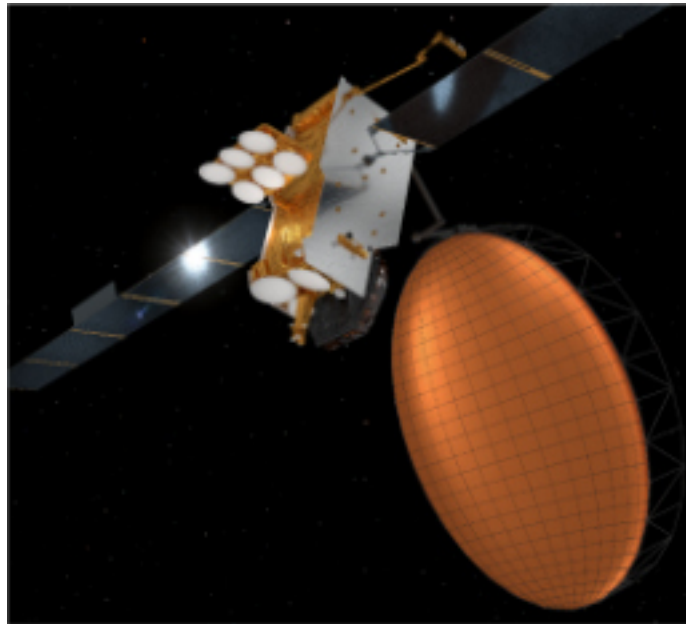




The Swordsman

Issue 46 - May 2021



**The Worshipful Company of
Engineers**

(Incorporated by Royal Charter 2004)



The Swordsman - Issue 46, May 2021

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Front Cover:
*UK-built Inmarsat geostationary communications satellite with
deployed antenna. Photo: Inmarsat.*

From the Editor

*“Mine at the last - when all is done it all comes back to me,
The fault that leaves six thousand ton a log upon the sea.
We’ll tak’ one stretch - three weeks an’ odd by any road ye steer -
Fra’ Cape Town east to Wellington - ye need an engineer.”*

Rudyard Kipling, “McAndrew’s Hymn”, 1893

“Much of what people think of as science is actually engineering, eg no such thing as a “rocket scientist”, only rocket engineers. Latter is who put humans on the moon.”

Elon Musk, Twitter, December 2020

Humans have a powerful urge to explore and exploit the world beyond their immediate surroundings and engineers have been instrumental in enabling that. The role of the ship’s engineer was celebrated by Rudyard Kipling in his poem ‘McAndrew’s Hymn’ in 1893. In it, an ageing Scottish chief engineer reflects on his life on land and at sea and the essential part he has played in preventing his ship from becoming ‘a log upon the sea’. Our late First Honorary Liveryman, HRH Prince Philip, must also have been aware as a Royal Navy ship’s commanding officer that engineers were essential to keeping his ship mobile and battle-ready. No doubt this helped inspire him to be such a strong supporter of the engineering profession.

Engineers continue to be at the forefront of exploration. Elon Musk, founder of SpaceX, recognised this when he Tweeted that it is engineers who are the real rocket scientists. We have seen the staggering technical achievements of Space X and in particular their ‘Starship’ series of rockets that can achieve successful vertical take-off and landing. I recommend readers to see the videos of this on YouTube.

On 21 February 2021, NASA’s Mars 2020 spacecraft successfully landed on Mars. It has since deployed the rover *Perseverance* and the small robotic, coaxial helicopter *Ingenuity*. 118 years after the Wright brothers’ first powered flight on earth, engineers have successfully (and autonomously) flown an aircraft on Mars.

‘Perseverance’ and ‘Ingenuity’ - there could be no finer tributes to the engineers who made this possible.

Chris Elston

The Marketors: a Message of Thanks

The Master, Court Assistants and members of the Company are very grateful to the Worshipful Company of Marketors for their pro-bono assistance and support in greatly improving our external engagement, particularly in these difficult times, through on-line and social media channels. This work was based on the 6 parts of the Marketors RAJER Presentation Series.

The Marketors’ advice and guidance enabled us to complete a comprehensive review of the Company’s approach to marketing itself, the various media to be used and the messages to be put across to our target audiences. A new Company information sheet was drafted and issued to the membership to support personal marketing and recruitment. The social media platforms used by the Company – Facebook, Twitter and LinkedIn were brought together to issue coordinated messaging.

We were also very pleased to acknowledge the Marketors’ help as a donation-in-kind, with a value of £2,250.

Contributors

My thanks to the following who have contributed articles: *The Master; the Immediate Past Master; Raymond Joyce, John Owen, John Chandler, Dave Cooper, Paul Mayo, Brian Back, Heather Clarke, Peter Chapman, John Garside, The Hon. Chaplain, PM Tony Roche, Carol Long.*



HRH The Prince Philip, Duke of Edinburgh, First Honorary Liveryman, 1921 - 2021

It was with great sadness that the Master, Wardens, Court of Assistants and all Members of the Worshipful Company of Engineers learnt of the death of HRH The Prince Philip, Duke of Edinburgh.

His Royal Highness’ support enabled the creation of the Fellowship of Engineering in 1976, the forerunner of today’s Royal Academy of Engineering. As Senior Fellow of the Academy, he agreed to the commissioning of the Prince Philip Medal which is awarded periodically to an engineer of any nationality who has made an exceptional contribution to **engineering** as a whole through practice, management or education. Winners to date include three Liverymen of the Company.

Prince Philip’s support was a factor in the Company’s formation, encouraging the Founding Master and Members in their endeavour. Shortly before the Presentation of the Company’s Letters Patent on 1st November 1983, the Founder Master invited His Royal Highness to accept election as the Company’s

first Honorary Liveryman, to which His Royal Highness was pleased to agree. His first visit to the Company was on 21st February 1985 when he was entertained to dinner by the Court.

The photograph taken on that occasion shows His Royal Highness with the Founder Master, Sir Peter Gadsden, and the Senior Warden, Sir Denis Rooke. The second photo is from the Election Court Dinner in 1999. It shows Dr David Mitchell (then Master) holding a loving cup with Prince Philip facing him.

Amongst his many roles and interests, Prince Philip was President of the Royal Commission for the Exhibition of 1851 for 46 years until he retired in 2011, and Chancellor of Cambridge University 1976-2011.

The Master wrote to Her Majesty’s Private Secretary expressing the Company’s sincere condolences and asked for them to be passed on to the Private Secretaries of the other members of the Royal Family.

Peter Blair-Fish



His Royal Highness with Founder Master Sir Peter Gadsden and Senior Warden Sir Denis Rooke in 1985.



His Royal Highness with Master David Mitchell at the election court dinner in 1999.

ENEMIES OF INNOVATION

The Junior Warden's lecture was delivered by Raymond Joyce BSc, MSc, LLB, DIC, CEng, FICE on 17 November 2020 to members of the Company who had logged into an on-line conference event.



One of the biggest current questions for the UK is how we will continue to attract investment and out-perform our global competitors in cornering a higher proportion of global wealth relative to our size. We know that answering this question correctly is necessary for our security, for improving the standard of living

for all our citizens and providing the public services that we all rely upon.

However, the challenge is colossal. We are out of the EU, the UK must adjust to different trading terms in the global market, the global economy has been set back by the Covid-19 pandemic, the UK manufacturing base is only 12% of GDP and our infrastructure needs renewal.

The answer to this challenge, some would say, is innovation. And I would agree. But what is innovation? I am happy to adopt the definition from the Government's recent Policy Paper:

Innovation – the development of new ideas, new ways of doing things, new products and services, new technologies and new business models.

'Regulations for the Fourth Industrial Revolution', 11 June 2019

Or more simply,

'Innovation is the application of knowledge to the production of goods and services'.

'HMG's Dept for Innovation Business and Skills' Fifth Innovation Report' March 2014

The UK Government has identified the challenges and opportunities presented by what it has called the Fourth Industrial Revolution in its White Paper published in 2019.

In fact, innovation is not a choice: it is an imperative. In other words, it is a call to arms for engineers. But innovation does not just happen because money and resources are thrown at it. The enemies of innovation are everywhere and not to be underestimated.

So, for the purposes of clarification, from the sidelines as a civil engineer and solicitor with 45 years' experience in the rough and tumble of engineering, and the law, this lecture is my personal view on the enemies of innovation.

The BBC's programme, 'Tomorrow's World', first presented by Raymond Baxter, was a programme dedicated to innovation, and during its 38 years featured more than 7,000 gizmos, ideas and discoveries. Many innovations were shown to the public which were hugely successful including breathalysers, digital watches, bar code readers, ATMs, camcorders and many others.

Of course, not all the innovations were successful that underscores the risk of embarking on innovation. But on the other hand, not to innovate is to become the victim of a competitor's progress! Kodak is a notable example of succumbing to digital printing even though an employed researcher had developed the technique for recording onto a cassette tape. Many engineers will have been involved in finding solutions to generic or specific problems. Engineers are, at heart, essentially innovators.

The dichotomy of the UK's approach to R&D is epitomised by the perceived need for technological advancement to be big, sexy and expensive. David Edgerton, a leading historian associated with science, technology and medicine at Kings College London, argues that the lure of big innovation leads, all too often, to misguided and wasteful ambition.

Thus, ever since the invention of the wheel, nearly 6,000 years ago, man has built civilisations upon its continuous improvement, so that today we have pneumatic tyres and awesome alloys.

To be world beating it is necessary to make improvements to achieve marginal gains. Such improvements are incremental and often quite modest, such is the nature of world beating innovation. We know this from the huge success of the GB cycling team where 1% performance improvements led to Olympic Gold.

My first steps into innovation

Looking back over my career, I have been involved, or instrumental in, engineering innovation as varied as soil testing techniques, cement, ceramics, delivery schedules, energy from waste and automobile lamps. In the law, I have exploited the procedural innovations that have become familiar in dispute resolution including mediation, adjudication and the



very exotic terminology for questioning expert witnesses called, 'hot-tubbing'.

My first involvement with engineering innovation was to define the geometry of a new design for a concrete tunnel lining that could be used as a bolted or expanded segment of the tunnel lining on the London Underground. The benefits to the economics of tunnelling were enormous by avoiding the need to use cast iron bolted segments and expanded concrete segments for differing ground conditions. In many ways the example is unremarkable. It was simply a case of a couple of engineers thinking of an innovative solution.

It did not require a massive investment but could self-evidently reduce tunnelling costs. It was an incremental step in combining the principles of two different types of tunnelling segments. It was not that risky.

Design risk

Innovation becomes riskier when the incremental steps become strides and push the envelope beyond the limits of prudence. By contrast there was a tunnelling technique known as the New Austrian Tunnelling Method that had been developed for tunnelling in rock. The method entailed spraying wet concrete on to the exposed surface of the tunnel for the purpose of resisting the external ground stresses and protecting the exposed surface of the strata. It was attractive as a method of tunnelling because it was quick and efficient.

However, the method came under scrutiny when the tunnels on the Heathrow Express collapsed in October 1994. The contractors were fined £1.7m for breach of health and safety legislation even though nobody had been killed or injured. The cause of the failure was put down to workmanship but the standards of workmanship required, as compared with tunnelling in rock would have been different.

The risks associated with workmanship needed close monitoring to control excessive settlement in sedimentary ground conditions, quite different from hard rock.

Pushing construction techniques to their limit and beyond is hardly unknown. I wonder if the engineers ever realised that what was being undertaken was in fact, an application that by its very nature was innovative.

Many of you will have seen the film of the Tacoma Narrows suspension Bridge responding to wind loading that caused oscillation of the entire deck

structure until its eventual collapse in 1940. Wind loading was also the cause of the collapse of the Emley Moor Tower in Yorkshire, which at the time was one of the tallest man-made structures in the world at 386m. In 1969 the low wind speed combined with the ice load cause oscillation and collapse.

In the inevitable litigation that followed, Lord Scarman, one of the Lords of Appeal, had no truck with the unforeseen consequences of wind speed and ice loading, and I quote, 'one who contracts to design an article for a purpose made known to him undertakes that the design is reasonably fit for purpose', always provided that there was no provision in the contract to the contrary.

The fact is that the law, subject to a contractual exclusion, will make no allowances for innovation in pushing construction techniques or design principles to their limits and this applies equally to products. Engineers can cause great harm and society's tolerance of harm to its citizens is quite different now as compared with acceptance of high death rates during the industrial revolution and two world wars. Since the 1950s there have been huge improvements in life expectancy, and standards of living which have steadily reduced that tolerance.

It is hard to imagine that the 33,000 deaths from Asian flu in 1957 and 80,000 deaths from Hong Kong flu in 1968 barely caused any disruption to daily life⁹.

Since the passing of the Health and Safety at Work etc Act 1974 there has been a slew of legislation to protect the interest of the public, including consumers' health and safety and financial interests. It is therefore even more remarkable that the mobile phone became widely available in the 1990's. I say this because there was, and to some extent there continues to be, a controversy about the link between cancer and use of the mobile phone held close to the ear.

The cellular phone was launched, as far as I am aware, without any risk assessment as to the effect of *cell phone* radio frequency electromagnetic radiation exposure, since when the association between cancer and cellular phones has been the subject of countless studies. The existence of that association has not yet been entirely dismissed.

Bearing in mind the catastrophe of thalidomide, tobacco and recent litigation concerning contaminated talcum powder, the ethics of launching the mobile phone could be said to be questionable. If the mobile phone were being launched today, would it ever have been sold without health warnings or guidance as to its use?¹⁰

Ethics

Engineers have a legal duty, and an ethical duty, to do no harm. Acting ethically, engineers need to evaluate the potential harm of new products and technology. That evaluation could stop development, or certainly delay its introduction, until studies to prove the new products and technology are safe.

The safety of products comes into sharp focus with the litigation history of breast implants. Some recent studies at Harvard Business School demonstrate the link between an increase in product liability litigation and a commensurate decrease in the number of patent applications, which adds up to a reduction in appetite for innovation, aided and abetted by the insurance companies who pick up the bill for the 'old technology'.

Regulations

So should we, as a society, find a mechanism to loosen the constraints of the law and regulatory framework to avoid depressing the benefits of innovation? This is a current dilemma in the quest for a Covid-19 vaccine where European governments have already reached an agreement with AstraZeneca to protect the company over any liabilities stemming from its Covid vaccine candidate. The agreement is designed to provide an indemnity for the high risks it takes in the rapid development of a potential vaccine for Covid-19 although under the arrangement, AstraZeneca would pay legal costs up to a certain threshold^{11,12}.

This agreement is to some extent presaged by the government's white paper, Regulation for the Fourth Industrial Revolution' which acknowledges that, *'Where businesses face lengthy, costly, complex or uncertain processes to secure regulatory approvals, they are less likely to be able to persuade potential investors or consumers of the merits of their innovation – and less likely to innovate.'*

The government recognises that unless there is a loosening, or relaxation, of the current law and

regulations that would ordinarily cause a negative impact on innovation, some of the most important innovations will never be funded or developed.

Industry standards

In addition to the constraints created by regulations, an innovator must confront the challenge of the standards making industry.

Regulations and standards favour the old technology, and the established 'players'. Just to avoid any doubt, standards and codes of practice do not have the force of law, as compared with regulations.

Earlier in my career I had been a member of Committees and European Working Groups for the making of industry standards for cement. I was arguing for the blending of pulverised fuel ash (PFA) from power stations, with ordinary Portland cement to make a superior product. The cement manufacturers fought tooth and nail to prevent the publication of a standard that would allow more than 5% of PFA in a cementitious blend, despite all the overwhelming evidence as to the efficacy of a PFA/OPC blend. The fight to have PFA recognised as a cementitious component of cement took over 30 years.

As a lawyer I have litigated and argued over cases in respect of surgical gowns and portable/modular buildings that depended upon the precise wording and scope of standards. Standards are an effective means by which established business can freeze out competition from superior products. I should point out that in my experience the advocates for the established business are engineers, digging in against innovation!

So the need for an innovator to persuade a standards-making committee to recognise the efficacy of a new product or variation to existing products creates huge hurdles for getting their product onto the market.

Protection of IPR

Another hindrance to innovation can be the very instrument to protect the exploitation of an invention. I am of course talking about the patent.

We had a highly informative soirée from David Knights, one of our Liverymen who is a patent solicitor, during the summer, on the history of patents. The use of patents to protect inventions provides the patent holder with an exclusive opportunity for 20 years to exploit the commercial advantage of being first mover. This creates a genuine conundrum.

A system designed to increase innovation, operates initially by suppressing the adoption and improvement of new patented technologies. The benefit to society is finely balanced but the evidence one way or the other is not conclusive.

As an aside, Matthew Boulton and James Watt's steam engine patent was litigated and suppressed the continuing development of the steam engine until the patent finally expired in 1800. In the following years, the power output of steam engines increased dramatically as the result of further innovations.

However, for the innovator, obtaining an effective patent that will provide the widest possible protection, is not inexpensive. It is even more expensive to protect patents by litigation. There is no point in having patents unless they are worth protecting. Start-up companies and SMEs can be hampered by the costs of patent applications and protection of patents in diverting cash away from the refinement of the invention for commercial exploitation.

Many businesses that have relied upon innovation never felt the need for patents, for example, the Worshipful Company of Clockmakers and the Worshipful Company of Spectacle Makers. Their argument in the eighteenth century was that patents *'restricted the free exercise of a skill whose development had always depended on small improvements freely exchanged among craftsmen.'*¹³

The number of patent registrations is often used as a metric to indicate the measure of innovation within a business. Such a metric can be a misleading guide to the innovatory drive because it is only inventions that can be protected by patent.

Patents are not the only means of protecting intellectual property rights. Apocryphally, the recipes for McVitie's Digestive Biscuits and Coca Cola have remained confidential to this day, thus providing evidence as to how effective confidentiality/non-disclosure agreements can be. Such agreements are relatively inexpensive and will be enforced by the Courts.

However, costs of infringing patents, even for big business should cause its Board and its investors to take stock when Court awards can be many millions of pounds. Patent litigation keeps 10 dedicated High Court Judges busy. It has recently been decided¹⁴ that even employees can be entitled to damages. The Supreme Court awarded £2m to an employee of Unilever for the outstanding benefit his inventions bestowed on Unilever.

People and (in)security

Human beings are capricious, devious, deceitful and dishonest in the pursuit of self-interest and after 30 years of practising law, my impression of human behaviour never ceases to improve!

The information in an employee's memory cannot be eradicated but the memory of knowledge is of decreasing value with time.

Documents, in any medium, will be specific, transportable and potentially very valuable to a

competitor. So, how can an employer ensure that the singular repository of confidential memories and supporting documents remains confidential?

The employee needs to be cloaked with a structure of control and legal gags. This is achieved through an effective contract of employment and management of access to documents.

Intellectual capital is often the most valuable asset that a company owns and yet is often protected in a routine, if not cursory fashion. Attention is often devoted to incentivising senior employees with bonuses, share options and career progression, all designed to engender loyalty and create motivation. But such incentives are not always effective if a bigger fish offering bigger bucks comes along! This is a particular risk for SMEs.

The value of a well drafted employment contract is not to be underestimated. If the value of an employee is properly recognised it is possible to build-in enforceable restrictive covenants and notice periods or gardening leave of over 12 months for the purposes of protecting a legitimate business interest. There are examples where the Courts have upheld protection for as long as two years. After two years the knowledge an employee had will have lost a great deal of its currency.

In my experience, one of the obvious controls that is often overlooked is the control of access to documents. Tracking when they have been downloaded, whether they have been printed, read or amended. Being able to adduce such evidence is very powerful in an application to obtain an injunction.

Over the years I have obtained injunctions and substantial damages for clients who have been the target of competitors poaching individuals and teams. For an employee who is restrained by a Court injunction for breaching an employment contract it is a sobering realisation that ignoring its terms can lead to imprisonment.

Another risk associated with employees is lax IT-security. Passing on passwords or handing over USB sticks to third parties are commonplace.

A more emotive term for the general area of stealing confidential information is industrial espionage. The risk of hacking by competitors, either directly into a company's computer systems or by tricking employees, is a present and serious threat. I have been involved with many companies that engage specialist professional 'hackers' whose task is to penetrate the clients' computer systems.

In a mercenary world, the 'friendly' hacker should be bound by contract to ensure that the penalties for going over to the dark side are too harsh to even contemplate. Not least of course, hacking into another person's computer system is a criminal offence under the Computer Misuse Act 1990.

The effort needed to protect confidential information cannot be over-estimated. It is a genuine cost and should not be skated over by using standard employment contracts or relying on standard virus software as a defence against cyber-attack to steal information. IT policy should be hard-wired into a company's management and incorporated in all employment contracts.

Lack of diversity

One of the uncomfortable experiences in my professional role as a trusted business adviser has been addressing the disparity in treatment between male and female employees. I have come across gross differences in pay between men and women by as much as 30% for essentially the same professional role. These differences are not commonly found in public service (except perhaps the BBC) but there are legions of companies where this is the case. The blindness, or unwillingness, of senior management to address the unfair treatment of women fills the Employment Tribunals with claims for equal pay and other unfair treatment. Even where I have pointed out the iniquity and the legislation demanding that women are treated equally, it has sometimes fallen on deaf ears.

The engineering profession knows that women are under-represented within its ranks. The lack of women in engineering has nothing to do with academic ability or lack of hard work. As females pass each academic milestone from GCSEs to degrees there is a pronounced decrease in the percentage representation of women. And of those women who have engineering degrees many do not stay in engineering.

Why women do not always receive equal pay, or choose engineering as a career, is beyond the scope of my lecture, but it has implications for innovation. It is well documented that diversity in the workforce bestows a positive benefit on an organisation's innovative capability that provides a commercial advantage.

Disruptive innovation is well served by diversity (consider human centred design and design thinking) whereas homogeneity breeds a more derivative approach. Disruption is game changing, hence progressive.

In its briefing paper entitled, 'Gender disparity in Engineering' published by Engineering UK in 2018¹⁵ it said,

'research has consistently shown that a more diverse talent pool brings with it increased creativity, and new ideas.... as well as enhanced motivation, retention, group solving problems and financial performance.'

McKinsey have estimated that bridging the UK gender gap in work, has the potential to add £150bn to GDP by 2025¹⁶ – only 5 years away!

But alongside gender issues, which are just one facet of diversity, we have a tendency in engineering to overlook the under-representation of ethnic minorities.

In 2019 the ONS data shows that 14.9% of science, engineering, and technical professionals had an ethnic background. This figure is comparable to the number of women in engineering, even though in the percentage of 14.9% there will be women, who are effectively double counted.

The Federation of Small Businesses commissioned some research from the University of Aston to assess the value of ethnic minority businesses (EMBs) to UK activity and enterprise. The report is entitled, 'Unlocking Opportunity'¹⁷. It concluded that 30% of EMBs had recent product or service innovation as compared with only 19% of non-EMB counterparts. There are 250,000 EMBs and they contributed £25bn to the UK economy in 2018 but, worryingly, they face barriers to growth despite the fact they are more innovative and more likely to export, particularly to Commonwealth countries, than their white counterparts.

Diversity also includes diversity of acquired experience, which is just as important and influential. Candidates for jobs should not be overlooked because their profile does not fit the stereotype. Unusual or unconventional areas of study, different industry background and foreign work experience can add to the competitive edge.

The Wall Street Journal examined diversity and inclusion among S&P 500 companies for a thought leadership article last year, entitled, 'The business case for more diversity'¹⁸. It concluded that 'diverse and inclusive cultures are providing companies with a competitive edge over their peers.'

The best companies attract the best candidates yet only 12 of the Sunday Times Best Companies to work for in 2020 came within the category of engineering, construction or digital technology. The engineering sector shows up poorly – by omission. My own firm has been ranked 50th in its best year. The status of being in the top 100 is taken very seriously because we know that it attracts outstanding applicants and is demonstrably inclusive.

UK law has provided a framework for treating all employees and members of society fairly and equally, to create and promote inclusiveness since the 1970 Equal Pay Act. All the subsequent legislation was consolidated into the Equality Act 2010. It is clear to me that senior management of engineering companies must try harder!

Investors and senior management

I have linked investors and senior management together because these are the very persons or organisations who one would think should embrace innovation and that their relationship should be aligned on the same goals. However, there is plenty of evidence pointing to the opposite because senior management and investors are persuaded that the risks of innovation are a threat to the business. On the other hand, the risk of doing nothing is certain failure. I have noticed that the Oil and Gas Technology Centre (OGTC) states on its website.

*'Whilst market and organisational factors can impact adoption, it is the psychological barriers that are the strongest and the least understood.'*¹⁹

For that reason, the OGTC has a study underway to identify the key psychological factors that influence the deployment of new technology and tools in the UKCS oil and gas industry. It is interesting to note that they identify different industries as more successful innovators, such as retail and automotive.

Investors, particularly founding investors, can run into difficulties, especially where a product has been successful and there are further rounds of funding. Either the investor has to accept being diluted or, as in a recent case of mine, the fact of dilution was litigated and threatened to hold up a public placing. Arguments between the Board and investors burn up cash and deflect efforts to achieve the best return from the innovation that everyone had been focussing on.

To achieve success in commercialising innovations and new products in start-ups, family business and SMEs, requires commitment and focus on the prize. Disputes can be avoided by well drafted shareholder agreements and an unswerving belief in the need for innovation.

State supported innovation

Largely in response to the challenge of Brexit, the government has issued several White Papers which set out its undoubted commitment to R&D and innovation. The plans are ambitious, with UK investment in R&D planned to be 2.4% of GDP by 2027 and to reach 3% in the longer term.

The House of Commons Science and Technology Committee looked at the balance and effectiveness of research and innovation spending and published its report entitled, 'Balance and Effectiveness of Research and Innovation Spending', in September 2020.

One of the 'stand out' issues for me was highlighted by the evidence of the Association of Innovation, Research and Technology Organisations (AIRTO), that the UK has generally had a ratio of 10:1 between science funding and innovation funding as compared to ratios of 'up to 1:1' in other competitor nations.

To me it is unfathomable there should be such disparity between science and innovation. However, a clue can be gleaned from the fact that over four days of oral evidence and 90 submissions of written evidence to the Science and Technology Committee, only two submissions were from industry, notably BAE and RR.

As an outsider it looks as though science policy is being driven by those organisations and individuals who will benefit directly from the government's largesse. The influence of industry on science policy needs to be widened to ensure that the importance of innovation, using known science, is recognised as an essential economic driver.

There are innumerable numbers of SMEs that have the ideas to make money from innovation but suffer from being unable to access the state's R&D coffers, either to initiate an innovation project or because they need top up funding.

There are many different science and engineering organisations that are involved in policy, advising and funding. It is an impenetrable tangle of different organisations that all have slightly different criteria for funding, yet with common parentage in many cases.

How do we communicate with the SMEs to encourage applications for innovation funding? I do not know, although the government's commitment to supporting innovation in SMEs is evident in its recent White Papers. What I do know is that there were 5.9 million private businesses in the UK at the start of 2019 – more than 99% of which are small or medium-sized businesses according to the Department for Business, Energy & Industrial Strategy.

There are too many SME's, many with great ideas who scabble around for private funding, who should be capable of being pointed in the direction of one address for an application for R&D or innovation funding.

Conclusion and closing remarks

The 'enemies of innovation' I have identified are:

1. Pushing a design philosophy or technology too far without appreciating its limitations;
2. The need to apply an ethical approach to projects or product development, especially health and safety issues that may stall progress, or even need to be abandoned;
3. Regulations, that can cause delay or stop innovation;
4. The making of industry standards that favour the established players and the old technology;
5. The cost of obtaining or enforcing patents, plus the more general effect on depressing innovation generally;
6. The behaviour of employees;
7. The lack of a diverse workforce;

8. The attitudes of the senior management and investors; and,
9. Government policy that is exceptionally biased towards basic research at the expense of innovation.

In a recent and very illuminating book, *'How innovation Works'*²⁰ the author states as follows.

'Most innovation is a gradual process. The modern obsession with disruptive innovation...is misleading. Even when a new technology does upend an old one...the effect begins very slowly, gathers pace gradually and works by increment, not leaps and bounds. Innovation often disappoints in its early years, only to exceed expectations once it gets going.'

I have called this lecture, 'Enemies of Innovation'. To overcome enemies you need heroes, or even the super-heroes my grandchildren tell me about.

Those heroes will, within a corporate enterprise, be able to create, contribute, cooperate and coordinate to make innovation a success.

Heroes are the team members, including the engineers, but I hope you will appreciate that one of the heroes needed to build the defences and sometimes lead the attack against the enemies of innovation is an indispensable engineering educated lawyer!

Raymond Joyce

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The Financing and Engineering of Space Technology

Promoting Engineering in the City of London seminar, 11 November 2020



Photo: Inmarsat

Ground Control - an Area where the UK space industry has significant competence

Wednesday 11th November 2020 saw the latest seminar in the series of joint events between the International Bankers and the Engineers Livery Companies in our campaign to share engineering innovation and strategic technology opportunities in the City of London. Originally scheduled to be held in the Guildhall Club due to the COVID-19 restrictions it was held 'virtually' with 75 members in attendance.

The event explored the strategic significance of the space industry to the UK economy, its technical maturity, investment horizons and risks. The intent was to introduce members to the opportunities for profitable investment in current and developing space markets.

A panel of experts presented the opportunities and challenges to the UK manufacturing base, supply chains and the economy.

The seminar was chaired by **Guy Saxton, Liveryman, WCIB**. He introduced: Prof Sir Martin

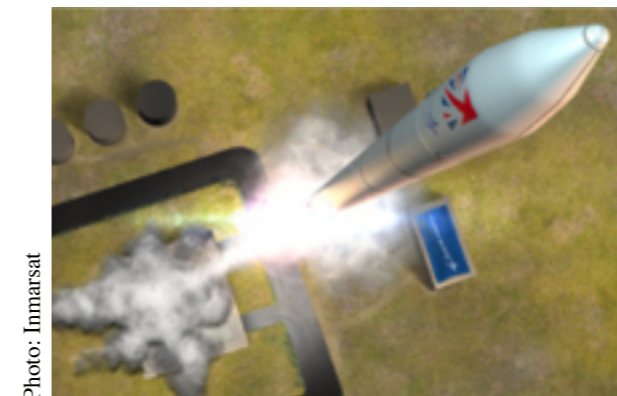


Photo: Inmarsat

Blast off from a proposed UK launch site

Sweeting OBE Executive Chairman SSTL chairman Surrey Space Centre, Dr Alice Bunn International Director UK space agency, Will Whitehorn President UK space (trade association of UK space Industry) and former CEO Virgin Galactic, Nick Shave Vice President Strategic programmes Inmarsat and Mark Boggett CEO Seraphim Capital (Seraphim Capital a London based venture firm that recently launched Seraphim Space Fund).

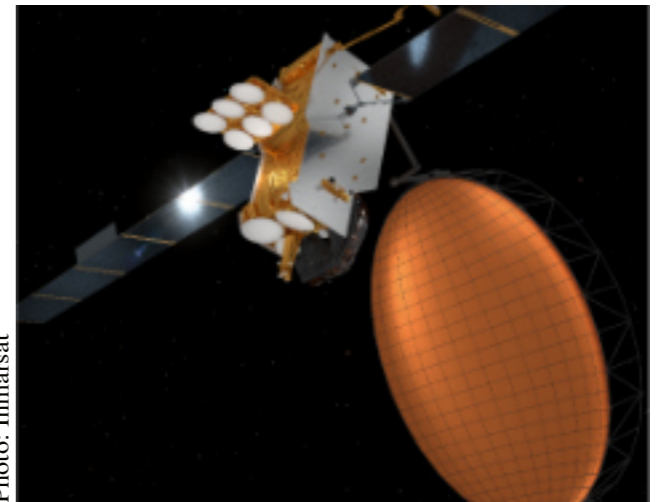


Photo: Inmarsat

UK-built Inmarsat geostationary communications satellite with deployed antenna

The panel explained how Space technology is fundamental to all aspects of everyday life, from weather forecasting, remote sensing, GPS and broadcasting. It has enabled a step change in applications, including integrated unmanned transport systems, large scale logistics, supply chain management, large dataset geotechnology, climatology and land management, surveillance. At the same time ubiquitous dependence of critical infrastructures on space technology exposes vulnerability to harsh environments, space debris, limited accessibility, cyber and physical attack and 3rd party and political uncertainties.

The presentations were followed by a series of question ranging from, does Government have to support future space ventures to risks from space debris. As Alice put it, the questions could have gone on forever!

John Owen

Low carbon leadership within the City

During his year as Master, Prof Masterton has been particularly keen that the Company should do its part in advancing the low carbon agenda.

Livery Climate Action Group

The City and Corporation of London launched a Climate Action Strategy in late 2020. It sets out a series of Actions in three areas to:

- Support the achievement of net zero (greenhouse gas emissions)
- Build climate resilience
- Champion sustainable growth

Alderman Alison Gowman was a key facilitator of the Climate Action Strategy, and in December 2020, reached out to a selection of the Livery Companies, including the Engineers through the Master and Senior Warden, to explore whether the Livery Companies could support the City's Climate Action Strategy, and how.

A seminar chaired by our Master on 26 January 2021 was designed to test whether there would be interest. Over 200 attended and multiple volunteers signed up to help. These offers crystallised into a series of workstreams on Investment; Property; Education; Wider Influence; Livery Charter and actions aligned with COP26.

Gordon Masterton co-chairs the overarching Group with Alderman Gowman and is leading the drafting group for a possible Charter. The Senior Warden and Middle Warden are members of the Property Group. Other Companies involved include the Constructors, Water Conservators, Chartered Architects, Guild of Investment Managers, Merchant Taylors, Fuellers, Wax Chandlers, Chartered Surveyors, Investment Bankers, Gardeners, Information Technologists and many others.

A second seminar on the UN Sustainable Development Goals was organised on 15th April 2021, with speakers from the MacQuarie Green Investment Group. The Lord Mayor introduced it, stating his intention to be known as the "green Lord Mayor". The YouTube videos of both seminars can be viewed on our YouTube Channel.

At the meeting of the General Group on 20th April, the Master gave an overview of a possible scope, purpose and timeline of activities for what has been agreed to be the Livery Climate Action Group, with the target to launch to the wider Livery:

- A Livery Climate Action Charter;
- Two or three exemplar Climate Action Plans from Companies in the vanguard (ideally ranging from a large hall-owning company; a medium-sized Company close to practitioners in carbon reduction measures or resource minimisation, etc; a small Company with no obvious professional expertise.);
- Three or four Guidance Notes on how to make a practical contribution;
- A web presence for information and further guidance.

A suitable platform is to be identified during CoP26, perhaps for telling the story of how the Livery Companies with their 110 spheres of influence are supporting the City of London's commitments.

The initiative is building momentum and the Worshipful Company of Engineers is at its heart.

Immediate Past Master, Prof Gordon Masterton



Achieving Net-Zero – the challenge of delivering zero-carbon energy systems

[one of a series of seminars promoting Engineering in the City of London]

Speaker:

Tony Roulstone, University of Cambridge

Panellists:

- Professor Michael Mainelli
Chairman Z/Yen, Sheriff of the City of London 2019–21
- Prof John Neil Loughhead, CB OBE
Chief Scientific Adviser, BEIS 2014–20
- David Orr, Senior VP Nuclear, Rolls-Royce plc 2016–20

Introduced by:

Gordon Masterton, OBE DL

Chair of Future Infrastructure, the University of Edinburgh
Master, the Worshipful Company of Engineers



The Worshipful Company of Engineers

(Incorporated by Royal Charter 2004)

Promoting Engineering in the City of London



with

UK Collaboratorium for Research on Infrastructure & Cities

Centre for Systems Engineering & Innovation

Imperial College London

Wednesday 10 February 2021 - 17:45 for 18:00 to 19:15

A Systems Perspective on Net-Zero Infrastructure

This Zoom seminar is part of the Engineers Livery Company's initiative to share knowledge of current engineering and technology issues relevant to the City of London.

Aim:

To highlight the broad challenges facing the City of London to achieve its Carbon reduction and sustainability ambitions, and the significant opportunities these ambitions yield.

Flyers from recent low carbon events hosted or co-hosted by the Company.

Radars Against the U-Boats

Virtual Soirée No. 14, 24 November 2020



Photo © IWM ATP 11240C

ASV Mk II on a Wellington GR XI

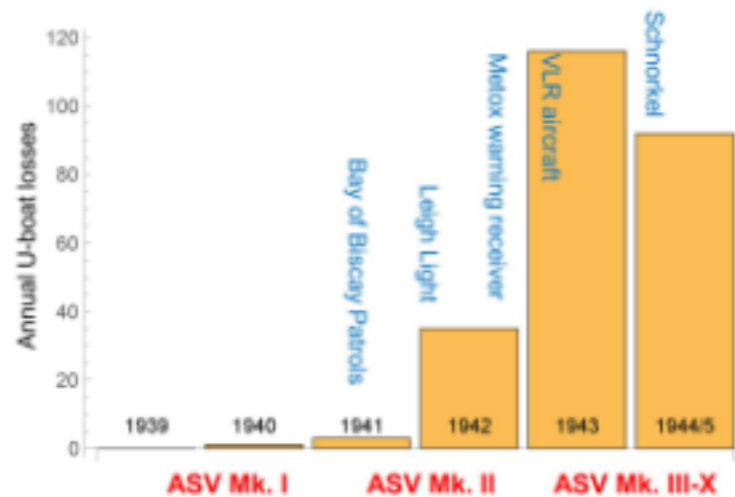
After Hitler's plans to invade us in 1940 were thwarted by the RAF, he turned his attention to inflicting unacceptable losses on the commercial shipping that brought us vital food, fuel and munitions. The U-Boat was his weapon of choice in that battle, the Battle of the Atlantic.

The U-boat campaign was initially very successful. Allied shipping was suffering grievous and, by 1942, unsustainable losses at the cost of very few U-Boats. However, a combination of Allied tactics, signals decrypts and technology turned the tables to the extent that during the first half of the War a U-Boat and its crew were destroying more than 20 ships before they were sunk, whereas by the last half of the War that same combination might only be sinking two ships each before they in turn were destroyed.

Much of this success was due to the development of airborne radar, known in service as Air to Surface Vessel (ASV) to detect submarines when they were surfaced, something that they usually had to do at night to charge their batteries. Drawing on his long career associated with radar development, **Liveryman Simon Watts** gave 95 of us a fascinating insight into the development and deployment of ASV, and the countermeasures that the U-Boats employed to try to defeat it.

A radar set was first flown in an RAF Anson in 1937 and it detected ships on its first flight, but by the end of 1940 only 50 aircraft had the equipment installed (ASV Mk I). It could indicate target range and whether it was to the left or right. It was soon replaced by ASV Mk II with improved reliability and

performance, able to detect a submarine conning tower at up to 12 miles. This was extremely effective when later combined with a Leigh Light, an aircraft mounted searchlight switched on only seconds before the final attack, giving the U-Boat no time to dive. The secrets of ASV were freely shared with our American allies and by the end of 1941, hundreds of RAF Coastal Command, Fleet Air Arm and US Navy aircraft had the equipment installed. U-Boat sinkings started to increase.



Annual U-Boat Losses to UK and US Land-Based Maritime Aircraft (graphic- Simon Watts)

However, equipment installed on U-Boats during 1942 allowed them to detect the ASV radar signal at long range, allowing them to dive even before they were picked up. Fortunately, the development of the magnetron permitted the use of much higher frequencies that they could not detect and ASV Mk III was deployed in early 1943 using

this technology. It had a detection range of up to 20 miles and the addition of a Plan Position Indicator (PPI) that gave better situational awareness for the aircrew. The U-Boat fleet eventually countered with the snorkel, allowing U-Boats to charge batteries while just under the surface, and with radar absorbent materials but these came too late to affect the Battle's outcome. Together with the introduction of the long-range Liberator patrol aircraft, ASV Mk III and its successors made a major contribution to the Allied victory in the Battle of the Atlantic.

The evening concluded with a lively Q&A session and the usual toast to the Company.
John Chandler

Liveryman Simon Watts joined EMI (eventually Thales UK) in 1967 as a student apprentice. He spent much of his career researching radar signal processing on the Searchwater radar used in the RAF Nimrod and then developed for many other platforms.

Christmas Dinner 2020

Thursday 10th December saw 123 members of the Company come together for its annual Christmas Dinner. As with all meetings during COVID times the event was held online and what a challenge that must have been for everyone involved with its organisation. I am sure that I speak for everyone in the Company when I say a very big thank you to everyone for their efforts in getting it to work. If I may be permitted to deviate for perhaps a sentence or two I think the Company has been magnificent in its achievements with online meetings during these testing times.

I digress! Noble House catering supplied us with our traditional Christmas dinners which were delivered the day before and we prepared them ourselves in parallel with the evenings proceedings.

The evening started at 6:30 with a welcome from the Master who handed over to our Chaplain, Peter Hartley, to take us through a wealth of carols. This

was a superb collection and once again mention must be made of the terrific amount of effort that must have gone into preparing the recording. I am sure that off microphone most of us were joining in with the words and singing along merrily.

Many of us recall with great fondness our annual attendance at the Chapel Royal in the Tower of London and this online event served to remind us of how lucky we are to enjoy this event every year. It is one of my personal favourites in our calendar. Nevertheless our enjoyment and friendship came together in jollity and song to create a wonderful evening.

The one thing that stood out in my mind as we came together was my usual role juggling a clipboard, pen and torch with frozen hands checking everyone in through the gate. I am looking forward to frozen fingers again in 2021!

Dave Cooper

Burns Night 2021

The first recorded Burns celebration was held in 1801, where a group of his good friends gathered – and so was born the legendary Burns Supper, held annually to mark the birthday of Robert Burns. Lovers of his poetry and song-writing gather together in countries all around the world to pay tribute to his life and works. On Tuesday 26 January, expertly coordinated by the Master Engineer, the Company ran an exceptionally successful Burns Supper via Zoom. The virtual nature of the evening did not lend itself to a full and lengthy Burns Supper programme, but a more suited and lighter version was formulated with music, singing and recitations of Burns' work, tapping in to the talents of members of the Company.

Following a welcome by the Master the Honorary Chaplain delivered the Selkirk Grace and guests

moved to their first rooms for their first course, before returning to observe the "Piping in" of the Haggis (credit to Sandy Wedderburn) followed by the "Address to the Haggis" (thanks to the Master) and then the Toast to the Haggis. Guests then moved to their next rooms for their main course before returning for pipe music and recitals and then onto their final rooms for the third course returning again for more recitals, closing remarks by the Master and, giftedly led by Natalie Masterton, a rendition of "Auld Lang Syne" where we were all invited to join in (on mute!). The evening continued with a few more "wee drams" before closing.

A fabulous night was enjoyed by all with highland dress and black tie with tartan accoutrements prevailing. A huge thank you to all those involved in making a night to remember.

Paul Mayo

Ale Conners, Flesh Tasters and Fire Raisers

Virtual Soirée No. 15, 15 December 2020

Presented by **Court Assistant Richard Nevard**, one of the most intriguing soirée titles to date, that attracted an audience of 74 including one guest, unveiled a story of complex and bizarre rituals, steeped in history and privilege, some dating back to Roman times, involving leather shorts, wet ale-soaked chairs, and all in the name of quality control.

Richard noted that those who attended the mid-summer election of Sheriffs at the Guildhall may recall being invited to vote for 4 Ale Conners and 2 Bridge Masters too; the plot thickened. He then went on to explain what an Ale Conner was, what they did, and why was this once considered to be one of the most privileged positions and its relation to modern day quality assurance, applied to the production and sale of ale and beers, hence lots of drinking.



Medieval Ale Conners pictured hard at work

Turning the clock back, he cited the first documented mention of the Ale Conner was in 1159. A time when two gallons of ale would cost just 1d. However, even with what to us appears as an incredibly affordable gallon, watering down was commonplace, and it was the task of the Ale Conner to sample the stock at the various City watering holes under a modern-day equal of Environmental Health and Trading Standards.

Watering down may seem a trivial offence, but in the days when water was often contaminated, and large parts of the population survived on ale and beer it was a major health concern.

The most intriguing part of the talk now follows where Richard explained that one of the tests was for the Ale Conner to don a pair of leather trousers, to pour ale on to the seat of a wooden stall and then to sit on it for a period of 10-minutes. Simply, if when he stood up the chair was stuck this would indicate that not enough of the brew's sugars had been turned

to alcohol, rendering the ale or beer unfit to drink as it may still contain deadly bacteria.

Now on to the Flesh Tasters. This title sounds like it has come from a 1960's Hammer horror film, but in reality, it is the name given by the Butchers' Livery to their quality assurance officers titled Flesh Tasters or sometimes a Flesher. With their jurisdiction,



A Plate fit for a Flesh Taster

extending for 1 mile beyond the walls of the City, the Flesh Tasters were the forerunners of the modern meat inspectors that now control quality at Smithfield Market ensuring that horse is not passed off as beef etc.

Richard then went on to talk about his own livery for which he was a Past Master, the Upholders, whose tasks included ensuring the quality and safety of stuffing used in furniture. He highlighted instances of fraud back in the 14th Century with the French cited as using a variety of unorthodox materials for stuffing including soap ashes, pigeon feathers, mixtures of wool, straw, quills, rotten matter and burnt feathers.

He concluded by talking briefly about some of the other Liveries and their involvement in quality control, including the Gunmakers, Goldsmiths, Armourers and Brasiers, which incorporated the Blademakers, and finally the Fishmongers.

In all, a very entertaining talk, enjoyed by all, providing a link between modern day quality control and the heritage of our City's Livery Companies.

Brian Back

Court Assistant Richard Nevard's career in project management has touched on quality in a wide range of manufacturing industries. A Fellow of the IMechE, he is now OEM Commercial Manager for Brigade Electronics Group who supply automotive safety equipment worldwide. He has been involved with Livery for many years and as Master Upholder was the youngest Master in the City in 2008.

Animal-inspired Robotics

Virtual Soirée No. 16, 12 January 2021

For our 16th soirée, **Liveryman Ivan Mactaggart** described his work with Animal Dynamics, a company whose objective is to improve engineering designs by learning from nature. 101 people attended, including 12 who had attended the potential new members' event earlier in the evening.

Ivan explained that the emphasis of Animal Dynamics is not on mimicking nature but learning from it using recent advances in computational analysis that allow them to build deep insights into how performance gains are achieved in nature. This arose from questioning key assumptions such as whether the propeller is the appropriate solution to propulsion through water and air or the wheel over land.

Founded in 2015, Animal Dynamics develops autonomous vehicle systems using insights from evolutionary biomechanics with cutting-edge engineering and software to develop unmanned aerial vehicles and other devices that are improvements over conventional designs. Examples are: a flapping propulsion water-based vehicle, using scientific insight into fish and cetacean movement, leading to efficiency improvements over traditional propeller designs; a small-scale drone with flapping propulsion designed to have lower power consumption for an increased range and to tolerate various wind and environmental conditions and which is based on the flight mechanism of dragonflies; and, as described by Ivan in his talk, a flying device based on birds' wings, which Animal Dynamics have called the 'Stork'.



Photo: Animal Dynamics

The Stork is intended to be a highly versatile autonomous unmanned aerial vehicle (UAV) for transporting large payloads at low cost and relatively small vehicle size and over long distances. Its design combines parafoil technology, similar to a stork's wing, with artificial intelligence software. Stork is intended to be deployed in real-world conditions to solve real problems and save lives.

Ivan described how Animal Dynamics scaled-up from research and development excellence in animal

Photo: Animal Dynamics



inspired biomechanics and to produce complex robotic systems through the use of sound Systems Engineering principles. From having no previous capability, he described how they identified, developed, and implemented a model-based systems engineering (MBSE) function that facilitated the design, build and certification of a first product. There were significant challenges in this such as recruitment of appropriately skilled engineers, identifying competency needs, developing in-house processes and evaluating and selecting appropriate tools. The advantages of this approach however were that it allowed them to establish clear objectives, follow a process, coordinate the activities of each business function (not only engineering) and to stay within the constraints of utility and affordability. It also facilitated rapid development and early safety certification.

The result was a vehicle with high payload capacity, long range, very short take-off and landing (VSTOL), a robust, damage-tolerant canopy with graceful failsafe mode and easy repair, autonomous guidance and navigation in both GPS and GPS denied environments, long-range silent glide for covert operation, and the ability to operate in a fleet.

There are currently two versions of the Stork: one that can carry a 10kg payload a distance of 40km and a larger vehicle in development that can carry loads in excess of 150kg over hundreds of kilometres. Potential applications are in delivering humanitarian aid, logistics, emergency response, conservation, agriculture, and defence and security.

A lively question and answer followed during which more questions were raised than could be answered in the available time.

Chris Elston

Liveryman Ivan Mactaggart is Past President of the International Council on Systems Engineering (INCOSE) UK and a member of the Engineering Council Quality Assurance Committee. He is an IET Fellow.

The Thames Barrier

Virtual Soirée No. 17, 24 February, 2021



Photo: Aleem Yousaf (cropped) <https://creativecommons.org/licenses/by-sa/2.0>

Soirees have become the mainstay of keeping the Worshipful Company connected whilst it is not possible to meet in person. I really enjoyed joining the then record breaking (117 members and guests virtually attending) presentation by Dr Graham Owens on 'Saving London from flooding since 1984 -The Thames Barrier'. Dr Owens began with a heartfelt thank you to Dick Tappin, one of the original Thames Barrier designers who had helped with his presentation and visuals.

To understand the reason behind the barrier you first need to understand flood history. The biggest flood of the last century was in 1953. The combination of spring tides with a low air pressure over the North Sea caused the water levels to rise. Add a northerly gale and this was blown down the east coast through Lincolnshire, Norfolk, Suffolk, Essex and Kent. Three hundred lives were lost with fifty-nine on Canvey Island in the Thames Estuary. A further eighteen hundred individuals drowned in the Netherlands from the same storm. As a low-lying estuary, a large area (48 square miles) of London remains at risk of similar storms. Had the 1953 storm hit London it was predicted to paralyse the city for at least six months meaning a solution needed to be found to prevent this happening in the future.

Forty-one different schemes were considered for the Thames Barrier including: high/low retractable gates, submerged gates hinged at river level, vertical lift gates, swing bridge gates and floating barriers. All were found to be ineffective.

Charlie Draper it is said, dreamt the solution we see in place today whilst in his bath or possibly through inspiration of a simple gas tap in his home. The barrier is constructed of 4 large and 2 small rising sector gates with infill panels to give coverage across the river at Woolwich.

The strength in the design is the third rotating position enabling regular maintenance fully out of the water whilst still in situ. Part of the reason the barrier is in such good repair today nearly 40 years later.

Construction of the barrier followed some significant steel structure failures in the early 1970's. This resulted in a 1/6th scale model being built which is where Dr Owens began his involvement with the Thames Barrier. The gentleman seen in the picture fitting strain gauges, gives an indication of the scale of the test piece.

On completion of the tests the full size structures were built on the sides of the Tees before travelling down the North Sea to the Thames ready for installation. The gate arms required tricky installation lifts in tidal waters up to 3½ knots. The gate arms each weighed 1300 tonnes and the gates 1400 tonnes, both significant weight lifts of the time and involving dual lifting barges. The web in the final picture is greater than the vertical design of Mr Draper, to bring more height to the top of the gate and allow some water under the gate to mitigate the impact of tidal surges rebounding back down the Thames.

In 38 years of operation there has been 15 collisions with the barriers. The first being the Sea Merlin which hit the completed barrier with 1500 tonnes and circa 15 knots. The Sea Merlin received greater damage than the barrier which sustained minor damage to a single panel. In the remaining collisions the ships have always sustained more damage than the barrier.

The barrier has been used over 150 times in the 38 years of operation with 2014/15 seeing operation 50+

Liveryman Dr Graham Owens has had a 44 year career in Structural Engineering, the second half as Director of the Steel Construction Institute. He is a Past President of the Institution of Structural Engineers and became an FREng in 2006. He worked on the Thames Barrier when he was a Research Assistant and Lecturer at Imperial College in the 1970s and '80s.

times due to high river flows coming down the river raising river levels which then surged on the incoming tide.

With the continued tilting of England and the increased weather patterns resulting in 1cm increase of flood heights per year it can be seen the limits of the barriers are being encroached and

flooding is increasing downstream of the barrier whilst the barrier protects London.

The challenge now faced is to design and build a new solution to protect London through the prevention of the Thames flooding by 2070. Will this be a conventional or different radical solution? Time will tell.

Heather Clarke



Gate leaving the Tees



Under construction



In operation

Photo: Environment Agency

"All that Glitters is not Gold"

Virtual Soirée No. 18, 23 March 2021

The eighteenth evening presentation was delivered by **Liveryman Dr Edmund Morgan-Warren**. The evening was hosted by the Master and the Assistant Clerk Sandra and was attended by a total of 96 members, partners and guests.

Gold: its Antiquity and Properties

A biblical reference to the refinement of precious metals including gold, appears in Zechariah 18 Verse 9 of the King James Bible. We may deduce an existence of at least 500 BC.

Gold is versatile. It is reflective, ductile, a good conductor of heat and electricity and malleable, thus resisting corrosion. This suggests other uses apart from jewellery and golden artefacts. A good example is its use in dentistry.

Hallmarking: its History and Importance

Hallmarking is Europe's earliest form of consumer protection. It first appeared in France in 1260 in a Goldsmiths Statute. In England in 1327 King Edward III granted a charter to the Worshipful Company of Goldsmiths headquartered at Goldsmiths Hall, from whence the English term 'hallmark' is derived.

The full traditional hallmark appears as a horizontal row consisting of five consecutive 'marks'. These are as follows:

Sponsor's Mark. This is the registered mark of the company or person that submitted the article for Hall marking. It comprises the initials chosen by that person or company inside a surrounding shield shape. A minimum of two and maximum of five initials must be included.

Traditional Fineness Symbol. This is an optional part of the hallmark, but applied as a standard of the Goldsmiths Company Assay Office

Millesimal Fineness Mark. This tells you how fine, or what quantity the metal is as well as indicating the metal type. This numerical format was made compulsory in 1999 and shows the precious metal content of the article expressed in parts per thousand.

Assay Office Mark. In 1478 the Assay Office was established in the Goldsmiths Hall which then bore the title of the 'Goldsmiths Hallmarking and Assay Office'. In 1773 other hallmarking and assay houses were established in Birmingham, Sheffield and Edinburgh, each with their own assay office mark.

Date letter Mark. A non-compulsory mark. The date letter changes annually on January 1st. The font, case and shield all change. So each can only indicate one specific year.

Commemoratives

Items of special interest may be commemorated in the traditional hallmark by adding an additional (sixth) symbol. Prominent are royal anniversaries, the symbol being the crowned head of the sovereign. An example is a sapphire and diamond ring dated 1895 coupled with a golden wedding ring dated 1871. These both bear Queen Victoria's crowned head.



Wedding ring London 1871, 22 ct gold

Diamond and sapphire gold ring, Chester 1896, 15 ct gold

The Vienna Convention, 1972

In the modern world, in an attempt at standardising the legislation on the inspection of precious metals, and to facilitate international trade a core group of European nations, including Great Britain, signed the 'Vienna Convention on the Control of the Fitness and the Hallmarking of Precious Metal Objects'. Articles which are assayed and found by the qualifying office of a signatory country to conform to the standard receive a mark known as the Common Control Mark (CCM) attesting to the materials fitness.

The multi-tiered motif of the Convention is the balanced scales superimposed for gold on two intersecting circles, for platinum a diamond and for silver a mark in the shape of a Latin letter M.

The evening concluded with the traditional toast to the Company.

Peter Chapman

During a distinguished career in metallurgy Liveryman Edmund Morgan-Warren developed special interests in welding and nuclear consultancy. He has been awarded Fellowships by the Nuclear and Welding Institutes and the Institute of Materials, Minerals and Mining.

The Rother Valley Railway

Virtual Soirée No. 19, 13 April, 2021

Continuing the series of evening video presentations. Liveryman Gardner Crawley provided an insight into the past, present and future of the Rother Valley Railway (RVR). As Chairman of the Heritage Trust, he has been involved in its preservation since 1961, following the line closure. The evening was facilitated by our Master, Gordon Masterton, supported by Assistant Clerk Sandra. Gordon welcomed 20 potential new members of the Company and 74 members, guest and associates. He remembered the Duke of Edinburgh, the first Honorary Liveryman, who died 9th April 2021, followed by prayers and one minute's silence led by the Reverend Peter Hartley, Hon. Chaplain.

The Master introduced Gardner who outlined the line's history. In 1896, the Kent Weald and East Sussex were devoid of railway connections. An Act of Parliament was passed for a railway from Robertsbridge, East Sussex on the London to Hastings line to Tenterden, Kent, following the courses of the River Rother. By 1900, Tenterden had a light railway which in 1904 was extended to Headcorn. It was taken over by British Railways in 1948. Dr Richard Beeching, an Old Maidstonian, was appointed the first Chairman of British Railways, in 1961. Under his plans, the line was closed in June

Later that year, Gardner, Tony Hocking plus two other Maidstone Grammar School pupils started the Kent and East Sussex (K&ES) Preservation Society, which adults soon took over.

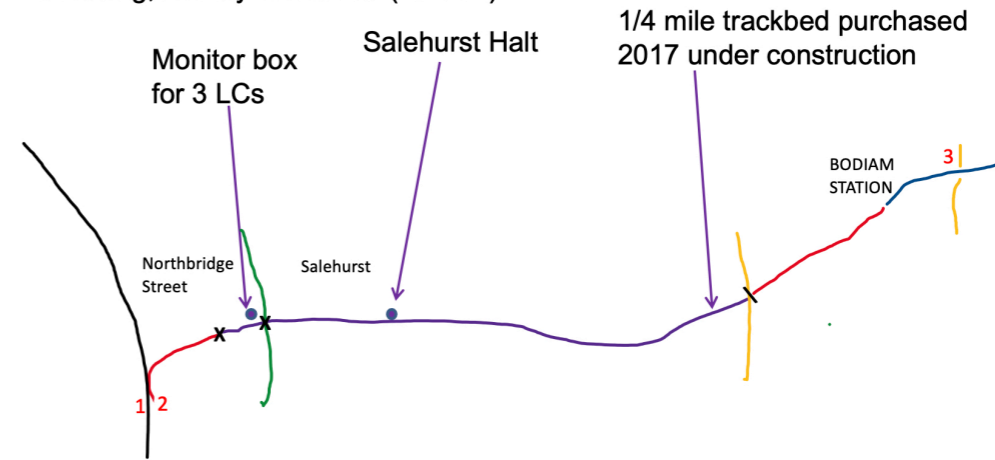
The Rother Valley Railway was re-born in 1992 as a Registered Charity. The RVR Heritage Railway Trust was formed to provide access to the area and promote tourism. It purchased the trackbed from Tenterden to Bodiam. This track was gradually reconstructed, extending westward from Tenterden, reaching Bodiam Station by 2000. Passenger trains ran again!

RVR achieved this by:

- Funding from private donors;
- Planning, design, and project management by volunteer railway professionals (RVR Limited);
- Donations of materials and equipment;
- Construction by local companies;
- Track laying by volunteers (RVR Supporters Association).

The challenge remained to link the K&ES railway to the Network Rail line from Hastings to London,

X = Full Barrier Automatic Level Crossing, Locally Monitored (AFBCL)



- (1) Robertsbridge Mainline Station (Network Rail)
- (2) Robertsbridge Junction Station (RVR - Under Construction)
- (3) Bodiam Station (K&ESR)
- Rebuilt
- Missing Link (Planning Application Approved)

providing access for network rail passengers and road users.

In 2006, Rother District approved "An extension to the Kent and East Sussex Steam Railway from Bodiam to Robertsbridge", providing:

- No compromise to the integrity of Robertsbridge flood protection system;
- Acceptable impact on the High Weald Area of Outstanding Natural Beauty;
- Incorporate appropriate level crossings for the A21, B2244 at Udiam, Northbridge Street and the River Rother.

The first train arrived at Junction Road in 2011, 50 years after line closure.

Progress to date:

- Reconnection to Network Rail Main Line in 2015. NR were impressed by the professional railway volunteers' quality of workmanship;
- Sir Peter Hendy CBE, Chairman of Network Rail, formally opened the RVR – NR connection in December 2016;

Gardner showed a series of illustrative photographs:

- Locomotive "Sir Peter Hendy CBE" travelling over connection
- A locomotive on; commissioning trials at Robertsbridge Junction Station;
- Robertsbridge Junction Station – Salehurst Primary School visit also, construction of luxury toilet block;
- Environment / wild life issues;
- Junction Road to Austen's Bridge.

Liveryman Gardner Crawley was introduced to civil engineering aged 4 when his father took him down a tunnel. After working on construction projects in UK and overseas, Gardner is Chairman of Rother Valley Railway, a project he started in 1961.

In acknowledgment, RVR were Winner of the ICE SE Region Engineering Excellence Award for Community Benefit, July 2017.

Recently 3/4 mile of track has been reconstructed, connecting K&ESR track to Junction Road. At the western end, five bridges, with track laid from outside the station area to Northbridge Street. However, several other bridges, including River Rother Bridge, await reconstruction together with three automatic road crossings.

A Heritage Railways Parliamentary Group in 2013 estimated the local economy benefited by 2.7 times the railway's turnover, potentially £7m p.a. for RVR/K&ESR.

RVR heritage railway will provide tangible transport links, increasing tourism to benefit the local economy:

- Finance is in place for the construction;
- The Planning Application has been approved by Rother District Council;
- The Public Inquiry into the RVR Transport & Works Act Order will be held July 2021;
- Collaboration with the landowners and farmers established to address concerns.

A full Q&A followed, dealing with local authorities, number of locomotives owned, track profiles, insurance indemnity cover and obtaining Welsh steam coal.

Junior Warden Raymond Joyce acknowledged the success of the Master's Engineering Soirees initiative by presenting Gordon with a Scottish malt whiskey. The Master thanked Gardner for his interesting presentation and closed the meeting by proposing the customary toast to the WCE.

John Garside

LIVERY EVENTS

Election Court 16 March 2021

At the Election Court held by Zoom on the 16th of March 2021, the following were elected to serve for the year 2021-2022:

Dr Peter Blair-Fish, as Master;

Mrs Audrey Canning, as Senior Warden;

Mr Raymond Joyce, as Middle Warden; and,

Sir Michael Bear, as Junior Warden.

Dr Clive Hickman, **Dr Dolores Byrne** and **Mr David Knight** were elected unopposed to fill three Court vacancies as Assistants

Installation Court and Annual General Meeting 5 May 2021

During an Installation Court held virtually by Zoom, and following the Election Court held on 16 March,



Dr Peter Blair-Fish was duly installed as Master for the year 2021-2022. Outgoing Master, Prof Gordon Masterton, was wearing the Master's travelling badge for the occasion, which he duly removed. Dr Blair-Fish's wife Diana then assumed Beadle duties and attached her husband's Master's badge and chain of office.

The new Master noted that this was the second time that the installation ceremony had had to be conducted in this way. He sincerely hoped it would be the last and that there would be an in-person handover next year.

He paid tribute to Prof Masterton's mastership in this Covid-challenged year, during which the Company had been able to put forward a full programme of virtual events that had engaged a large number of members and guests, to expand its social media presence and to host a virtual new members' evening to continue our recruitment drive. In addition, the Company had been able to adopt a leading role in the City in the promotion of a low carbon agenda.

Dr Blair-Fish reflected that sadly there would be a need for events to continue virtually for some time because of constraints on venue capacity during covid but he and Diana looked forward in particular to being able to welcome members and guests in person their Out of Town event in Durham in September. This had been several years in the planning and Peter was pleased to report that there had been a strong expression of interest from members in attending.

The incoming and outgoing wardens had previously met in person, under terms of strict Covid compliance of course, to exchange badges and Mrs Canning and Mr Joyce were duly appointed as Senior and Middle Wardens, respectively.

Sir Michael Bear then made his declaration and was sworn-in as our new Junior Warden.

The Master said he looked forward to working with his Wardens over the coming year.

Dr Clive Hickman, Dr Dolores Byrne and Mr David Knight also made their declarations and were appointed as new court assistants.

The Installation Court was followed by the Company's AGM and then by a virtual Installation Dinner, hosted by the Master and Diana. This was a formal event, with 'black tie' and badges being worn. Entertainment was provided by Alan Hudson, a close-up magician who excelled in baffling diners with his tricks. The dinner concluded with the traditional Grace and toasts. Orchestration of the technology required was once again ably carried out by John Canning.

Forthcoming Events

Members might like to note the following:

9 June: The Junior Warden's lecture, '**From Fruit to Futures**'. Sir Michael Bear will reflect on how the City of London continues to adapt to new challenges and changing circumstances, including the changes wrought by Covid and the move towards virtual working.

26 June: **Visit to the gardens of Blenheim Palace**, picnic and walk of the Palace grounds boundary. Contact Audrey Canning audrey.canning@btinternet.com for details.

13 July: **The Annual Awards Ceremony**. This will be a virtual event on Zoom.

29 October: **The Annual Banquet**

Some notes on the Annual Livery Service 2021

We could not go to our usual church, St Vedast alias Foster, so the Service that followed this year's Election Court was virtual, on Zoom, and was led by our Hon. Chaplain, the Reverend Peter Hartley.



The unusual tower of St Vedast's Church with concave and convex storeys

The Service opened with Words of Comfort from Jeremiah 31:-

*"Your life shall become like a watered garden
Like a deep spring whose waters never fail.
Then shall your young women sing and dance
And young men and old shall be merry.
For the One who makes the sun shine by day
And the moon and stars glisten by night
Will turn your mourning into joy and give you
gladness instead of sorrow."*

The reading was by the Master, from I Kings 19: 4 – 11, the story of the exhausted Elijah collapsing under a tree, but being sustained by angels and by food and drink, for the onward part of his journey to meet his God.

In his sermon the Hon. Chaplain drew comparison with our own personal journeys through Covid and the long journey of our Livery through soirées and Zoom suppers whereby we have all been nourished and refreshed. We have indeed been travelling through a viral wilderness, but maybe there is just a glimpse of our destination ahead. How that will work out in practice is by no means clear, but it's unlikely to be business and activities just as before. "Let us build on those old ways with our new insights", he said.

Then followed a hymn, recorded in Norwich Cathedral, and prayers before a Blessing and departing organ music.



St Vedast's interior

The Master, Wardens and Liverymen of The Worshipful Company of Engineers send their best wishes to the Rector and the community of St. Vedast alias Foster.

They look forward to coming to the church again for their Annual Livery Service in March, 2022.

The Revd Peter Hartley, Hon. Chaplain

Photos: St Vedast's Church

Obituary

Dr Robert Hawley CBE BSc DSc FRSE FReEng CEng FIMechE FInstP FIEE HonDEng HonDSc

23rd July 1936 – 11th October 2020



Robert (Bob) Hawley was the 22nd Master of the Worshipful Company of Engineers

Born in Wallasey, Cheshire, he attended Wallasey Grammar School, with his higher education at Kings College, Durham University where he gained a BSc. and a PhD, followed by a DSc from the University of Newcastle.

His career focussed on electrical power generation, initially with C A Parsons Ltd where he gained promotion to Chief Electric Engineer and then Director of Production and Engineering. NEI took over C A Parsons in 1976 and Bob was appointed Managing Director of the Power Engineering Group. In 1992 he became the Chief Executive of Nuclear Electric plc and subsequently Chief Executive, British Energy plc.

He was an acknowledged international expert on power generation, energy and the environment and continued to promote the growing importance of nuclear power generation through his role as Vice Chancellor of the World Nuclear University, a global network committed to enhancing international nuclear education and leadership.

In 1987 he was awarded a CBE for services to the industry.

Throughout his career Bob was deeply engaged with professional engineering organisations being elected as President of the Institution of Electrical Engineers in 1996 and appointed as Chairman of the Engineering Council from 1999-2001. The work of the Hawley Group led to 'The Universe of Engineering' report and the creation of the Engineering Technology Board (ETB). He was a Fellow of the Royal Academy of Engineering, Fellow of Royal Society of Edinburgh, Fellow of the Institution of Mechanical Engineers, Fellow of the Institute of Physics, and First Class Member of the Smeatonian Society of Civil Engineers. He also had a number of Honorary Engineering and Science Degrees.

He was a life Member of the British Korean Society, becoming its Chairman in 2007 and subsequently Joint President where he was active in promoting closer understanding between the British and Korean people. His efforts were recognised by a succession of ambassadors to the UK from the Republic of Korea as well as the many friends of Korea living in the UK.

Bob was admitted to the Livery in July 1987 and became a Member of the Court in April 1995. His Master's year ran through 2005-2006 and included a variety of events including dinners, lectures and visits. His Out-of-Town event took place in September 2005 based in Newcastle upon Tyne where he had spent much of his professional life. We were all issued with Geordie Passports ("wi a veesor") and in anticipation of inclement weather a black umbrella which had a magnificent red lining- as it happened they were hardly needed. Visits to Bamburgh Castle, Robert Stephenson's Engine Works, Gateshead Millennium Bridge, the Sage Music Centre, Alnwick Castle Garden and Auckland Castle provided a very full itinerary.

He was a very strong advocate for improvement in the environment and to this end he secured donations from his many industrial contacts which provided a £5,000 contribution to the Charitable Trust Fund. Interest from this contribution is used to create an award named after his children and called the Fiona & Nicholas Hawley Environmental Award. Throughout his years with the Company he was enthusiastically and gracefully supported by his wife Pamela.

Bob Hawley had a passion for engineering both as a practitioner and as an advocate and you could never spend long in his company without him extolling the virtues of engineering as a discipline and its contribution to human progress. His years in the world of commerce were the era of true Captains of Industry and Bob was certainly one.

There is a poem composed many years ago specifically about Bob and focussed on his career entitled 'He talks of art in a turbine's blade'; it runs to six verses and includes the words 'Of early scouse with geordie'. He used both these two dialects to good effect on many occasions- if you were on really good terms he addressed you as 'Wack' like a proper scouser. He was a good friend to many and his smile and positive attitude will be long remembered.

Tony Roche, Master Engineer, 2008-9

HE TALKS OF ART IN A TURBINE'S BLADE

Of the poem in a jet of steam
Says beauty's about in the pulsing flow
That powers the electric beam.
Insists there's room in a craftsman's kit
For the spanner and the dream.

He's dared wax lyrical about
A dam. With great bravado
Lobbed Stephenson and Faraday
Up there with Leonardo.
Turned down the tired old Hobson's
choice
Of chips or avocado.

That autobiographic mix
Of early scouse with geordie,
Has charmed the technologic socks
Off Chinaman and Saudi.
Won unique honours from Korea,
All maxima cum laude.

He's tramped more bridges round
the globe
Than seconds in the hour,
From Sidney to Millennium,
Hong Kong to Tyne and Tower,
He's made the bridge our metaphor
For mixing sweet and sour.

He's seen, rewritten in the runes,
What energies flood forth

When sculptor crafts with
engineer
Some Angel of the North.
Just as when science, craft and art
First jointly bridged the Forth.

Where Parsons, Royce and
Reyrolle trod
He's been and doffed his hat,
But 'best' means always yet to
come
In Hawley's habitat.
Only Connect's his arbiter
Of where our future's at.

Written by Ralph Windle 'Profiles
of Our Business Greats'

Book Review: Voices on the Great Wall: He is Still Here



Béatrice Crawford (known in this Company as 'B') writes a travelogue of her "beautiful and unique adventure" along both the Great Wall in countryside China and the "tourist wall" nearer Beijing. B writes with openness on the deep question of grief and joy in coexistence. She shares her palpable grieving process 13 years after the loss of her young adult son, Eric. The heartache is mixed with the cathartic excitement of 68-year-old B's uncharacteristic solo adventure.

With B, you meet the local people who help tourists walk the steep steps and rough paths in the unrestored wall. She shares her interest in Chinese history and language. There is an insightful contrast of wild historic wall and commercial presentations of the restored stretches. There are human touches too: a European woman's search for privacy and facilities. The descriptions of lodging places, people, emotions, and the wall are vivid. You feel the pace of B's trusty boots and the hesitation at the top of a zip wire. You hold her as grief overtakes her and relish her moments of joy at the spectacular landscape.

In observing some of her healing, readers are gifted thoughts for themselves. It is an extraordinary memoir worth revisiting.

Carol Long

ISBN 978-1-849145-55-8
Béatrice Crawford
Voices on the Great Wall: He is still Here.
Completely Novel Books, UK 2014

Virtual Gin Tasting
27 April, 2021



On 27 April, 53 members and partners had the pleasure of taking part in a virtual gin experience by Zoom. Fortunately, there was nothing 'virtual' about the gin, which was supplied by Hayman's, who hosted the event. Members purchased in advance a selection of three gins and mixers and were guided through the tasting by Christopher Hayman, great grandson of Hayman's founder (and uncle of our own Liveryman and Court Assistant Richard Nevard) and brand ambassador and event organiser Daryl Beare.

We were taken through the history of gin as it has waxed and waned in reputation and popularity. We were shown the difference between 'Old Tom', an old fashioned gin, and the more recent 'London Dry' variety.

Gin is currently experiencing a resurgence in popularity, as I'm sure many members will know!

Chris Elston

Company News

The Immediate Past Master's Report

A summary of this report was presented to the Installation Court on 5 May 2021.



Despite the catastrophic impact on activities as a result of the Covid-19 pandemic, the Company is in strong financial shape. I also believe that, despite the loss of any face-to-face events or meetings for my entire year as Master, the Company has succeeded in retaining, and in many cases rebuilding, the bonds of fellowship with members. It has also increased its influence and visibility within the Livery movement and indeed its public profile beyond the community of engineering.

The main message from the Company Accounts is that we have returned a substantial operating surplus and rebuilt our reserves to be very close to the target agreed by Court in 2018. This has been partly due to the national lockdown curtailing activities and therefore, for example, not being able to offer hospitality to VIP guests at Livery Dinners. Despite the lockdown, it was encouraging that we increased our membership by 13 in 2020, with an impressive total of 32 admitted to the Freedom (the trend continuing with a further 20 declarations up to May 2021).

From the time that it became apparent that my original plans for the first part of the year had been thwarted by Covid-19, steps were taken to cancel or postpone venue bookings on a six-week rolling basis (in hopes of a speedy resolution!) and to plan an "Alternative Lockdown Programme" by appealing to members to propose topics for an "Engineering Soirée" comprising a 20 minute online talk to be followed by 30 minutes of interactive questioning, with time set aside for the Honorary Chaplain and Company news, concluding with a Toast to the Company. This format was successful and introduced many members' enthusiasms and talents to the wider Company. On some evenings, Middle Warden Audrey Canning organised a Zoom supper to follow on, and these were similarly very well supported. Planned seminars were converted to online webinars, as were a number of other social events.

Postponements and/or cancellations were to become the norm throughout the entire year, and the 2020/21 online programme eventually consisted of 19 Soirées, three seminars Promoting Engineering in the City of London, nine Zoom suppers, the Warden's Lecture, the Annual Livery Service, a virtual site visit to

Crossrail's Old Oak Common Depot, a wine tasting, a gin & tonic tasting, a banquet, a carol service and a Burns Supper. Numbers attending the Soirées grew steadily, with the highest attendance being 117 viewers from 90 log-ins.

A special effort was made in December 2020 to create a more formal online event. Members attended in formal wear, external catering was arranged to have a three course meal and wine delivered to our doors. The evening began with a carol service devised by the Honorary Chaplain featuring, by permission, King's College Choir Cambridge and a reading by the Master. The online platform then presented us with a seating plan of the Mansion House, and we could circulate around the room, then being seated in a group of six for the dinner.

After dinner, I announced the first seven inductees to the City of London Engineering Hall of Fame, culminating in Sir John Parker, Past President of the Royal Academy of Engineering and our VIP guest, who graciously accepted the honour. Other guests included the Masters or representatives of the six other companies that had collaborated in the Hall of Fame initiative (Ironmongers, Armourers & Brasiers, Shipwrights, Scientific Instrument Makers, Information Technologists and Water Conservators). Web pages for the inductees are under development and more inductees will be added each year, and more engineering-minded Livery Companies will be encouraged to join the founding group of seven.

Another initiative has been the launch of the Company YouTube Channel. Edited versions of seminars and talks have been uploaded to promote engineering and raise the profile of the Company. Since its launch in August 2020 it has had over 1800 views, 123 hours of watch time and 53 subscribers, reaching many more than the original event (292 in the case of the Hall of Fame inductees), and increasing the outreach of the Company quite significantly.

The website has been under review, and as a first step, I introduced a new Blog section, which has since had 26 member blogs of general engineering interest, with a lighter touch but a serious message. Some, on engineering responses to Covid for example, have had wide exposure through LinkedIn and Twitter. The Marketing & Communications committee with expert input from Freeman Simon Evans, has made many improvements in the Company's communications platforms, with more soon to come.

During 2020, we carried out a review of our bookkeeping requirements and put these services out

to competitive tender, JCA Accountants being successful. We are grateful to Livery Accounting Services for the services rendered from January 2018 to December 2020, and their support to this year's annual audit process.

I would like to pay special tribute to Colonel David Swann, our Clerk, who throughout most of the year has been combining his Company duties with caring for his wife Charlotte. A reduction in committed hours from January 2021 has been partly backfilled with temporary volunteers from the Company, including the Wardens Peter Blair-Fish, Audrey Canning and Raymond Joyce and Immediate Past Master Barry Brooks, but still supported by the Clerk whose expertise and guidance has been unstintingly provided to the Company through his oversight and assurance, despite difficulties in balancing his time. The Company should be very grateful for this. The Assistant Clerk, Sandra Watts, has been particularly supportive throughout this period, taking on additional responsibilities.

I would also like to thank the volunteers who have supported the last year through their work on committees, such as Almoner Barry Gasper, Honorary Treasurer Past Master Pat O'Reilly, Archivist Andrew Figgures, Swordsman Editor Chris Elston (starved of photographs of Livery Dinners this year!) and Honorary Chaplain Peter Hartley, who through the power of the internet, may have been seen by more members of the Company, and more frequently, than in a 'normal' year, all the more fitting for a year in which we have been acutely reminded of our spiritual needs and support. Special thanks are due to Norman Dawson (temporary Court secretary) and Norman Train (temporary F&GP secretary) for stepping up when the Company required extra assistance.

The Lord Mayor and the Livery movement in general, has also adapted to online delivery, and Lynda and I have settled down on many occasions for coffee with the Lord Mayor and Lady Mayoress and to view talks and demonstrations on many crafts from wood-turning to stained glass windows, and professional talks on future cities, fundraising through carol singing, and notable City events such as Armed Forces Day. So, although it is not quite the year we had bargained for, with no Livery dinners, Garden Parties or Ironbridge weekend where we would meet other Masters and Consorts, it was not entirely without sociable interaction!

The Company has supported Alderman Alison Gowman, a prime mover behind the City of London Corporation's Climate Action Strategy, and a prospective Sheriff, in efforts to engage the Livery in the journey towards Net Zero Carbon. I was asked to chair the inaugural seminar from which a number of working groups sprung, and I now co-chair the oversight group with Alderman Gowman, the aim being to encourage the Livery Movement to be

proactive in the varied ways they can contribute to a Net Zero Carbon future. The Senior Warden and Middle Warden also participated, and I expect our high-profile role in this initiative to continue.

It has indeed been a very different year, but Lynda and I have enjoyed growing our friendships within the Company, and in being as flexible and innovative as we could by devising at short notice, with considerable help from a supportive Company, a quite different year of activities. We wish incoming Master Peter Blair-Fish and consort Diana every success and sincerely hope that our face to face events resume within their year.

Gordon Masterton, Master 2020-2021

Honours and Awards

Chief Royal Engineer and Honorary Liveryman Lt Gen Sir Tyrone Urch, CBE, CEng FICE FInstRE was awarded a KBE in the 2021 New Year's Honours List in recognition of his role as Standing Joint Commander, in which he led the military's contribution to the UK's fight against COVID-19.

Liveryman Jane Atkinson, FEng FICHEM, E, Engineering & Automation Executive Director for Bilfinger UK, was made a CBE in the 2020 Birthday Honours List for her outstanding services to Chemical Engineering.

Liverymen Dawn Childs and Dick Elsy have been elected Fellows of the Royal Academy of Engineering

The editor would be pleased to hear from members of any new honours, awards and appointments.

Obituaries

The Company has been informed about the recent deaths of the following members:

Liveryman Professor David Newland FEng. Prof David died on 9 December at the age of 84 from pulmonary fibrosis. He joined the Company in 2000 and became a Liveryman the following year.

Liveryman Alan Howell. Alan joined the Company in 2017 and became a Liveryman the following year. Of particular note, and great personal pride, he was a member of the Inmarsat Team that won the MacRobert Award in 2010 for their Broadband Global Area Network (BGAN) service, providing internet data connectivity anywhere on the Earth which is widely used for remote connectivity for business, government, broadcasters, aid and relief agencies, and emergency services.

Continued overleaf...

Obituaries, continued.

Liveryman Thomas Mayer CBR FREng on 16 February 2021. Tom joined the Company as a Freeman on 1 January 1984 and became a Liveryman that July; his Livery number was 64. He was also a Fellow of the IET and the Royal Television Society

Liveryman Michael Selfe OBE FICE. Michael died on 22 April at the age of 91, following a fall from which he did not recover. He joined the Company as a Freeman in March 1993 and advanced to the Livery in January 1995. Michael's wife, Margaret, had predeceased him.

Liveryman Dr Michael Purshouse FREng FIET. Michael died on 2 May at home, surrounded by his family following a short illness. Michael joined the Company in November 2011 and advanced to the Livery in December 2021. He was a naval engineer and defence systems expert. He had worked for BAE SYSTEMS 1978-2000 (Fraunhofer-Gesellschaft, Germany 1981-84), Thales UK 2000-2012 and as an independent consultant since 2012. He was an Hon Fellow of Sidney Sussex College and President of the Cambridge University Engineers' Association 2012-2017.

New Liverymen

We are delighted to welcome the following to the Livery:

Mr Trevor Hirst

In April 2003, Trevor successfully completed a progressive military career of 22 years as an Artificer Vehicles in the Royal Electrical & Mechanical Engineers (REME). He achieved the rank of Warrant Officer Class 1 and served in a number of challenging and varied posts including UK, Germany, Cyprus, Canada and Brunei.

On leaving the Army, Trevor joined an Engineering Consultancy in Shropshire (Quorum) whose core capability is that of Supportability Engineering. He is the Operations Director, and his focus is specifically the strategic direction of the company and he is responsible for the planning and managed execution of current programmes.



Trevor is a committed and active member of the IET and provides support to many areas in the institution with particular focus on the volunteer community. He is also a STEM Ambassador and coordinates activities for schools and colleges in Shropshire and Staffordshire.

He enjoys keeping fit and is frequently seen pounding the lanes of the Shropshire countryside (running and cycling). He has recently completed a couple of half marathons and is presently training for a triathlon. Trevor's other keen interest is photography which allows him the opportunity to leisurely capture the Shropshire countryside with his 'happy snaps' (and possibly planning new routes for his running and cycling).

Professor Simon Jones

Simon Jones is a computer engineer and international higher education leader. He pioneered the design and implementation of application-specific processors. At the age of 32, he was appointed a full professor at Loughborough University and held the ARM/Royal Academy of Engineering Research Chair. He left the UK to take up a senior post at Massachusetts Institute of Technology where he directed the MIT Media Lab's overseas operations. Subsequently, his work involves creating STEM-based Research Universities in Central Asia, the United Arab Emirates and Oman. Nazarbayev University in Kazakhstan was a \$5Bn project to create a University, Science Park and National Laboratories in conjunction with 6 of the top 30 universities in the world including Cambridge, UCL, NU Singapore and Carnegie-Mellon. He was founding Provost and received a national award for his work there personally from the President of the Republic. Most recently he was the founding Vice-Chancellor of the National University of Science and Technology in Oman, merging 3 existing colleges into a single integrated institution. In 2021 he returned to the UK and advises institutions worldwide on higher education. In his spare time, he idles exceedingly well.



Dr Stefan Kukula

Stefan has had a varied professional life; following graduation he spent a year working in the nuclear industry, before heading off back to academia to study composite materials – largely because they are what you make rowing boats out of, and there was a chance to see how far he could get in the sport. Luckily, he enjoyed the subject, because he hit his limit in sport, and it led to an eventful seven years in

Japan working for Kobe Steel; a period which included being rendered homeless in a major earthquake and captaining the Japanese team in an international dragon boat competition. Back in the UK he has worked for Dyson, of vacuum cleaner fame, as well as materials companies ranging from multi-nationals to start-ups. He is now Chief Executive of the Engineering Equipment and Materials Users Association, an industry body for owners and operators of fixed engineering assets, expensive capital plant with high



degrees of hazard to people and the environment. He still rows, pandemic permitting; the ability to bob along the surface of rough water, literally and metaphorically, is not often cited as a life skill – but perhaps it should be.

Julie Wood

Julie is an Arup Director, an Honorary Fellow of the Association of Project Management, a Fellow of the Institution of Civil Engineers and an Honorary Fellow of the Royal Institution of Chartered Surveyors. She is an elected member of the Council of the ICE where she is leading a piece of work to increase the pipeline of major project leaders. She has over 25 years of experience in the construction industry much of this involved in the delivery of major complex projects. These include projects such as the Glaxo Group Research Campus, McLaren HQ, The Francis Crick Institute and most recently the HS2 Euston Station. Julie is also a member of the Council of the ICE, The London Mayor's Infrastructure Panel and a 'Freeman' of the City of London. She is a keen landscape photographer particularly long exposure shots. In fact, they are so good she is still a practising engineer.



Sue Threader

Sue Threader is a fellow of the Institution of Civil Engineers with senior-level experience in the public, private and charity sectors. She was the first woman and first engineer in its 620 year history to be appointed Bridge Clerk (Chief Executive) of the medieval Rochester Bridge Trust. She is the author of "Learning about Bridges" a learning resource for primary schools and the engineering advisor on the children's book "Lift the Flap Engineering" and recently appeared on Channel 5 with Rob Bell sharing her expertise on the history of

the medieval London Bridge. In 2016 Sue was awarded an honorary Doctorate of Science for her work to promote civil engineering, particularly to young people.

Sue recently led the multi-million pound refurbishment of Rochester Bridge, a challenging once-in-a-generation project. She is a member of the ICE Archives Panel and received an award for outstanding career contribution to civil engineering from the Kent & East Sussex Branch. She has been a finalist in the national Charity Chief Executive of the Year Awards three times.



Her two young sons keep her busy and in her spare time she enjoys writing articles and all kinds of craft – from painting to crochet, baking to papercraft.

Stephen Futter

33 years ago, I started my career as an apprentice toolmaker, the beginning of an illustrious career. A decade later, I took upon the role of designing and developing prototype laboratory equipment for Pfizer LTD as an R&D engineer.

In 2011, I joined Cummins Power Generation holding the roles of Mechanical Engineering and Technical Project Leader. I am currently Assistant Chief Engineer with global engineering product responsibility for HHP generator sets ranging from 38L - 91L, covering development and released products. I graduated with an MSc (Distinction) in Mechanical & Manufacturing Engineering.



Being an accredited Chartered Engineer and Fellow of the IMechE instils my passion to promote engineering. I am an IMechE PRI and sit on the PRC panel. Within Cummins I am the IMechE site administrator for Kent and Peterborough, sitting on the UK steering committee.

I am an avid sportsman. I have represented my County and Country at Cricket and Tae Kwon Do respectively. I hold multiple Black Belts in Tae Kwon Do and Shotokan Karate. I still play 5 a-side football and enjoy skiing with my family. I live in Margate with my wife Carol. We have three grown up children who have made us very proud parents.

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