was subsequently Chief Scientist for the whole company and finally Technical Director of what had by then become THORN EMI Electronics.

Roger was a wonderful person for a young engineer to work for. He was highly innovative, always with a stream of ideas of how to exploit the latest technology to develop our products: he published over 50 papers in professional journals and was granted over 100 patents. Roger's ideas were often related to radar systems, but also to electro-optic imaging systems, electronic devices and signal processing. He was always prepared to give time to encourage and teach his craft to others.

Roger himself, after leaving school with limited qualifications, acquired all his further education through part-time study whilst working at EMI, which he joined as a trainee in 1948. He acquired over time the degrees of BSc, MTech and DTech from London University. Studying part-time in this way was a true test of commitment and a demonstration of his intellect. He was awarded the degree of Doctor of Science (Engineering) from University College London, in recognition of his lifetime's engineering publications and patents.

He was a Visiting Professor in the department of Electronic and Electrical Engineering at UCL, actively advising on their research in radar, a role he continued right to the end. Prof Hugh Griffiths FREng at UCL worked with Roger where they shared an interest in the history of radar, particularly the German Klein Heidelberg bistatic radar. Roger published a paper on this in the IET RSN journal as recently as 2012.

Roger was also an influential chairman of the DSAC Sensors Technology Board. In all his work he was always thinking about how to solve problems. He would never accept the received wisdom, but always questioned and probed.

He was a great mentor and a strong technical leader (who, by the way, did not suffer fools gladly and was not afraid to make his views clearly known!). He was greatly respected in EMI and throughout the international radar community. As an example of his work, he was a key contributor in the 1970s to the design of EMI's Searchwater radar which saw service in the RAF Nimrod maritime patrol aircraft from 1980 to 2010 and throughout that time remained the world-leading radar in its class.

I have only written here of Roger's professional life, which is how I mainly knew him. In this he was an inspiration, but he was also a supportive friend. He is survived by his wife Vida, to whom he had been married for over 48 years.

The following photographs appeared in the March 2006 Issue 15 of The Swordsman showing Roger and Astley at the Second Informal Lunch organised by Penny Taylor. See Penny's report on her 17th July Informal Dinner on Page 27. ET)

Shown with Roger are Vida his widow, Ken and Marjorie Slater and Tony Roche. Sadly, Marjorie is no longer with us.

Shown with Astley are Diana his widow, Lawrence and Jean Turner and Winifred Mitchell. Sadly, Jean and Winifred are no longer with us.

Astley Whittall
CBE FIMechE FIMarE FIET CBIM
1925 – 2015

Astley Whittle (Livery No 25, clothed in January 1985) was made a Freeman in December 1983, soon after the Livery was formed. Past Master Lawrence Turner remembers the life of a close friend.

Astley was one of the original group of distinguished intrepid engineers who founded the Worshipful Company of Engineers. He became a Freeman in December 1983 and was clothed in the Livery in January 1985. He died at his home after a short illness on the 28th August – just a few days short of his 90th birthday. Astley and his wife Diana have been excellent supporters of many Company events and will be greatly missed.

Astley was born in Birmingham in 1925, his father being an Inspector in the City of Birmingham Police Force. He attended Handsworth Grammar School and on leaving at the age of 18 commenced as a Pupil Apprentice at Bellis and Morcom. He qualified in due course as a mechanical, electrical and marine engineer and rose through the ranks by hard work and ability to be Works Manager, Director, Managing Director and finally Chairman.

In 1952 he married Diana Margherita and lived in Harborne and Edgbaston in Birmingham. They also acquired Brook Farmhouse near Fairford, Gloucestershire as a weekend retreat which they subsequently enlarged extensively to become their very comfortable and spacious retirement home.

During his time at Bellis and Morcom he became much involved in the Engineering Employers Federation which represented 6,500 companies and was appointed Chairman. The Director General was Anthony Frodsham and they forged relationships with Cabinet Ministers, Whitehall Mandarins, Captains of Industry and the General Secretaries of the major Trade Unions. This culminated in both being awarded the CBE in 1978.

In 1981 Bellis and Morcom (now called Amalgamated Power Engineering plc) was the subject of a take over bid and Astley, as Chairman found it necessary to step down. The news soon got around however and many offers were made, anxious to secure his experience and expertise. He was appointed Chairman of BSG International and also Ransoms. He was also made a director of APV, Sykes Picavent and the Engineering Training Authority.

His funeral service was held in Kingsdown Crematorium near Swindon on the 14th September

which was extremely well attended. The Company was represented by David and Gill Scahill, Ted and Sally Wilmott and myself.

Astley has led an extraordinarily successful career and life strongly supported by Diana and their warmth and hospitality will be greatly missed by their many friends.

Henry Fredrick Watts FIMechE -2105

Mr Henry Frederick Watts (Livery No 541 clothed July 2004) passed away on 12 February 2015 from pneumonia.

MEMBERS' NEWS

Golden Wedding Congratulations!

Liveryman Don Ives and Patricia celebrated their Golden Wedding Anniversary on 16th January 2015.

Don wrote: "To celebrate our family was taken on the largest cruise ship ever launched, the Anthem of the Sea, where we all enjoyed a three-night cruise from Southampton. Weather not good but the size of the ship prevented a view of the sea."

Double Congratulations!

Congratulations to the Senior Warden, Isobel Pollock-Hulf and Robin Hulf who were married in London on 24th June 2016, and….

to Isobel who was recently been appointed a Patron of the Women's Engineering Society (WES.) Dawn Bonfield, President of the WES, said of the appointment: "Isobel was a natural choice for us and I am delighted that she was able to accept our invitation to be our patron. She has so many great accolades to her name, many of which have involved bringing engineering to new audiences, something WES is very passionate about. I know she will be great champion for our cause."

Honorary Doctorate

Congratulations to Peter Flewitt who has been awarded an Honorary Doctorate of the University by the University of Surrey. The award was made at a graduation ceremony on the 15th July 2015 by the Chancellor, the Duke of Kent.

RECRUITMENT (Your Livery Company needs you!)

As all Liverymen will know, our Company is allowed to have up to 350 Liveryman (and any number of Freemen). Although the Master's strategy encourages us to grow from around 300 to closer to the 350 limit, we are not achieving much success and hover at around, or just under, 300 Liverymen. Recruitment rates are barely enough to outweigh "losses" let alone grow our numbers. The Membership Committee, chaired by Middle Warden Richard Groome, seeks the help of all Liverymen to identify potential recruits and to

attract them into the Company. If each of us can invite one person to consider joining the Company, and 1 in 5 of those does join, we should be on track for a new steady state of about 350 Liverymen. However, as well as recruitment, we need to improve retention of members by ensuring that each of us helps new members, and those whose other commitments have precluded recent participation on the Company's programme, to enjoy the benefits of our Company.

As a reminder, the application procedure is at http://www.engineerscompany.org.uk/index.php/membership/application-procedure, but, of course do keep our Clerk, Tony, or Membership Committee Secretary, Court Assistant Barry Brooks, informed of prospective new members.

ROLVENDEN CARRIAGE SHED OR A TALE OF TWO CHARITIES

Liveryman Gardner Crawley is chairman of Rather Valley Railway (RVR) and volunteer Civil Engineer. Court Assistant Dave Cooper is the volunteer Electrical Engineer.

RVR was the winner of the Institution of Civil Engineers' Kent & East Sussex Engineering Excellence Community Benefit Award 2015, the citation read:

"Saving historic carriages on the Kent & East Sussex Railway from the ravages of the weather within the cost of £500,000 required an extremely economic design matched with donations of professional skills, volunteer labour, gifts and recycling of materials.

Rather Valley Railway funded and project managed the construction of a four road, 20 carriage storage shed 120m long by 18m wide with electric lighting and roller shutter doors. Carried out without interruption to the existing railway, the K&ESR volunteers fabricated and laid 1 mile of track and 12 points using materials recycled from elsewhere or donated."

Gardner Crawley

Liveryman Gardner Crawley and his deputy Mike Hart receiving the award

BRIGANTES BREAKFAST

Liveryman Patrick Waterhouse attended the first Brigantes Breakfast in May 2015 and writes:

"The Late Sheriff, Past Master Actuary and staunch Lancastrian Adrian Waddingham CBE was in the chair at the inaugural Brigantes Breakfast, the northern luncheon for City of London Liverymen, which was held at The Midland Hotel in Manchester on Friday 29 May. Two hundred and thirty Liverymen and guests attended, from over seventy Companies, including many current Masters and Past Masters. The Engineers' company was represented by Ian Walker and Patrick Waterhouse.

The response from Liverymen to this first northern function was so great that it had to be moved to a larger venue from the one originally booked. Among the official guests were Mrs Amanda Parker JP, the High Sheriff of Lancashire, Mr Richard Clowes, Trustee of the Ironbridge Gorge Museum, and the Venerable Cherry Vann, Archdeacon of Rochdale and Chaplain for the Day, who said Grace.

Around 1,200 City of London Liverymen are resident in the North of England which, for this purpose, runs from Leicestershire/Staffordshire to the Scottish border. Forty-one Companies have ten or more Liverymen in the area. In 2015, the North of England is home to seven Livery Masters, up from four in 2014.

From discussions with a number of Masters and Clerks last year there is a recognition that some northern Liverymen, whether working or retired, find it difficult to attend City-based Livery events regularly and can become less engaged from the Livery. In a move to redress that situation, and with the full support of our Lord Mayor Alan Yarrow

and his predecessor Dame Fiona Woolf CBE, the Brigantes Breakfast was born.

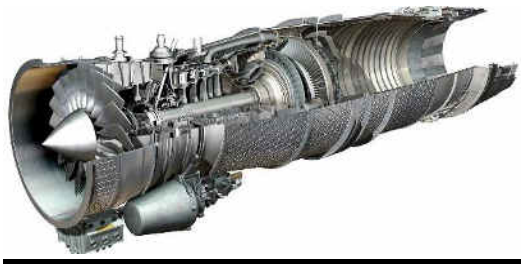
Following a light-hearted operatic interlude, and while proposing the toast to the guests, the Late Sheriff explained that a name was required for the northern luncheon, embracing the main elements of who, what and where. After some head-scratching, the geographical area under consideration was found, fortuitously, to coincide with that occupied in pre-Roman times by the fearsome Brigantes tribe, and thus the Brigantes Breakfast was born.

The Principal Speaker was Alderman Sir David Wootton, Lord Mayor in 2011/12. Sir David made no secret of the pride in which he holds his Bradford roots and Yorkshire generally. In emphasising the ever-closer bonds between the City of London and the North of England, Sir David highlighted the prominence given to the North in the Queen's Speech two days earlier and the vision of the Chancellor of the Exchequer in a Northern Powerhouse for economic growth based around the cities of Liverpool, Manchester, Leeds, Sheffield and Hull.

The other speakers were Nicholas Woolf, Past Master Tax Advisor, deputising for the Late Lord Mayor, Dame Fiona Woolf, who was abroad on business, and David Bentley, Immediate Past Master Baker, who presented Sir David with a donation to the Lord Mayor's Charity Appeal on behalf of those attending and announced that the 2016 Brigantes Breakfast would be on Friday 20 May at Cutlers Hall in Sheffield."

STOP PRESS!

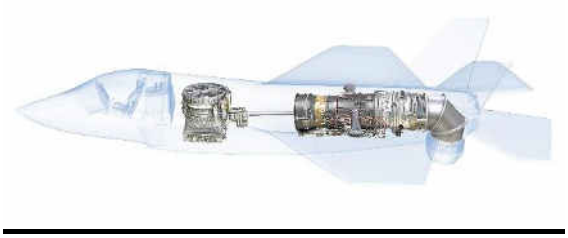
Since compiling Issue 35 of The Swordsman, we are forunate to have received the following photographs from Ric Parker which have relevance to the the OOT visit to Rolls-Royce and are reproduced, courtesy of Rolls-Royce. ET



Turbounion EJ200 engine for Eurofighter Typhoon

EJ200 production

Rolls-Royce Turbine blade (MT30)



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F35 with Rolls-Royce LiftSystem