



# Imperial ENGINEER



**LEIF ERIKSON**  
**ROAD TO DELHI**  
**HERTHA AYRTON**  
**SITTING IN A SPITFIRE**  
**ENCHANTED COTTAGE**

For members of City & Guilds College Association  
and The Royal School of Mines Association

ISSUE 23 AUTUMN 2015





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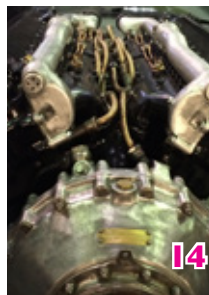
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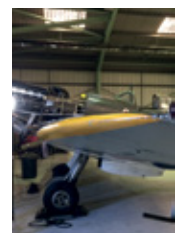
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**Front cover photo:**  
*MJ627 flying over Kent*

**Back cover photo:**  
*MJ627 in the Biggin Hill Heritage Hangar undergoing maintenance*  
(See pp14-17)



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STORY IDEAS FOR THE NEXT ISSUE BY FEBRUARY 1 2016

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As we slip quietly from late Summer into Autumn, and reflecting on the passage of time and the cycles in life, I want to start by drawing to your attention the sad end of one important cycle in any CGCA member's life – the life of Rogers Knight. An obituary starts on page 26; for my wife Jean and me, Rogers has been a constant in CGCA, being there from when we first got involved in the Association until earlier this year and encouraging us, as he did so many others, in all our activities.

Equally, Autumn brings a new term and the cycle of a new academic year, with many new students to Imperial – full, we trust, of hope and determination for an exciting, challenging and rewarding time engaging in all that IC has to offer, as well as their education! The new academic year also brings new officials in the Student Unions, and I am already looking forward to our first get-togethers with the new City & Guilds College Union officers and with department society representatives on 20 October. Your committees are continuing with their push to strengthen links with the Departmental Societies, to support students and feed back from our experience to assist the current students.

This issue of Imperial ENGINEER is in the middle of another cycle – reporting on this year's Annual Dinner at The Stationers' Hall and announcing next year's Dinner at the Fishmongers' Hall next to London Bridge – see the enclosed flyer/booking form. Friday 26th February 2016 is the date when Jean and I look forward very much to welcoming many members and their guests, and our Principal Guests and speakers Professor David Balmforth, the current President of the Institution of Civil Engineers, and Sarah Porter Waterbury, Imperial College's first Vice President of Advancement. The Dinner will be held 50 years since Jean and I started our studies at Imperial – yes really! – and we are aiming to encourage as many of our classmates as we can to join us!

Before then, I look forward to a particular pleasure of introducing a Past President of ICE and fellow CGCA member to speak at our Christmas lunch and seminar on Monday 14 December. My wife and business partner Jean will be speaking on her role of Chairman of the Nuclear Liabilities Fund and, amongst other perhaps more-important issues, will indicate how that role can possibly be linked to her previous experience in flood risk management! I hope we can fill the dining room at 170 Queen's Gate to capacity and look forward to seeing many of you there. The flyer/booking form is also enclosed with this copy of IE.

Finally, I have two more cycles for you, for both of which I invite – indeed request – your input.

- First, we are seeking your input to the cycle of events that we arrange for members and what kind of event programme you would find useful, enjoyable, worthwhile. I am delighted that General Committee member Charles Parry has taken on the role of Events Coordinator – please write to him with your ideas at [charles.parry81@alumni.imperial.ac.uk](mailto:charles.parry81@alumni.imperial.ac.uk).
- Secondly, at the strategic level, your Executive Committee has decided to embark on a strategic review of the Association's purpose and activities. Association Vice President Judith Hackitt is leading the project; please read the article on page 5 and send us your thoughts. I look forward very much to reading your input and working with Judith and many other members to determine the future direction for CGCA.



## Roger Venables

# PRESIDENTS REPORT



## John O'Reilly

I did not expect to be penning another missive for the Imperial ENGINEER but was conscripted by the committee to undertake another year as President. The period between the spring and autumn issues of this publication is always a quiet one in terms of RSMA and RSMU activities. The 2015 Annual General Meeting of the Association was held on the 25th June, followed by the final year Bar-B-Q, which was again well attended by the students plus a few stalwart alumni. Once again, Eddie Gadd donated 2 pints of his Ramsgate Brewery's finest ale which was much appreciated by one and all. The (unapproved) minutes of the AGM, including the President and Treasurer's report will be posted on the RSMA website.

The RSMA was again represented at the IC alumni reunion day in May and this is a great opportunity for alumni to meet old friends and to see the Imperial of today and to absorb all the innovations and frontier developments in research and education, that warrant Imperial's position as one of the world's top academic institutions. Des Kearns, President of RSMU in 1964-65 was a welcome visitor, from the USA, this year.

The 131st annual dinner will be held on Friday 27th November at the Rembrandt Hotel in Knightsbridge. It is hoped that as many members as possible will attend as this is the most significant event in the Association's calendar. A group e-mail will be sent out to all members with application for tickets attached. The Rugby World Cup saw a significant influx of overseas alumni into London, many supporting teams from their adopted homes and a reunion on Friday evening 23rd October in the Union saw the renewal of many old friendships, with the Southern Hemisphere visitors having bragging rights. Visitors over the period included Chris Molam (RSMU President 1966-67) from Harare; from Australia, Barry Sullivan (RSMU President 1968-69) and John Ballard; and from South Africa, Nick Icely, Roger Marshall and Dave Hodgson (see Chaps Club photos on page 5).

The student executives for this academic year are Sam Argyle, President, and Eleanor Bryant, Secretary. We look forward to a strong relationship in our continuing support of the RSMU. A good rapport has been developed with the student body which bodes well for the future.

Over the last few months there has been extensive dialogue with college to formalise an agreement on the type of access that the Associations will have to alumni and members' data held by the college, together with the membership reconciliation process. The Association position is that we require unfettered access to our members, including communications, appeal for funds etc. The discussions with the college's Development Department have been held in a spirit of collaboration and hopefully a formal agreement will ensue shortly that is acceptable to both parties.

It is recognised that the RSMA website is now in need of an overhaul with easier access to news and membership issues and with archiving of past events. This will be undertaken over the next couple of months. Members are welcome to post items that they feel may be of interest to fellow members (notification of reunions etc) and should forward them to the committee.

There are now 1974 RSM alumni registered LinkedIn and a strong presence on Facebook. The number on LinkedIn is interesting as we have fewer than half that number as paid up members to the Association (and some of those paid up members will not be on LinkedIn). There is therefore a need for a renewed push on membership that embraces all those alumni who have registered an affiliation with the RSM, through social media, but who have not formally joined the Association!

## Imperial's President on Imperial Engineers

On the 20th March, the CGCA Annual Dinner was held at Stationers Hall, with principal guest speaker Lord Berkeley. Imperial's President, Professor Alice P. Gast, responded on behalf of the guests and shared her observations on Imperial Engineers.

Mr Venables, Mrs Venables, Lord Berkeley, Ladies and Gentlemen

Thank you for your warm welcome to all of us on this marvellous occasion. As a chemical engineer for thirty-five years, it is a great honour to represent the guests here this evening and deliver a few words of thanks and appreciation on their behalf.

Thank you Lord Berkeley for an insightful and inspiring talk.

Thanks to President and Mrs Venables and the leaders of the City and Guilds College Association for your hospitality.

Founded in 1897, the City and Guilds College Association was established to 'maintain an effective connection between the present and former students and staff'. This is clearly what is happening tonight. It is wonderful to see so many members and their guests spending a delightful evening with students and friends.

This beautiful hall is the home of the Worshipful Company of Stationers and Newspaper Makers. The company was formed in the fifteenth century as a company for roaming text writers, illustrators, bookbinders or booksellers who set up stalls or 'stations' around St Paul's Cathedral. The company is thriving today with members working in new media as well as in traditional print and broadcast media. Perhaps their work is even more important today as they are now "roaming" across the world.

The company's Latin motto is translated as: 'The word of the Lord endures forever.'

The company has changed as the way we communicate has changed, but as the motto suggests, the power of language endures.

I have no doubt that this enduring belief in the power of language would give 15th century booksellers roaming the streets of London a strong affinity with today's publishers. Imagine the way Twitter would have improved communication among them.

The history of the Stationers shows us how traditions bind communities together. It also shows how traditions and disciplines adapt to meet the needs of changing generations.

Like the Stationers, Imperial's engineering disciplines have adapted and changed over time.

As engineering methods became increasingly relevant to medical challenges the discipline of bioengineering arose. The young field of computing now pervades every aspect of our lives and academic



Photo: Ziyuan Mao

disciplines. The foundational field of civil engineering has evolved and incorporated increasing amounts of environmental engineering into its research and education, to reflect the needs of society.

Since coming to London, I have had the pleasure to meet many Imperial engineers, past and present. I have been struck by the spirit of discovery, the passion for research and education, the sense of purpose. At Imperial, there is a compelling commitment to achieve enduring academic excellence and lasting benefit to society.

Whether they are current students and staff, or distinguished alumni, Imperial engineers share a common spirit which unites the generations.

**Firstly, Imperial engineers are great problem-solvers.**

They are able to address complex and challenging problems, whether at home or abroad.

For example, our civil engineering researchers have developed with Arup a low-maintenance and sustainable way to build seismic-resistant housing in developing countries, using local materials.

**Secondly, Imperial engineers are great collaborators.**

They recognise that problems are not solved without bringing ideas from multiple fields together.

Dr. Jindong Liu from the Department of Computing exemplifies this through his prototype robotic trout for

monitoring water pollution levels. Inspired by nature, his trout mimics natural fish movement with an algorithm that enables each body part to move in sync. Weighing in at around 4.7kg, Ichthus is a nice sized trout indeed.

**Thirdly, Imperial engineers are risk-takers.**

Their skills are such that they are confident when others are fearful, or out of ideas. You only have to look as far as those who fearlessly drive Bo', the City & Guilds Union mascot car from 1902, from London to Brighton every year, to see how risk-taking is embedded in Imperial culture.

**And finally, Imperial engineers are driven by a desire to achieve excellence.**

All of Imperial's Engineering departments are ranked in the top 5 in the research excellence framework peer-review exercise; the department of Civil and Environmental Engineering was ranked the top department in the country.

I am excited about Imperial because of this great tradition. I am also excited by the great opportunities on the horizon.

We are creating multidisciplinary hubs focussed on addressing major societal challenges. The first will be the Michael Uren Biomedical Engineering Research Hub at Imperial West which will bring engineers, medics and scientists together to create technologies and

treatments for healthcare.

We are also excited about the School of Design Engineering, which welcomes its first cohort of students in October this year. Keep your eye on our design engineers; they will be leading the world.

These opportunities are not without threats and great challenges in our world of knowledge and discovery. We must be especially diligent in addressing the threat to reliable and sustainable support for research and education; the threat to free flows of talent across our borders; and the threat of rigidity in a world of changing technology, social contracts and modes of learning.

I believe that our future success will be determined by our ability to rapidly and effectively engage in a connected, collaborative, and contributory world of research and education.

As the Stationers adapted, and as Imperial engineering disciplines have adapted, so we need to make this changing world work for us, not against us.

The power of the bonds and ties strengthened through events such as this evening's dinner are vitally important if we are to realise the opportunities, and address the challenges ahead.

Thank you all for supporting the College and the City and Guilds College Association. Thank you for being role models for our students.

Finally, on behalf of the Guests, I would like close by saying thank you to the City and Guilds College Association for a splendid evening.



## Shaping CGCA for the future

The Executive Committee of City and Guilds College Association (CGCA) has recently been giving thought to how we might need to improve our offering to past, present and future students and staff of the Engineering Faculty of Imperial College. Why? Well, there are several reasons. Here are a few of them:

- Membership numbers are declining. Despite efforts to attract people to the Association at the point of graduation, we are seeing a drop off in those who join and it becomes increasingly difficult to make contact with people once they leave College and move on to pursue their chosen careers.
- Despite holding a number of successful events, the level of engagement with CGCA is only a small proportion of our membership. Some of this may be because CGCA members are happy to simply be kept informed of developments at College via publications like Imperial ENGINEER, but we also have to look hard at whether the events we offer are the right ones to

attract participation.

- The level of activity being undertaken by the College in relation to alumni is increasing with the development department once again fully up and running. The Faculties and individual Departments are also being encouraged to develop their own plans for increased engagement of, and with, alumni.
- Although we have good participation by students at some events, the calendar of events for students is already pretty crowded. It is also proving increasingly difficult to identify what sort of interactions between past and present students would be most valuable to current students and would attract good levels of attendance. A recent careers event with a difference – where three alumni talked about how their career had developed and the influences they found important – was well received by those attending, and we will be seeking to repeat the format in different departments this year. But what else might alumni do to

really help students in their studies and as they step out into the world after graduation?

Our conclusion is that it is time for us to consider how CGCA can position itself within this changing environment so that we can continue to do what we do, but do it better, and change where necessary or desirable. We also want to work in collaboration with others who have shared goals and objectives.

We have a strong connection to the history of the Engineering Faculty and our relations with City and Guilds College Union are good. We have members who feel a strong attachment to the College but we need to get better at understanding whether, and how, people want to be involved with the College, or whether their engagement with CGCA is strictly limited to maintaining contact with their peers.

Our aim is to ensure that we set CGCA on the right road for the future and we want to take enough time to make sure we get it right. We want to build the membership but also increase the level of engagement. We are launching the

“Shaping CGCA for the Future” project now and will spend time during the rest of 2015 and into 2016 gathering information and talking with CGCA members and other stakeholders. Any changes we propose will be properly communicated to the membership and this is likely to take place around the time of the AGM in May next year. The project will be led by Judith Hackitt CBE FREng who is currently Senior VP and will take over as President of CGCA in May next year.

We are really keen to get your input to this project and will be conducting a survey of the membership in the near future. Please ensure that we have your email details to make sure that you are included in the survey – please update your profile on the IC alumni system, or send your email address to our Hon. Sec. Nigel Cresswell at [nigel.cresswell@hotmail.co.uk](mailto:nigel.cresswell@hotmail.co.uk). If you have any immediate thoughts or comments to offer for the project please contact Judith at [judithhackitt@hotmail.com](mailto:judithhackitt@hotmail.com) with a copy to Nigel.

## A curious bundle

In the summer, the incoming CGCU President found a bundle of red/grey striped material in the CGCU office with a note on it saying that Richard Gundersen (EEE, 1973-6) had ordered it and asked that it be brought to the UK and dropped off at the CGCU office. Knowing nothing about it he asked Teresa Sergot who in turn contacted Richard. Richard, in South Africa, related the story behind the bundle...

The story goes back to the run-up to Bo's Centenary in 2002.

CGCU were keen to replace the jackets but were finding it difficult and expensive to source the material in small quantities. I casually volunteered that we had companies in the Natal Midlands that made all the striped blazers for the local schools and discovered that they were prepared to do a short 'once-off' run.

Only two or three blazers were produced, which I seem to recall I brought over for the Centenary in June 2002. The photo (left) shows the jackets being worn for the Brighton Run in November 2002.

The parcel is the left-over material, that was kept here on hold, in case another blazer was requested. It was then put aside, waiting for a courier to take the parcel to college, got packed away during a move and was eventually

delivered to college by Thomas Bence who came over in 2014 for a work experience.

I heard more recently that other jackets have been made since the ones I had made in 2002 so, presumably, a local (UK) source for the material has now been discovered.

For the record, there were several discussions as to the width of the stripes and how maroon the red should be and whether grey or silver. I am not sure if this was ever 'officially' resolved.



**November 2002 Brighton run. The new Guilds jackets looking stunning – a huge improvement on the old ones apparently. Bo' performed admirably with Dan Lehmann driving and James Devine co-driving, reaching Brighton before 3pm. Almost visible in the back is Sir Noel Davies, chairman of Ricardo and Bo' driver in the mid 50s.**

## Chaps Club Rugby Reunion



**A group of “old” Chaps Club members got together in the Union bar ahead of the Rugby World Cup semi-finals. Participants included, Boo-boo Smith (not even hiding Geoff Parsons's tie), Chris Molam, John O'Reilly, Nick Icely, Bernie Pryor, Peter Waugh, Squaddie Paterson, Danny Hill, Pete Brown, Trevor Fletcher and current Club President Jonny Rankin.**



**Chris Molam (L) President of RSMU in 1966-67 visiting from Harare reunites with his VP John O'Reilly and Nick Icely, visiting from Johannesburg.**

## DEVELOPMENTS AROUND THE ENGINEERING FACULTY

### Soft tissue fossils

An inter-departmental team from Imperial have detected what look like soft tissue remnants in the fragments of 75-million-year-old dinosaur fossils even though the fossils are poorly preserved.

The researchers suggest their study may cause palaeontologists to rethink how fossils are preserved, and may be the first step towards a better understanding of the biology of dinosaurs and the relationships between different species.

To carry out their study the team used a range of techniques. The first involved the use of a scanning electron microscope (SEM) to observe the structure, composition and location of the soft tissue inside the dinosaur fossil fragments. The team then used a focused ion beam (FIB) to slice into the samples and observe the internal structure of the fossils. They also examined the fossils using a transmission electron microscope (TEM) to detect the fibrous structures.

Birds are the distant relatives of dinosaurs, so the researchers used an ion mass spectrometer to compare their ancient soft tissue to a blood sample taken from an emu. This enabled them to compare and contrast the samples and see that their fossils had some similarities in the organic signatures to the blood cells present in the emu sample.

The next step will see the team carrying out more research to confirm that the structures that they've observed are found in a wider range of fossil samples and also to understand how widespread this sort of soft tissue preservation might be in dinosaur fossils, how far back this type of preservation could go in the fossil records and the reasons why it may have occurred.

### London Duathlon

In Richmond Park, on Sunday 20 September, 122 participants from nine Engineering departments took part in the London Duathlon.

Working in teams of three as part of the Duathlon Relay, the race comprised a 10km run, 44km bike ride and 5km sprint finish.

All teams competed admirably, but special mention goes to Leroy Gardner, Katherine Gardner and Mark Bennett for setting the fastest time from across the Engineering teams, and achieving 2nd place overall in the whole event.

The real winner has been the excellent fundraising total achieved for Médecins Sans Frontières, which is almost at the Faculty's target of £10,000 for this worthy cause.

## A plethora of awards across the faculty

In the Department of Bioengineering, **Professor Jon Clasper**, clinical lead for the Centre for Blast Injury Studies and **Professor Peter Mahoney**, associated with the Centre through his leadership in anaesthesia and critical care, were appointed to "Commander of the Most Excellent Order of the British Empire" in the Queen's Birthday Honours List.



**Dr Bjoern Schuller** of the Machine Learning group in the Department of Computing, was selected by the World Economic Forum as one of '40 extraordinary scientists under the age of 40' to participate alongside business and political leaders from 90 countries in the Annual Meeting of the New Champions (also known as the 'Summer Davos') held in September in Dalian in China. Dr Schuller's work focuses on innovative algorithms to enhance the intelligence, emotional intelligence, and perceptive skills of the next generation of computing machines.



**Professor Erol Gelenbe**, from the Department of Electrical and Electronic Engineering, has been made a Fellow of The Royal Academy, Sciences, Letters and Art of Belgium. The honour recognises his pioneering efforts in the field of modelling of computer systems, and for inspiring several industrial prototypes. For the past four decades, Professor Gelenbe's research has focused on developing programs that can be used in industry to check that computer systems are able to respond in a logical, consistent, reliable and timely manner, helping companies to determine in advance the performance of their systems.

Four Imperial researchers were elected Fellows of the Royal Academy of Engineering this year. This takes the tally of Imperial staff and associates who are current Fellows or Honorary Fellows of the Royal Academy of Engineering to 86.

The new Fellows are:



**Professor Claire Adjiman**, Department of Chemical Engineering, focuses on developing new ways to design better chemical processes and devices. With her colleagues, she has developed new techniques that enable engineers to predict the properties of the materials they are processing. The methods also enable them to predict how those properties affect the performance of the process and link them to what happens at the molecular scale, to determine how different decisions may affect the industrial process overall. This approach, called Molecular Systems Engineering, can have a range of benefits for industry such as improving the cost effectiveness of manufacturing processes and making them more environmentally friendly.



**Professor Daniel Rueckert**, Department of Computing, focuses his research on developing algorithms that extract clinically useful information from medical images. Professor Rueckert and his colleagues are aiming to develop techniques that can detect the type and progress of Alzheimer's at a much earlier stage, which could lead to better treatments. These computer algorithms are tuned to detect biomarkers, which are characteristic biological properties or molecules that may indicate normal or diseased processes in the body. The team aim for these

techniques to be used in diagnostics as well as in clinical trials to help other researchers who are developing treatments.



**Professor Mary Ryan**, Department of Materials, leads Shell's programme for Materials and Corrosion at Imperial. It was set up to help industry develop new ways to manage and protect equipment by providing a better understanding of how to predict the behaviour of materials. Finding ways to reduce corrosion is a serious challenge for industry, estimated to cost upwards of \$2.2 trillion globally each year, and cause safety and environmental risks. In June 2015, Professor Ryan was appointed the new Royal Academy of Engineering/Shell Research Chair in interfacial nanoscience to carry out research to link processes at the nanoscale to 'real-world' materials' performance. Her work has helped us to understand the behaviour of nanomaterials in the environment and in the body. Professor Ryan has also donated her expertise to help with conservation activities that have national significance.



**Professor Nilay Shah**, Department of Chemical Engineering, is the Director of the Centre for Process Systems Engineering, which looks at industrial systems, and all their complex components, as a whole. By looking at how all the processes interact with one another, Professor Shah and his team of researchers aim to develop refinements in industrial processes, which could have a range of benefits from reducing the impact of industry on the environment to savings on operational costs.



# DEVELOPMENTS AROUND THE ENGINEERING FACULTY

## Bionic eye

A team of engineers from Imperial's Department of Electrical and Electronic Engineering are creating an artificial retina that captures light to build an image of its surrounding environment. The researchers behind the EU-funded 'SeeBetter' project suggest that replicating the retina on a single, specialised silicon chip will enable more accurate artificial visual sensing in industrial processes.

The team, working in conjunction with the Institute of Neuroinformatics in Zurich, and international research centre IMEC, aim to combine the artificial retina with a simple software infrastructure, enabling information to be processed in a way similar to that in the brain. When applied in industry, this could allow a robot to process and react to information, which could for example, enable manufacturers to more quickly recognise faults in their production.

In the long term, the team predict that the technology could be adapted into a prosthetic to restore vision. The technology could interface with the human neural system, conveying visual information directly into the wearer's brain.

Dr Konstantin Nikolic, one of the lead researchers, said: "The ultimate goal for this technology is in healthcare to restore sight to people who are blind, but this is still a long way off. In the short term we see our technology being extremely useful in improving machine vision in manufacturing. In order for a conventional camera to capture and identify a faulty product on a manufacturing production line, the conveyor belt must be moving fairly slowly. When you use a faster image capturing and processing system, such as our artificial retina, it could recognise a faulty product and react faster, saving money in the manufacturing process."

The technology combines an off-the-shelf vision sensor with software developed by the team. This could make it cost effective to manufacture and ultimately more affordable for industry. Dr Nikolic suggests that if industry were to identify specific potential uses, and the relevant testing and assessment was carried out, the technology could be in use within a year.

The next step will see the team adapting the technology for other uses. For example, they plan to develop a visual to auditory 'sensory substitution system', in the form of a smart phone app to convert visual information into sound to enable the user to 'see' with their ears.

Photographs: Imperial College

## James Dyson Foundation

In our Spring issue, Professor Peter Childs wrote about the School of Design Engineering that he is heading, the first new engineering department to be established at Imperial in two decades. It was subsequently announced that the James Dyson Foundation has donated £12 million to set up the new school, it's largest ever single gift, and the Dyson School of Design Engineering was formally launched by James Dyson and George Osborne in March. The school will be housed in the former Post Office building on Exhibition Road, which the College recently purchased from the Science Museum, and will in future be known as the Dyson Building of Design Engineering. The first students on the new MEng in Design Engineering have just started this term, and are currently using existing facilities – teaching will move to the new building in October 2017. Professor Childs said "We expect the School to galvanise [...] ingenuity, becoming a manufacturing and design hub in the heart of South Kensington, producing gadgets, experiences and services that have the potential to transform our lives."

Welcoming the announcement, Bernard Taylor, Chairman of the Royal Commission for the Exhibition of 1851, said, "The sale of the Science Museum's Post Office building to Imperial College, to become the Dyson School of Design Engineering, is very exciting. We strongly support this initiative. Our Albertopolis cultural estate in South Kensington was founded with the profits of the Great Exhibition and this new use of the building fits perfectly with Prince Albert's aim, and our objects, of increasing the influence of science and art on productive industry. The new school will become a major contributor to achieving this mission and I wish it every possible success."



**James Dyson with Jeff Magee (Dean of Engineering), Peter Childs (Director of the Dyson School of Design Engineering) and Imperial President Alice Gast**

## Grantham Institute climate change projects

The year ahead will see international leaders negotiating the future of greenhouse gas emissions at the Paris 2015 UN Climate Change Conference in December.

Scientists, engineers, and medical and business experts at Imperial are beginning work to understand and predict the future of the climate, avert disastrous levels of change, and find ways for humanity to adapt to an altered environment.

Details of the projects are published today in the Grantham Institute Outlook 2015-16. The Grantham Institute is Imperial's hub for research in climate change and the environment: driving forward discovery; translating innovations into applications; and communicating academic knowledge to businesses, industry and policymakers to help shape their decisions. The projects include:

### Generating power with no carbon-emissions

Engineers are building the world's first power plant that emits no greenhouse gases, in North Yorkshire, UK. The plant will be fuelled by both biomass and coal, and include technologies capable of capturing 2 million tonnes, or 90 per cent, of the plant's carbon dioxide emissions, which will be stored beneath the North Sea. The White Rose CCS Project is an industrial collaboration between energy companies Alstom and Drax

Power and industrial gas company BOC, with Grantham Affiliate and chemical engineer Dr Niall MacDowell studying the role that carbon capture and storage (CCS) can play in the UK's energy system.

### Improving research with flying laboratories

Imperial engineers are building a laboratory to design and test the next generation of Unmanned Aerial Vehicles (UAVs). Low-cost flying 'drones' can be equipped with sensors to accurately map environmental parameters like temperature, humidity and salinity, or the distribution of bacteria or vegetation. Aerial Robotics Laboratory Director, and Grantham Affiliate, Dr Mirko Kovac foresees many ways in which these robots will be used in upcoming environmental and climate research.

### Informing policymakers

Chemical engineer, and Grantham alumnus, Dr Christoph Mazur, is researching an Institute-funded briefing paper on the future of road transport, providing a snapshot of the latest developments in key low-carbon transport technologies and analysing their costs. Aimed at policy makers at a local and national level, the paper will use case studies to highlight the best policy choices for the UK to support the development of these technologies and the uptake of low-emission vehicles.

## Cryptocurrencies

The rise of cryptocurrencies especially Bitcoin, has prompted the Faculty to spearhead further research by launching the Centre for Cryptocurrency Research and Engineering, under Professor William Knottenbelt.

Cryptocurrencies and their underlying technologies have the potential to revolutionise the world of financial payments, offering an alternative to traditional currencies via a distributed, trustless, self-governing framework promising low-friction financial transactions while preserving the freedom and privacy inherent in cash.

The Centre's launch follows the successful Bitcoin Forum, set up to gauge the level of interest across the College. With an overwhelming response from staff and students, the Centre will coordinate research grants directed at designing and engineering improvements to the protocols that underpin blockchain technology. It will also coordinate application-based funding directed at prototyping blockchain-based solutions across multiple domains.

## High speed trains

Imperial has joined with China South Railway (CSR) Sifang Corporation, the world's largest maker of electric locomotives, to establish the Sifang-Imperial Centre for Rail Transportation Manufacturing Technologies.

The new Centre will be based in the Department of Mechanical Engineering and headed by Professor Jjanguo Lin. It will focus on developing rail technologies to streamline the construction and testing of high speed trains, so that they are safer, more cost effective and environmentally friendly. Using the latest manufacturing techniques, the researchers aim to create trains from advanced materials with fewer components, making them lighter and more fuel efficient.

The Centre is part of the Faculty's initiative to promote multi-disciplinary manufacturing research, led by the Manufacturing Futures Lab. The lab brings together academics in future manufacturing technologies and underpinning science to develop a more coherent and strategic programme in manufacturing.

# The Road to Delhi: A journey

In July, an email arrived from Nick Fern (Mineral Tech. 1962-5,65-8) with a beguiling start: “50 years ago this morning, July 6th, 1965 four young men left Kent for India. We are now, older, wiser perhaps, though this is open to discussion and scattered across the world.” Nick went on to say that he would be writing up the trip in 16 weekly episodes to be emailed out to interested parties. We have included the first episode below and a couple of highlights as tasters of later episodes. If you want to read all Nick’s episodes, get in touch with him at [nickfern@skynet.be](mailto:nickfern@skynet.be).

## ORIGINS & PREPARATIONS

**Diary entry:** July 6th 1965

“Left West Malling at 10.10 – only 10 minutes late”

Not the most seductive of opening lines, but, even so, the reader may wonder what went on before. This was the pre-internet age, well before low cost travel became the norm. Now, one can find a last-minute package on-line, leaving within a day or so and go. Though, for those wishing to visit India today, which in 1965 was visa-free for Brits, the cost and hassle involved in getting a visa is worthy of its own travel narrative. So, some background.

Mike and Richard were at school together, Nick had met Mike on their first day at Imperial College and then a couple of years later on a plane on the way to Canada for summer vacation work. Mike & Malcolm met through a mutual friend when both were living in one of the IC halls of residence.

Sometime in the autumn of 1964, in a bed-sit in Turnham Green, was hatched the idea of doing “something interesting” in the next long vacation; the last for all but Malcolm, a year younger. The original idea was to drive through Africa to Capetown, the flimsy reason being that Richard had considered working there after graduation. However after some minor research (political problems in Ethiopia and the unpleasantness of driving through a central African rainy season) it was decided that Capetown was not the best destination, so the group decided to drive to Delhi instead. Why not? The road was relatively well travelled; in those days wars and revolutions had not interrupted the route and it seemed sufficiently adventurous to do without too much risk of not being doable. And, anyway, we had all read *First Overland*, the classic story of the drive to Singapore in the mid 50s and we weren’t going beyond North-Central India, so felt well prepared.

Parent’s reactions? Well for Nick it was, at least from his mother, “How nice dear and how’s your cold? For the others, the reaction, perhaps a little less casual can’t have been negative and were it not for parents’ passive support and, from Malcolm’s mother, hours of typing letters to those companies who we thought would give some in-kind help, we wouldn’t have been able to leave “only 10 minutes late”.

With three of us in our final year, two at Imperial College, one in Oxford, there was much to be done. First we had to find a vehicle. For us there was no choice: it had to



**From left to right: Mike, Richard, Nick & Malcolm. Perhaps the photograph was the reason for the delay.**

be a long-wheelbase Land Rover; several were seen and one finally bought; ex-BBC Outside Broadcast Vehicle. It had already done 70,000 miles but, built to last, seemed to be in good condition. It cost us £400, with a 2 litre petrol engine and, as a wonderful extra, a really good winch on the front. The LR went down to Mike’s parents’ house in Kent to be fitted out. That is, in between being driven up and down impossible slopes by all of us when time permitted; great fun. And, of course being winched up slopes when we felt the tree would not suffer. The modern LR Defender comes with all mod cons as standard or available installed on order, but ours was pretty basic. Malcolm went on a brief maintenance course at Land Rover and we had £40 to £50 of spares, not all as useful as expected, but that is for later. Tyres were new; we probably had extra leaves on the springs and we had what we thought was a full tool-kit. In those days, most things under the bonnet could be done by amateurs without the aid of computers and super-specialised tools. But then maintenance was an everyday activity, certainly if we had had a long drive over bad roads. The roof rack was cobbled together and we fitted jerry-can holders at the front and built shelves into the back of the car.

Richard, de facto-film maker, had acquired a clockwork super-eight cine camera, so though we had no pretensions as to film making, we bought rolls of film with which, we hoped, to amuse ourselves later on long winter evenings and bore all our friends to death in the process. We all had cameras with lots of colour film, to produce boxes of slides to add to the film shows. In this pre-digital age point, click and send via social media was not yet even a weird science fiction fantasy.

Malcolm was business manager, master of budgets and financial records, who masterminded the requests for support sent out to numerous organisations and companies, many of whom provided supplies or gave generous discounts on purchases. Slowly, the replies from our begging letters came in, usually in the form of a box of goodies. We had sugar beyond any need and also tins of golden syrup. Some probably ended up in mothers’ store cupboards. The Shredded Wheat was carefully packed into the LR and returned, mainly unpacked, having had a 4 month and 15,000 mile storage trial. Loo rolls, hundreds of them, ended up almost as useful as scrip currency as for their functional use.

Nick had the responsibility of being Doc. After a brief visit to the London School of Hygiene & Tropical Medicine to find out the horrors of Asian travel, he debated with himself for several minutes as to the sanity of continuing the plans. However the medicine chest was prepared, with the advice both of the School of Tropical Medicine and his G.P., and we had what inoculations were recommended. Pure water being a health necessity, we bought at what seemed an exorbitant cost a hand pumped ceramic filter (with added silver). So preparations continued.

Mike was map master. The AA provided a series of route descriptions starting at the Hammersmith fly-over and ending in the Raj Path in New Delhi. We had, no doubt, a full set of maps to get us there and back, but the instructions were possibly the best guides we had. Looking back, we seemed woefully unprepared as far as small scale geography was concerned. Politics across the countries were of no interest and I don’t think we prepared ourselves to be tourists in any way, though we



must have had a “to see” list; getting there and back was the goal. Mike and Malcolm trudged the streets of London going from embassy to consulate in search of those vital visas.

All this was being done with three working on 3rd year projects, revision, then finals and job searches, whilst Malcolm was considering third year options (and worried about coming back for a rather late start to his final year). Anyway, eventually Mike got his job offer from Costains, a Civil Engineering Company, Richard an offer from IBM and Nick an offer to stay on to do a Ph.D, subject to exam success (a 2.1 or better).

As May and June advanced, there must have been a hiatus in preparations, but a departure date was set, based possibly on Nick’s need to hand in an SRC grant application before leaving. As this application was contingent on degree grade, which, officially would not be known until later in the month, there was a problem. However, he was told to come in on the 5th of July and if the Prof’s secretary said there were some forms to complete certain assumptions could be made. So he, at least, left with his results. The others had to wait until Teheran.

London-end communication was easy, three of us were on the same campus, but with Richard in Oxford, keeping him involved was not so easy. However he set up office in a GPO telephone box near his digs. There, juggling paper and pencil, a heavy receiver and ensuring the pile of pennies was at hand to top up the slot, work was not easy. Anyway, somehow all were kept up to date.

The political geography of Europe and the Middle East in 1965 was somewhat different from that of today. The Iron Curtain divided Europe, though the Hungarians had tried to regain their freedom in 1956 and the Prague Spring was still in the future. Yugoslavia was Tito’s fief, somewhat independent of Moscow-speak. The Berlin Wall, constructed in 1961, exemplified the physical divide, but Ceauşescu’s assumption of power in Romania, early in 1965, indicated that the Soviet zone of control was not monolithic.

Following a Coup d’état in 1960, Turkey was under military rule; the Shah reigned over Iran, then relatively secular; Afghanistan, nominally a monarchy was, well, Afghanistan. India and Pakistan were at constant loggerheads, mainly over Kashmir. Iraq was a somewhat unstable republic; Saddam Hussein came to full power later. Jordan’s western frontier ran through the middle of Jerusalem, just to the west of the old city. Lebanon was still the land of milk and honey, at least on the surface, and Syria was under a Ba’athist quasi-military rule.

In the wider world, the Vietnam War continued and the USA and the USSR kept *our* world relatively calm, through proxy cold and hot engagements throughout Africa and Asia. We were to see part of the “no hostilities” engagement as we crossed Afghanistan. For us, it was the Golden Sixties, with no student debts to live with and fortunately no ongoing Sterling Crises, so there were no problems in leaving with the funds we needed, mostly in

the form of traveller’s cheques.

So, over the first weekend of July, luggage (we limited ourselves to one small suitcase each) and supplies were loaded into what we now called Abdul or VLW 119 (Very Long Way) as its number plate said. Gas cylinders for the cooker took up more space than we liked, but none of us liked the idea of primus stoves. We found space for a little multi-band radio, over which the mellifluous BBC English newscasters’ voices were of some comfort when times were troubled, and a portable typewriter. Goodbye telephone calls were made to parents and girlfriends; the last minute check of papers and passports made and, at 10.10 on Tuesday 6th July we headed out of Mike’s home, towards the A2 and down towards Dover.

**COST NOTE**

This was our original budget, based on the added North African leg; we were somewhat optimistic with our plan.

<b>Vehicle Expenses:</b>	<b>£</b>
Land-Rover Second Hand	500
Insurance, taxes	100
Spare parts	50
Servicing, AA fees	10
Petrol & Oil for 14000 miles (at 27/6d per 100 miles)	180
Boat passages:	
English Channel	12
Beirut-Port Said	18
Tunis-Sicily	20
Local ferries	5
Maps & Information	5
	<i>Subtotal:</i> 900
Resale value of L-Rover expected	-300
<b>Net expenditure on vehicle</b>	<b>600</b>

<b>Personal Expenses:</b>	<b>£</b>
Boat passages per person	16
Visas, etc	10
Living: 14 weeks at £4 per week	56
Extras, sight-seeing, etc	25
Photography	10
	<i>Subtotal</i> 117
Quarter share of Vehicle	150
<b>TOTAL COST PER PERSON</b>	<b>267</b>

The vehicle cost a bit less than planned and we did eventually resell it, but not for the budget price. We were away for longer and drove somewhat further. A consensus, over 40 years after the trip, was that we spent nearer £400 each. Looking at these cost estimates it seems impossible that we could have done what we did so cheaply, but a starting graduate in London was being paid about £1000 per year, so in income terms we are talking half a year’s net salary for the trip.

**From the next episode...**

Although Mike had driven to Greece in 1963, none of the others had any experience of continental driving, so even their start was a new experience, as Nick’s diary entry suggests:

*“...we were cruising comfortably at 45mph. The heavy lorries on the autobahn were quite terrifying at times.”*

He explains:

After 3 hours on the ferry we juddered over the cobbles, to the highway towards Brussels and points east. Brussels, then without its outer ring road, must have been a driver’s nightmare negotiating trams, cobbles and notorious Belgian drivers for whom a driving test only became obligatory in the early 60’s. However despite *priorité a droite*, we came through unscathed and headed east towards Liege and the frontier with Germany.

Driving through (and camping in) Germany and Yugoslavia, they came to Bulgaria, where they eventually arrived in Sofia:

We drove into the centre of Sofia on a hot and muggy late afternoon. As far as we could determine, we were the only foreigners and became a somewhat unwelcome centre of attention. However, from the crowd came a couple, she speaking French, he English, and they gave us a brief tour of the centre of the city including the immense Alexander Nevski cathedral. We went in to hear the orthodox service for the eve of Sunday. No organ but a large and sonorous male voice choir. Given our perception as to the lowly place of the Church in Communist political philosophy we were surprised by this magnificent singing, the ceremonial and the ornate splendour of decoration. However, the congregation was small, old, with a preponderance of women, heads decorously covered with scarves. After a meal, our first Balkan/Turkish taste which was to become very familiar when we ate out in these eastern Mediterranean lands, we found the campsite and set up for the night.

As they proceeded south east across Bulgaria, their way was blocked by a village wedding, at which they were immediately treated as guests. Eventually, they headed off into Turkey, leaving Europe for Asia.



**Malcolm and the bridal couple. Note the banknotes pinned to her dress: better perhaps than the never-to-be-used toast rack?**

# Women in Engineering

## Hertha Ayrton – engineer, inventor, pioneer

Over the last couple of years we have had some fascinating articles by and about women engineers. It was recently proposed that IE should take a look back into the early history of women in engineering at Imperial. Our first article, in what will hopefully be a series over subsequent issues, focuses on an amazing woman suggested as a subject by Roderick Rhys Jones (Civ. Eng. 1964). Hertha Ayrton was named by the Royal Society in March 2010 as one of the ten most influential British women in the history of science.

One of the first women to work in electrical engineering in the UK – an engineer, physicist, mathematician, inventor and pioneer in the application of science to the solving of practical engineering problems – Hertha Ayrton was born in Portsea, Portsmouth, on April 28th, 1854, the third child of Levi and Alice Marks. Her father, a clockmaker, died when Hertha was only seven years old, leaving her widowed mother, a seamstress, with seven children to care for and another on the way. In spite of these obvious difficulties, Alice remained absolutely determined that her daughter, a very bright girl, should not become overburdened with helping to care for her younger siblings at the expense of her own education. Hertha was therefore sent to stay with her aunt, Marion Hartog, who ran a school in London. At her aunt's school, Hertha received a good education and, by the age of sixteen, she was making her own way in the world, working as a governess.

It was during these teenage years that Hertha, who had originally been named Phoebe Sarah, now declared herself agnostic and adopted her new name: that of the fertility goddess of Teutonic mythology, who had been described in the contemporary poem, *Hertha*, by Algernon Swinburne.

In 1873, an introduction to Barbara Leigh Smith Bodichon, one of the co-founders of Girton College, Cambridge, led to Hertha applying to read mathematics there. Through Bodichon, Hertha also met George Eliot who was similarly keen to further the cause of the education of women. At the time of their meeting, the novelist was working on what was to be her last completed novel: *Daniel Deronda*. It has been suggested that Hertha may have informed some of the physical and personal attributes given by Eliot to her fictional protagonist, Mirah Lapidoth.

Ill-health caused Hertha to defer the taking up of an offer of a place at Girton, but her health improved and Bodichon, Eliot and others helped to fund her, allowing her to start her life as a student. During her time at Cambridge, Hertha was tutored and encouraged by the physicist Richard Glazebrook, who later went on to be the first Zaharoff Professor of Aviation and Director of the Department of Aeronautics at Imperial.

Whilst still a student at Girton, Hertha began to show her ability as a problem-solver: inventing a device to record pulse beats, and a line-divider for use in drafting, which she later patented. (She would eventually go on to



patent at least 26 of her inventions). She was also involved in the founding of the college's Fire Brigade and was a prominent member of its Choral Society. One contemporary described Hertha as "always the most striking figure among the students".

Examination nerves – which she herself described as "a want of... presence of mind in the exam room" – meant that Hertha was disappointed by her own academic performance at Cambridge. However, she had completed her studies and had passed sufficient examinations. Despite this, she was not awarded a degree at Cambridge since, at that time, women were allowed only to attend, not graduate from, the university. Instead, on returning to London to work as a teacher, Hertha was tested by the University of London and consequently awarded a BSc degree from that institution, in 1881.

Hertha worked as a tutor of mathematics and related subjects. She also wrote and set mathematical problems for publication in the *Educational Times*, and became recognised as a gifted mathematician particularly in spatial and geometrical reasoning. Her interests began to turn towards science and she started attending physics classes at Finsbury Technical College. It was here that she met her future husband, William Ayrton.

Ayrton was a widower with a young daughter, having previously been married to **Matilda Chaplin**, a member of the *Edinburgh Seven* campaign to open medical education up to women (see the side bar). An outstanding

physicist and gifted teacher, William had, in 1881, been made professor of Applied Physics at the Finsbury Technical College, created as a feeder college for the Central Institution. In 1884, he was made Professor of Electrical Engineering at the Central Institution, in its new purpose-designed building adjacent to the Royal School of Mines (RSM) and the Royal College of Science (RCS) in South Kensington and, in 1892, he was appointed President of the Institution. In 1907 the RSM and the RCS were incorporated into Imperial College. The Central Institution was renamed the City and Guilds College, and was incorporated into Imperial College in 1910. Finsbury College closed in 1926, when it too was incorporated into Imperial.

Hertha and William married in 1885 and the demands of her new domestic responsibilities initially reduced the time that Hertha could devote to scientific work. However, in 1891, a legacy from her loyal sponsor, Barbara Bodichon, enabled Hertha to employ a housekeeper and so continue her own research. Her husband had been researching the electric arc lamp. As he now moved into different areas of research, Hertha took over the project.

Used for lighting in streets and public buildings, electric arc lamps operated by means of passing an electric current between two carbon rods. Through her experiments, Hertha showed that the hissing associated with this form of lighting, and the related reduction in performance, was due to oxygen coming into contact with the rods. She demonstrated that if the arc could be protected from direct contact with air, the hissing could be prevented.

When the Society of Telegraph Engineers (STE) had been set up, in 1872, it had thought it inappropriate to allow women to become members, despite the relatively large number of women who were then working as telegraph operators. However, in 1895, Hertha published a series of articles on her work, in *'The Electrician'*, which led to her becoming, in 1899, the first woman to present a paper to the STE – now renamed the Institution of Electrical Engineers (IEE) – and to her being elected the IEE's first woman member in that same year. Sadly, this enlightened approach from the IEE, was not matched when Hertha was later proposed as a Fellow of the Royal Society. Her husband, a Fellow since 1881, and several other male scientists supported her candidature, but the Council of the Royal



Society met and stated that, “We are of the opinion that married women are not eligible as Fellows of the Royal Society.” They went further: “Whether the Charters admit of the election of unmarried women appears to us to be very doubtful.”

Despite this, Hertha’s book, *The Electric Arc*, was published in 1902, to international acclaim.

Subsequently, observations she made while at the seaside led Hertha to investigate the nature of the ripple motion on sand and water, and she was even permitted to present a paper describing her theories on this subject to the Royal Society, in 1904.

Though it maintained its ban on female members until 1923, the Royal Society acknowledged Hertha’s work by awarding her its Hughes Medal, in 1906. Established in 1902, and named in honour of David Hughes, inventor of the microphone, the Hughes Medal is intended to recognise original discoveries in the physical sciences, particularly as applied to the generation, storage and use of energy. In Hertha’s case, the medal was awarded for ‘her experimental investigations on the electric arc, and also on sand ripples’. To this day, Hertha remains the sole female recipient of the Hughes Medal.

Following William Ayrton’s death, in 1908, Hertha continued her research in fluid dynamics. During WW1, she applied this research to the development of a fan to expel poisonous gas from battlefield trenches. After an initial struggle to get the Ayrton Flapper Fans accepted, thousands were produced and issued to front line troops. Hertha also worked to improve the design and efficiency of search-lights.

Hertha was an enthusiastic supporter of the campaign for women’s suffrage, taking part in suffragette marches and caring for recuperating hunger strikers in her home. She was also a friend of Marie Curie, inviting Mme. Curie and her daughters to stay with her for several months in 1912 and vehemently refuting suggestions that Curie’s work had in fact been carried out by her husband. On this issue, Hertha stated that, “an error that ascribes to a man what was actually the work of a woman has more lives than a cat.”

After the war, she further improved the design of the fan and continued her research on vortices. Hertha died on 23rd August, 1923, leaving a daughter and step-daughter and bequeathing the bulk of her estate to the IEE.

*You ought, I say  
To work all day;  
And even go on working in the dark.  
I will lend you with felicity,  
My work on Electricity,  
And also Mrs Ayrton’s on the Arc.*

**Maurice Solomon**  
**President, Old Centralians, 1924-26**

### Matilda Chaplin Ayrton (1846-83)

William Ayrton’s first wife, Matilda Chaplin, was, unusually for the time, a qualified physician, having studied medicine in London, Edinburgh and Paris.

She began her studies in 1867, passing the preliminary examination at Apothecaries’ Hall, London. However, in 1869, when she presented herself for the later examination, the Society of Apothecaries refused her admission, on the grounds of her gender.

One of the *Edinburgh Seven* (see below), Chaplin eventually matriculated at the University of Edinburgh, gaining high honours in anatomy and surgery at the extramural examinations, but she was barred from further instruction, and graduation, in medicine by the Court of Sessions judgement of 1872, which finally prohibited women students. Undeterred, Chaplin went on to study and earn her degrees at university in Paris.

In 1872, she married Ayrton and, in 1873, obtained a certificate in midwifery from the London Obstetric Society, the only medical qualification then obtainable by women in England.

Accompanying her husband when he took up an academic position in Tokyo, Matilda opened a school for midwives – delivering lectures through an interpreter – and was the author of anthropological studies on the people of Japan. Sadly, by 1877, Matilda was already exhibiting symptoms of tuberculosis.

She returned to Europe and continued her studies, becoming a licentiate of the King and Queen’s College of Physicians in Ireland (the only female candidate, she won first place in the examination). In 1880, she was studying diseases of the eye at the London School of Medicine for Women (now the Royal Free Hospital).

Over the next two years, as her health steadily deteriorated, she strove to take advantage of her need to spend the winters in warmer climates by continuing her studies, at the hospital of Algiers and then in the Physiological Laboratory in Montpellier.

Matilda died in London on 19 July 1883, aged only 37.

### Women in Medicine

While women have, throughout history, acted as herbalists, midwives and carers – tending the young, aged and sick in both the domestic and religious spheres – medicine as a recognised profession remained an almost exclusively male preserve until relatively recent times. In Europe, the structuring of medicine as a profession began from about 1400, with the introduction of decrees restricting the formal practice of medicine to those who had received their training in universities. Since women were not permitted to attend university they were to be excluded, and restricted to the roles of nurse or midwife. Additionally, women were barred from membership of the medical guilds – forerunners of today’s medical profession associations – which set standards and protected their members.

Though not allowed to form guilds, midwives were required to be licensed. However even this female stronghold was threatened, in England from the 1700s, by the rise in the number of

‘man-midwives’ – male doctors who attended births in place of female midwives.

Over the centuries, there have been a few, rare exceptions to this male dominance. Dr Laura Bassi, for example, was appointed Professor of Anatomy at the University of Bologna in 1732. In addition to anatomy, Bassi went on to teach Newtonian physics for 28 years and publish 28 articles, mainly on physics and hydraulics, finally becoming Professor of Experimental Physics at the Institute of Sciences, in 1776. There have also been women who have successfully practiced medicine by the challenging expedient of pretending to be men. One such, Margaret Ann Bulkley, contrived, with the support of her family, to train and graduate from Edinburgh medical school in 1812, as ‘James Barry’. After a brief spell working at St Thomas’ Hospital in London, Barry joined the army as a surgeon in 1813 and had a successful 46-year-long career in army medicine.

As the 19th century progressed, women began to push for a greater role in medicine, battling against the opposition of the majority of male doctors and medical institutions. Several exceptional women made progress but each time one of them found a loophole that allowed her to progress in her career, the medical profession acted swiftly to change the rules to close that loophole and stop it happening again.

### The Edinburgh Seven

In 1869, seven determined women gained entry for matriculation in medicine at the University of Edinburgh. The seven were: Sophia Jex-Blake, Isabel Thorne, Edith Pechey, Matilda Chaplin, Helen Evans, Mary Anderson and Emily Bovell.

All passed their first term examinations, several with distinctions. Indeed, of the 152 students who sat the matriculation exam in October 1869, only five were women, four of whom came within the top seven results. Unfortunately, their success sowed resentment among many of their fellow students. This resentment erupted into open hostility with the ‘Surgeon’s Hall Riot’ in November of 1870, when a large mob tried to intimidate and physically block the women’s path as they attempted to enter the hall to take an anatomy exam.

The riot was widely reported in the newspapers and engendered a great deal of support for the women but, despite this, when, in 1872, having completed their training, the seven women challenged the Edinburgh University Court’s decision that they could not graduate with degrees, they failed. The Court of Session supported the University’s right to refuse the women degrees and even went so far as to rule, by a majority, that the women should never have been admitted in the first place.

### What a difference a century makes...

In 1911 there were only 495 women on the Medical Register in Britain. This compares with the situation in the UK today, a century later, where, after reaching an all-time peak of 61% in 2003, the percentage of female medical students has settled to 55% of the total medical student population in the UK. In time, these numbers will be reflected in the relative numbers of male and female doctors on the medical register; in 2012, 57% were male and 43% female.

# Taking a Leif out of Erikson's book

Nigel Fitzpatrick (Metallurgy 1962-65, 65-68) wrote to tell us that, half a century after gaining his PhD in the RSM, and although ostensibly retired, he had a paper accepted for the Engineering Institute of Canada's Climate Change Technology Conference in Montreal in May. The idea for his paper had accelerated when staff at Parks Canada located and sent a report on iron made by Norse settlers at L'Anse aux Meadows, the settlement established by Leif Erikson in Newfoundland (according to the Vinland Sagas). Pursuing that theme, Nigel also sent us a short report of his trip to see Erikson's settlement in Newfoundland (below right) as well as a trip to Iceland where Erikson started out (opposite). Nigel's paper can be downloaded from the CCTC website at <http://bit.ly/IE23-NigelCCTC>, but we have summarised it here (below left). Closer to home, Cluff Natural Resources announced in February finding a potentially large source of metallurgical coal on its licences near the Solway Firth in Cumbria.

## Metallurgical coal replacement and vehicle weight reduction compared

It has been suggested that 80% of coal reserves need to stay in the ground from 2010 to 2050 to hold the global average surface temperature to a rise of 2°C. Reserve estimates of coal range from 892 to 1052 billion tonnes. Total global coal production in 2013 was 7.8 billion tonnes. Using 20% of the lower number for reserves over 40 years is equivalent to cutting annual coal usage to 4.5 billion tonnes or 42% less than 2013 usage.

In 2013, 1.2 billion tonnes of metallurgical grade coal went to the steel industry, mostly to make the coke used in blast furnace iron production but a fraction was injected as powdered coal. Steel is made into a range of products in many countries, and the energy to make and ship a product such as wire or automotive sheet differs hugely from that to make a casting at an automotive plant. We are not looking for the differences between those processes but between the routes to make the raw steel they consume. Helpfully, public data from the World Steel Association and the International Energy Agency can be combined to explore the broad shape of a steel industry as greenhouse gas emissions are reduced.

The understanding of the history of alternative steel-making processes was recently enlivened in Canada with the analysis of iron made by Norse settlers at L'Anse aux Meadows, Newfoundland with a then standard technique. In Europe until the 14th century iron ore was converted in the solid state directly to porous sponge iron in which oxide impurities were entrapped as gangue. These were squeezed out by hammering. Some of the resulting product had the range of carbon content that categorizes steel. This original solid state process was the progenitor

of today's directly reduced low carbon iron (DRI) processes from which the gangue is removed in electric arc furnaces (EAF).

For decades, the steel industry has been improving the efficiency of its use of coke and coke-oven gas made from the coal. Asia imported, and Europe and North America exported, scrap steel in 2013. When scrap is melted in EAFs, operators seek lower carbon extra 'iron units' more compatible with scrap than the output of a blast furnace. Operations near markets major in scrap melting. One example is an operation in Contrecoeur, Quebec, owned by the world's largest steel company, ArcelorMittal S.A. Another example is the largest US steel company, Nucor Corporation.

Overall, the steel industry emits approximately 5% of global greenhouse gas (GHG) emissions. The scale of GHG reduction that can be attained by reducing road vehicle weight is of the same order as that of moving present steel and iron production to areas with low carbon power and natural gas. An automotive transition would be swifter.

When less automotive steel scrap becomes available, the use of relatively pure DRI will allow lower grade (more impure) scrap to be used and the demand for DRI will increase.

Should there be an agreement to restrict coal use, iron and steel production will rise in locations that have ore access, natural gas and low carbon electricity. There would be a tendency for steel and iron production to grow in Canada.

A coal limitation would slow the growth of steel production where there is a reliance on blast furnace iron.

## Low carbon in Newfoundland

Newfoundland, the closest point of the Americas to Europe, is a natural place for new ideas to arrive. A Norse explorer, Leif Erikson, established a temporary settlement on the northern tip eleven hundred years ago, and from Signal Hill in the south, Guglielmo Marconi received the first Trans-Atlantic radio Morse code message, in 1901.

After spotting a mist-shrouded iceberg from Leif's settlement a few days before, Joan and I reached Signal Hill on a bright sunny Friday, August 1st. Out at sea a curious flat-top boat was headed towards the St. John's harbor entrance. It was a catamaran with an enormous deck covered in photovoltaic solar panels. We were witnessing the arrival of the New Zealand designed, Swiss registered, German, French and Swiss funded, MS Türanor PlanetSolar at the most northerly point the boat had so



**Türanor PlanetSolar seen from Signal Hill**

far reached as it returned across the Atlantic to Europe.

In the harbor, we admired the iconic naval architecture. The boat is 31m, extendible to 35m, and has a beam of 15m, extendible to 23m. It carries 11 tons of Gaia Lithium lon batteries with a voltage of 388V and capacity of 2910Ah (485Ah/cell). The 127 photovoltaic panels have an efficiency of 18.8%.

GAIA Akkumulatorenwerk GmbH describes the battery as having "the world's largest Li-ion round cell". GAIA elsewhere says, "The diminished safety of these cathodes can be partly compensated by suitable intelligent battery management systems and innovative cell design." They continue "Thanks to their high intrinsic safety, fast charging and long cycle life, LFP cells are expected to become the number one cell type for electric and hybrid vehicles of the future."

Change-makers would not now arrive from Europe using a hybridized mix of oars and sails or communicate with Morse code. Our civilization will choose ever more viable low carbon technologies. We applaud the MS Türanor PlanetSolar and the courage of its developers and crew, and expect and look forward with them to technologies that bring the rise of carbon to heel.



**August 1963 view of coal mining taken by Nigel from the Canadian war memorial at Vimy Ridge when an IC club stopped there on the way home. The mines closed in the '90s and Vimy was restored in 2007. The monument has also been restored and is no longer likely to be blackened by coal dust. Nigel hopes that, a century from now, we will look back at 2015 as the year we came up with ways to cap coal use sufficiently.**



## Recalling Geology at RSM

When, in February 2014, Joan and I received an invitation to a UK family event, we heard also that Icelandair was initiating twice weekly flights to Europe from Vancouver via Reykjavik/Keflavik.

Icelandair is very phone-friendly and explained that we could stop over in Iceland for up to seven nights with no extra fare. There was a fully cancellable/changeable 'Economy Comfort' fare that then had the edge on the lowest major carrier direct fares. We could change flights or cancel without cost and though it may not always work out thus, we were delighted to find our specific fare came with use of airport lounges, free food and bar service as well as more space.

On July 7th we departed Vancouver International on a Boeing 757-200 named *Surtsey* after the island that I recall rose from the sea in 1963, during my first year at Mines. We had the luck to be in business seats with only the service downgraded to Economy Comfort. At 6 am local time, rested, we disembarked down steps into bright sunlight at Keflavik. All passengers went through a security check on landing. With a two hour stopover we went through Passport Control, entered Iceland, breakfasted and left again with two stamps in our passports before heading on to Gatwick.

Family events done, we returned to Iceland on July 16th from Heathrow's Terminal 1. In less than two and a half hours we were landing at cooler Keflavik. We had pre-booked on a shuttle bus to take us fifty kilometers to two nights at a reasonably-priced guesthouse close to the tourist centre of Reykjavik. On the outskirts, we were transferred to a smaller bus whose driver kindly hunted for our guesthouse.

Iceland-born Leif Erikson is featured at the Saga Museum where an exhibit illustrates how his settlers made the first iron to be produced on the American continent. So enthused are citizens of the United States with Leif's 'before Columbus' discovery of Canada that they have donated a striking statue; Leif now overlooks



**US donated Leif Erikson statue looks towards the continent he discovered – in front of Hallgrímskirkja**



**Nigel at Reynisfjara – southernmost beach in Iceland**

Reykjavik from the hill on which a stunning church, Hallgrímskirkja, stands.

The capital enjoyed, on a wet second morning, a pre-arranged, 'ash-insured', 4WD was delivered to our obscure guesthouse. It was easy to leave the city and drive to the spectacular rift at Thingvellir where the world's first parliament met in 930 AD. That first meeting was in the open, the speaker's voice enhanced by the reflection of sound from a cliff at the edge of the North American continental plate. Grateful for waterproof clothing and boots, we enjoyed a short hike and lunched near this World Heritage UNESCO centre.

Then we were two nights in self-catering accommodation at Laugarvatn by a quiet lake, a good base for visits to the tour-bus-embattled sights beyond. There one can enjoy history, a geothermal spa, a public pool, tour-book rated restaurants and, as always, pizza and beer.

You can stay longer in costly Reykjavik and go around the Golden Circle in nine hours; your trip will include Thingvellir, the geysers at Geysir and the remarkable waterfall at Gullfoss, more striking to us than Niagara Falls. Staying in more economical Laugarvatn, we filled a day just quietly seeing the geysers and falls, and leaving enough time to return for a swim before dinner.

Next morning we drove to Vik, the southernmost and wettest town in Iceland, via easy stops including the beautifully located former centre of Christianity at Skalholt, and easily found waterfall, Selljalandsfoss. In Vik we stayed in our only two real hotels of the trip and enjoyed hiking along scenic black beaches

where we saw puffins both on cliffs and in the sea.

From Vik, we drove back west on a sunny, glacier-spotting day, to Grindavik, the only harbour on the south coast. Our last night was in creative and very pleasant self-catering accommodation. Excellent fish soup was easy to find there, only twenty minutes from Keflavik where we were to drop off the rental car the next day.

On our final morning we hiked at no cost around cool blue ponds surrounding the exotic 'Blue Lagoon' and saw a geothermal exhibit and lighthouse. We went again from one tectonic plate to another as we explored the lava flow that is the south-western corner of Iceland.

With the car dropped at Keflavik we visited the large duty-free shopping area where the amazing 25% local tax is saved. Then, remembering in time that we had to go through Passport Control to leave Europe, we boarded our last Icelandair flight to enter Canada on time at Toronto.

A week or so later, we flew back to Vancouver both having fast-forwarded an onboard Russell Crowe movie *Noah* to where the Ark lands on a beach near Vik.

Iceland, the last major piece of land to form naturally on this planet, is a magnificent, peaceful place with splendid welcoming people. And where better to recall and enjoy some of what I learned half a century ago when aspiring metallurgists were required to go on Geology field trips in their first year at Mines?

Nigel Fitzpatrick graduated from Imperial in Metallurgy in 1965 obtaining his PhD in 1968. He joined an Alcan plant in Banbury, Oxon. Moving to Kingston, Ontario, he helped start a continuous casting plant in Jonquière. Joining Alcan's research team, he co-developed metal production processes before leading clean energy product projects. At BC Research Inc., Nigel worked on transportation projects and helped start a hybrid vehicle company.

Nigel's account of his trip to L'Anse aux Meadows and Signal Hill is a revised version of an item that first appeared in September 2013, in Volume 49 Number 9 of *Advanced Battery Technology*, a monthly journal published by Seven Mountains Scientific, Inc. (<http://7ms.com/>)

# Sitting in a Spitfire

Our managing editor, Peter Buck, arranged for a visit to the home of an icon of design and engineering as a surprise to celebrate the birthday of his wife, our production editor, Alison.

Alison has always been a fan of the design of the Spitfire, a beautiful plane with a distinctive silhouette in the sky. Living on high ground in north Kent, we often see one of these splendid creations flying over us. Recently, of course, there has been a plethora, thanks to the various events surrounding the 75th Anniversary of the Battle of Britain. A friend who lives even closer to Biggin Hill mentioned that it is possible to go up for a flight in a Spitfire. We investigated and found she was right, but it was beyond our budget. An option that we could afford, however, was to visit the Biggin Hill Heritage Hangar where they are permanently restoring Spitfires – and for a small additional fee you have the opportunity to sit in an airworthy Spitfire cockpit. How could we resist?

## The Heritage Hangar

Hangar 528, known since 2012 as the Biggin Hill Heritage Hangar, was originally intended to be the home for TA805 Spitfire HF Mk IX *Spirit of Kent* (FX-M), but now also houses a collection of airworthy Spitfires, as well as a Hurricane and other planes and various other items from the planes' heyday. There are a number of Spitfires currently undergoing restoration as well as some that are frequent visitors for service and maintenance. When we were there, we were guided through the hangar by Paul Campbell, who told us much

of the background to many of the aircraft we saw, as well as stories of some of the people who originally flew them.

This was a busy hangar where engineers were working on various of the planes as we were making our way around. Unlike a museum there were no barriers between us and the aircraft, allowing us to not only get close to them, touch them and look at fine details of fuselage, wings, engines, propellers, control surfaces, but also the controls themselves, even to the extent of sitting in the cockpit of TA805.



TA805, Spirit of Kent



Paul Campbell was our guide



Alison in the Cockpit of TA805







**Step up onto the wing ...**



**... and then into the cockpit over the door – which you'll notice has a crowbar fitted in case the canopy is stuck and the pilot needs to break their way out in an emergency!**

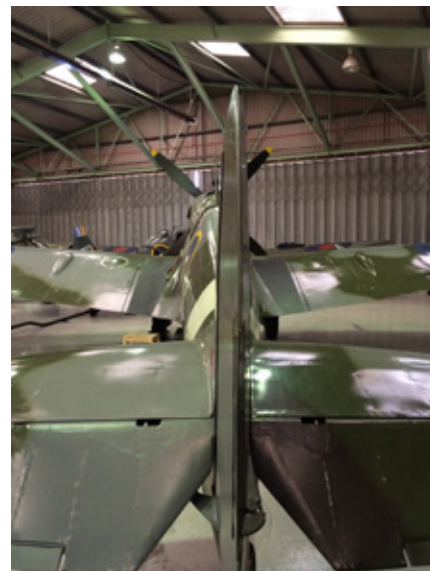
For both of us the responsiveness of the controls and light touch required to operate them were an eye-opener – we were assured that, even at high speed with the airflow over the surfaces, the controls are still extremely easy to use. This was a unique experience, there is nowhere else offering the chance to sit in a Spitfire.



**View in the cockpit**



**D-Day markings under the wings**



**Parked immediately behind TA805 in the hangar was a Messerschmitt ME109. This was its view of our plane – which also meant that when we looked in the rear-view mirror above the cockpit of TA805 we could see the front of the Messerschmitt!**

We also saw TE184 Spitfire MkXVI (DU-N) and the two-seater MJ627 Spitfire TR9 (9G-Q). In various stages of restoration were EE602 Spitfire Mk V (DV-V), LZ842 Spitfire Mk IX (EF-F) and others including a Messerschmitt ME109 parked immediately behind TA805! The hangar was crowded with aircraft, so much





## FEATURES

so that some of their permanent collection was in overflow hangars. But, they told us, they are soon moving to a larger hangar.

### Restoration

The restoration work in the hangar is carried out by engineers from The Spitfire Company (Biggin Hill) Ltd. Project manager Paul Ager and chief engineer Franco Tambascia lead a team of engineers and contractors who undertake the restorations. They have restored three Spitfires and have another three currently underway. Where a previously scrapped Spitfire is restored, as much material as possible is recovered from the original airframe to be incorporated in the rebuild, for authenticity. They also have a large collection of original Spitfire parts, some still in their unopened boxes.



**Some parts still in their original unopened boxes, including a label that says “not to be opened until required for use”**



**“The Merlin engine is refurbished and zero timed by Retro Track and Air Ltd with the engine bearer manufactured by us here at the Spitfire Company. We then fit the bearer, engine and propeller, at which stage the Spitfire gets to look like a real warbird once again.”**



**The fuselage and tailplane come to Biggin Hill from Airframe Assemblies on the Isle of Wight, having already received the camouflage treatment from Vintage Fabrics, at Audley End. When they arrive, the fuselage and tailplane are just empty structures which require Paul Ager’s team to fit systems such as hydraulic, pneumatic, fuel, oil, coolant, instruments and flying controls. “We fit every item with the greatest attention to detail” says Paul, “using original drawings and photographs to make the aircraft operate and look as if it were straight off the production line. Once these systems are fitted it is then the turn of our electrician to rewire the aircraft to the original Supermarine drawings.”**



**Usually the wings will arrive about three to four months after the fuselage, again as empty structures for the engineers to install the systems, before fitting them to the fuselage. At this point Ian Ward, from VMI Engineering, supplies restored ailerons and flaps and assists with reaming the wing spar attachments. “At the same time,” adds Paul, “we carry out one of the more difficult tasks of assembling and fitting wing root panels, engine cowlings and other final metalwork details.”**



**Even once they are restored and airworthy the Spitfires need servicing and maintenance**





**Some Spitfires, like the one above, are in a very sad condition when they first arrive. But as much material as possible is recovered and cleaned up to be reused, keeping as much authenticity as possible.**



**MJ627 was built in 1943 as an LF Mk IX and entered service with the Royal Canadian Air Force in 1944 as 9G-Q. After damage sustained in a forced landing in the Orkneys, she was repaired and stored. Vickers Armstrong converted the airframe into a two-seat TR9 trainer. This involved removing the central fuel tank and moving the cockpit 12 inches forward to make room for the second cockpit. Sold to the Irish Air Corps, she stayed in service until 1960. In private hands after that, and used as a source of spare parts, she was restored in 1993, suffered some damage in 1998, but flew again in 2002. Now owned by the Biggin Hill Heritage Hangar, she is used to offer flights over the Kent countryside.**



**If you want to restore a Spitfire yourself, there IS a Haynes manual!**



**TE184 was built as a Mk XVI with a Packard Merlin 266 engine in 1945. In 1946 she was loaned to the Belgian Air Force and on return was used as an instructional airframe. By 1967 she had become a museum exhibit until she was bought privately in the late 80s. She flew again in 1990, but infrequently, until 2009 when she was recommissioned and in 2011 the current owner acquired her and bases her at the Heritage Hangar.**



**EE602 was built as a Mk Vc, entering service in 1942. She hit an obstruction while flying low in 1943 and was abandoned. She is now privately owned and her reconstruction has been recently completed, taking to the skies again in May this year.**

Photographs by Alison and Peter Buck

More details of the aircraft kept in the Biggin Hill Heritage Hangar can be found on their website at <http://bit.ly/IE23-Spitfires> where you can also book a visit to *Sit in a Spitfire* or even *Fly a Spitfire*!



# Hans and Matilda's

Over 20 years after completing an Electrical Engineering degree, Andy Clark (EE 1994) finally put his EE skills to good use and won a trip to New York.

After leaving Imperial College in 1994, Andy swiftly moved into a software job and has stayed there ever since. Earlier this year the electronics distributor Element14 challenged engineers from around the globe to add 'enchantment' to an everyday object.

Andy took an old style Black Forest Weather House and swapped its inaccurate string-based mechanism for new electronics, 3D printed parts, a servo and WiFi-enabled micro controller. The weather is requested with a knock on the roof, a piezoelectric sensor triggers the boards to wake up and call a weather API on the internet. The response is parsed and the figures move to indicate the weather. If it is rainy the man appears and if it is sunny the lady leaves the house. An RGB LED shows the temperature in colour form with a scale from blue for cold to red for hot.

*"The judges were impressed by the content you produced and how you blended mechanical functionality with the electronics/sensing aspect. What set you apart was how you stayed in the theme of it being 'enchanted' with the storyline woven throughout."*

As part of the project, the challengers were asked to produce weekly reports of progress. So that these would be enchanting rather than dry technical reports, Andy incorporated a storyline telling the tale of Hans and Matilda who were helped by a range of other characters to rebuild their house. The first report is reproduced below, read more at:

<http://bit.ly/IE23-AndyClark>.



## Disaster strikes the Enchanted Cottage

### Once upon a time

Deep in the forest is a small cottage owned by a timeless couple, Hans and Matilda who are doomed never to meet. When it is wet he goes outside but when it is dry she must leave the house. They lived a happy life in their cottage however and had regular visitors who were interested to know what they could tell them about the weather.

### The storm

One night there was a terrible storm and Matilda was scared and hid in the back of the cottage. Outside Hans was transfixed as the torrents of rain washed around him. Just before dawn, when the storm was at its wildest, the lightning struck. Fire raged around the house and their old-fashioned temperature and humidity sensors were destroyed.

### Help was at hand

Luckily Hans and Matilda has insured their house with a policy from Premier Farnell. As Hans was reading the conditions, he was pleased to see that it was a 'new for old' policy and they would have their sensors and displays replaced with modern electronic components. It was not going to be an easy challenge however as they had to complete all of the work themselves by Friday 26th June or their policy would be void. Matilda wrote up a plan of action and put together a shopping list of parts not covered by Farnell.

### The Wolf

Nearby in the forest lived a wolf, he danced with glee as he heard about the disaster that had befallen the enchanted cottage. He'd been selling weather reports to the locals and Hans and Matilda's service was costing him dear. He planned to set up a fake weather server and provide the wrong information hence discrediting our weather-telling couple.



### Enchanted Cottage Project 2015

- House rebuild - Strip out, new floors and walls
- Control system - Arduino Yun
- Motion control - Servos
- Lighting control - Infineon RGB
- Power supply and management
- Temperature sensor
- Temperature display





# excellent adventure

## The project

The idea was to take an old fashioned 'cat gut' based weather house and use electronic components to bring it up to date. The key features would be servo-driven mechanics, LED showing the temperature and the Arduino Yún for getting the weather from the internet.



**Hans and Matilda's new home**

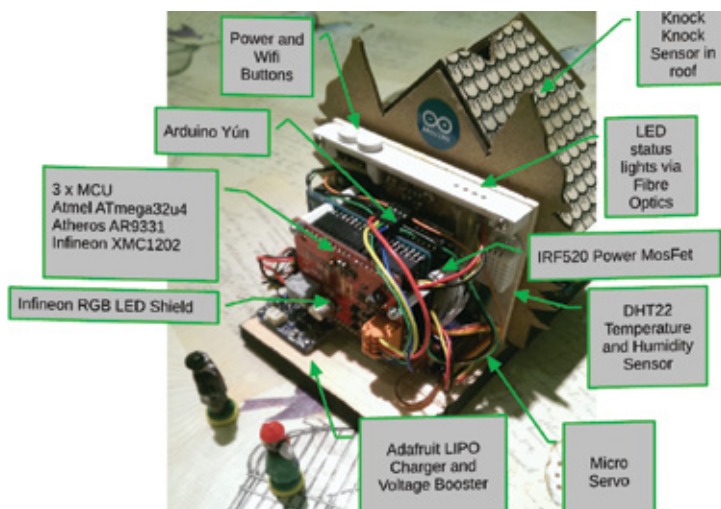
The project has stayed fairly true to its original idea, the LED bar graph for the temperature has been swapped with a coloured LED and the need to have a button to check the temperature has been eliminated. The mechanics have been 3D printed and fitted together with magnets under the cottage so that the figures move straight in and out of the house with no obvious form of propulsion.



**Andy's mechanism showing the Watt's linkages used to approximate straight line movement for Hans and Matilda**

## About me

Before the project, I knew a bit about Arduino, nothing of the Linino portion of the Yún and had not touched Linux for years. I also had not coded in Python before or used RGB LEDs and piezo sensors. I'd only just started with 3D printing back in January. I do have some electronics background, having done GCSE and AS-Level electronics and then an EE degree at Imperial back in the early 1990s.



I've been in software ever since then and just returned to electronics as a hobby in the last couple of years.

## Technical issues and challenges

The build for the Enchanted Cottage was not all smooth progress. There were a selection of technical challenges and mistakes along the way.

The servo provided was a continuous rotation servo; to use that would have made the project particularly challenging. The tinkerkit servo was also a bit large for my weather house so I purchased a smaller positional servo.

The Arduino Yún provided its own set of challenges. First was making it connect to the Web API using a HTTPS connection, this required installing certificates and jumping through some hoops to get the Python components needed. Luckily there was more than one Python library to use so I managed to find one that worked and validated the certificates.

The mechanics to make the figures move took a few attempts, firstly to get the correct motion, then to get something that could be reliably 3D printed.

The wiring took a couple of attempts to get right; I had initially put the cables too far into the sockets, leaving no room for the pins. I also used solid core for these wires which is all I really had spare. This meant that the wiring loom was quite stiff and difficult to manoeuvre; swapping this with flexible cable would make sense.

There were some physical issues too, the short cable on the LiPo battery is definitely one to watch for. Generally finding enough space for all of the components so that they did not clash, and issues, like the height of the components on the Yún and different holes in the proto board, meant a few on-the-fly changes were needed to the structure. Knowing what I know now, I would build the woodwork differently. The proto board inevitably ended up a little messy as the layout was revised a few times. Again, there was

difficulty finding space for the connectors so that they did not clash with the board and mounting struts.

Managing power became one of the key topics as I wanted to run the house on batteries, I found what I needed online and my experiments produced good results.

The Infineon RGB shield was easy to use, and previous challengers had generated some good documentation and code libraries. I knew I'd be at the lower current limits of the board but, with the right settings and timings, the current was set correctly.

The knock knock circuit was heavily researched before incorporating into the project. The circuit was straightforward to understand and build, with just the lack of a pull up resistor on the comparator output causing any delay.

I've learnt a few bits of electronics along the way, such as driving MOSFETs and handling the signal from the Piezo transducer, and I've learnt lots about the Arduino Yún.

## Working project demo

A video of the house in action is available on the blog ([bit.ly/IE23-CottageDemo](http://bit.ly/IE23-CottageDemo)). The demo mostly shows the long boot time of the Linino portion of the Arduino Yún. It typically takes around 60 seconds to boot and, depending on the disk state, it could take longer. I did some research into how this time can be reduced, but did not have a chance to implement anything.

On power-up, the figures move so that Matilda is just inside and Hans just outside. This would indicate a slight chance of rain.

A flashing light at the start of the process shows the system waiting for the boot. Once it's booted, the light changes to indicate that it's processing the weather, and then changes again to a solid light with a slight movement of the people to the middle position to show that it's going to be a 'changeable day in Chicago' which is where I've configured the system to check for weather.

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As part of the promotion for the competition Andy also got to see his name in lights.

### The user experience

#### Initial setup

The one time setup of the system is the out of the box experience provided by Arduino; you have to configure the WiFi to point to your local network.

Unless you live in Chicago, IL, you'll also need to set your location in the configuration file.

#### User Operation

Then, all the user has to do to get the weather is wait, the figures will automatically adjust their positions and the light will change colour as new data become available.

Impatient users can simply knock on the roof to trigger a system wakeup and check for weather.

Rather than needing to read small digits the user can quickly tell the temperature from the LED colour.

### Conclusions

The design challenge has definitely lived up to its name; it was very challenging. I've learnt a lot about embedded systems during this project, from interrupts and low power options on the Atmel microcontroller, to MOSFETs and power control thanks to Infineon. I've also learnt a lot about 3D printing, and designing models to make them print reliably. One of my key lessons learnt is to keep an eye on the physical space required for connectors so that they don't clash with other components.

I'm happy with the end result and enjoyed making the Enchanted Cottage, and I'd like to thank Element14 for giving me the opportunity to participate.

### Finale

And so our enchanting tale comes to its end. If you go down to the forest, there in a little clearing you will find an Enchanted Cottage. If you knock on the door then a delightful couple will pop out to tell you the weather. But be careful not to stay too long as you might bump into the wolf.



Hans and Matilda enjoyed the Faire

The grand prize: a trip to the Maker Faire in New York for Andy – Hans and Matilda went too, of course!



The Maker Faire is a massive event spread all over the site of the World's Fair and New York Hall of Science. There is a diverse range of projects and people, from massive robots to tiny intricate 3D printed castles. Andy said that he, Hans and Matilda all had a fantastic time and have come back with some ideas for future projects. Below he tells us about the trip.

Thanks to a 'gentleman's flight' I did not have to rush to Heathrow and also had plenty of time when I was there. As the plane flew into Newark, I took the train and subway over to Queens and got a view of the city. The nearest subway to the hotel (an overhead line) had a view of the Unisphere, observation platforms and the science centre and rockets.



Hans and Matilda stopped off to see the Unisphere on their way to the Faire

In the morning I had a bagel at a local deli and headed over to the venue. I have been to a few other Maker Faires such as the UK one up in Newcastle and the mini makers faire that ran at Elephant and Castle for a couple of years. I've also seen the Makers at Mex that were at Sandown last year. However the Americans being the way they are, have a much bigger faire, I knew this in advance but was still surprised by the sheer scale of their setup.

The Maker Faire was divided into six zones, each focusing on a rough topic area such as electronics, maker spaces, education or robots



Stilt-walking Jazz Band and Dancing Cardboard Dinosaur

and drones. As we were waiting to go in, we were serenaded by a stilt-walking band with a dancing cardboard dinosaur. I knew this was a good sign of the great things to come. I took a shortcut through the science centre gardens and said hi to the Atmel crew and also spotted Massimo Banzi, the co-founder of the Arduino project.

I also headed over to the Makershed to meet fellow Brit and laser cutting expert Dominic who'd traded some of his time for free accommodation and was helping out with the Solarbotics stand. I also met up with Andy Sigler from Patchbay. IO who was unfortunately frustrated by a lack of power so I promised to return later to see things in action. I was impressed with the turn out in the Maker Health Tent, a group of Makers dedicated to healthcare and promoting democratised access to medical fabrication. There was a great example of a Lego MRI and proton beam machine that were used to show kids how they worked so they would not be so scared when inside. I also liked the add-ons for kids' motorised ride-on toys that meant that not only were they easier for disabled children





to use but they could also be used to help develop certain skills or muscles.

Whilst I was there I also attended a few talks, some were thinly disguised sales promotions but others were from enthusiastic makers wanting to share their experiences and ideas. I managed to miss the start of the Les Machines de l'Île de Nantes but saw the slides of their fantastic ride-on motorised Elephant, factory/gallery and next project, the Stork Tree, which is a giant metal tree with two ride-on storks that take 60 people at a time in huge baskets under the wings. They pay for their projects via grants, sponsorship and by charging an entrance fee to their gallery where they get the public to test out their latest prototypes. There were also some good talks on making, hacking and fixing.



**Cardboard Formula One racing car**

There were lots of fantastic projects inside the science centre too, and I got to see a work-in-progress cardboard Formula One car being made, Stirling engines, a semaphore flag game with image processing to rate the flag user, magical 3D printed castles and another fellow Brit, Ross Atkin from Crafty Robot, who is kickstarting his project shortly. There were a lot of people who were just about to run Kickstarter projects, and a lot of those were in the Startup zone. Here there were gadgets to show what mood your dog was in by how he wagged his tail, giant building blocks, architecture kits, multi-headed 3D printer, laser cutting milling machines and some chaps from Dublin with a novel pin board for holding circuits or projects in place whilst you solder them.

I ended the first day exhausted, so managed to miss the Menthos and Coke show over at the UniSphere.

The next day I decided to revisit the electronic section and say hi to Cadsoft. They were really friendly and explained the new



**Magical 3D Printed Castle**



**Life Size Mousetrap**

licensing model to me. Also I spotted another celebrity, Eben Upton.

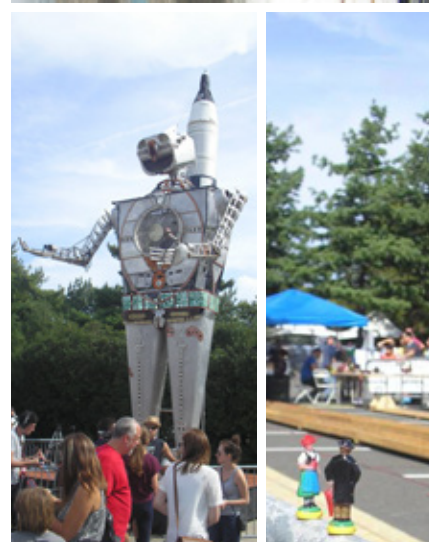
There were a few announcements (that I mostly missed) whilst I was at the show. Arduino has finished their new WiFi shield with Atmel's cryptography chip on it. Adafruit is bringing out a new board and Atmel were talking about the new Atmel Studio and their web-based IDE.

I did however manage to see the Life Size Mousetrap in action, watch drone racing, see experiments being done, talk to loads of people and buy some presents.

I finished my weekend by watching the Eepybird chaps spraying coke zero all over the place, in time to music.



**Tiny Arcade Machines**



A big thanks again to Element14 for arranging the trip and selecting me as the winner.

All photographs by Andy Clark



## ICENAE Fortieth!



**Back L to R: Ian McWalter, Tony Richardson, Andrew Mongar, David Goodman, Andrew Jackson, Mike Barron, Richard Olley, Bill McAuley, Toby Gilsig, Tom Pugsley, David Hayes, Sandy Eames. Front L to R: Pam Olley (nee Horrocks), Jackie Richardson, Simone McWalter, Anne McAuley, Lil Jackson, Mary Goodman, Lily Mongar, Cherie Hayes, Clare Gilsig, Ros Rossetti, Claudette Sergerie (widow of Michael Evans), Teresa Pugsley. Seated on floor: Mike Osborn (husband of Ros Rossetti). IC graduates are entire back row plus Pam Olley, Mary Goodman and Ros Rossetti.**

Twenty-five ageing but intrepid souls gathered in the Adirondack Mountains of the Empire State (aka New York) on the long weekend of September 29 to October 4, to celebrate the fortieth gathering of the ICENAE (Imperial College Exiles North America East). The acronym was coined as a somewhat laborious hat-tip to the gallant Essex girl (well, Norfolk girl actually) who gave Nero's corrupt procurator Catus Decianus a hell of a kicking, until she was finally overcome by the governor Suetonius Paulinus. But I digress.

The first two days were attended by an advance party at the Woods Inn in Inlet, NY. Inlet was the site of the first 15 gatherings at the Rocky Point Inn, until its proprietor Arch Delmarsh, sold his birthright for a mess of pottage and decamped to Florida. (He's now back in Inlet; when they are old, salmon swim back upstream.)

Our main event took place in the more opulent surroundings of the Crowne Plaza Resort in Lake Placid, where unseasonably chilly and windy weather curtailed the ambitious intentions of marathon hikes and

golf games to more modest versions of the same activities. However, the social and bar activities were as lively as ever, but more restrained as befits a maturing group. Tributes were paid to recently departed members and best wishes to those unable to attend.

The intent is to return to the Woods Inn for further gatherings. They have offered to take on the organisational responsibilities for these, which this year were nobly and excellently undertaken by Sandy Eames and Pam Olley. A very good show!

**Bill McAuley (Chem E 60-65)**

## Glossop Medal and Award

We received an email from John P. Harrison (Civil Eng 1976-9, 85) who's now a Professor at the University of Toronto, alerting us to this year's Glossop Medal and Award from the Geological Society, to be presented on 4th November at Burlington House in London.

The Glossop Medal goes to Dr. Tony Waltham (Mining 1960-63,66-68) 'Control the Drainage: The Gospel according to Sinkholes' and the Glossop Award to Yung Loo (Geology 2006-10) 'Engineering geological geological solutions for CERN's underground infrastructure'.

John pointed out that both Yung Loo and Tony Waltham are RSM alumni, and he thinks this is the first time in the history of the awards that both Medal and Award winners have been Imperial alumni. John said of Tony Waltham, "I also know that he was the Imperial College Caving Club President in the late 1960s or early 1970s, as I remember his name being on the Club President's pewter tankard held in the Union Bar. I know this because it was a few entries up from the 1978-79 name of J.P. Harrison!"



**Tony Waltham, winner of this year's Glossop Medal**



**Yung Loo, winner of this year's Glossop Award**

## WE WANT YOUR NEWS

Let us know your news or stories  
Contact Teresa Sergot  
(address and deadlines on page two)

## DIARY

**Friday, 27 November 2015**

**RSMA**

131st Annual Dinner

Venue: The Rembrandt Hotel,  
11 Thurloe Place, Knightsbridge,  
London SW7 2RS  
19:00 for 20:00

**Saturday, 28 November 2015**

**CGCA/RSMA/RCSA**

Decade Reunion 2015

Venue: Queens Tower Room C,  
Sherfield Building  
12:30 for 13:00

**Monday, 14 December 2015**

**CGCA**

Christmas Lunch

Venue: 170 Queen's Gate  
12 for 12:30

**Friday, 26 February 2016**

**CGCA**

Annual Dinner

Venue: Fishmongers' Hall  
18:45 to 22:45

**Wednesday, 25 May 2016**

**CGCA**

AGM

Venue: tbc

**Thursday, 23 June 2016**

**RSMA**

AGM /Final Year BBQ

Venue: tbc

**London Walks**

Next walk details not yet finalised.  
Please see the website at:

[bit.ly/LondonWalks](http://bit.ly/LondonWalks)

**For more information  
or to book, contact  
Teresa Sergot  
t.sergot@imperial.ac.uk  
or 020 7594 1184**

## Cave Junction update

John Gardiner (Civil Eng 1966-70) sent us an update on life in Cave Junction. As a city councillor he was recently instrumental in the City Council taking a public stance against a proposed nickel mine. The council voted to support congressional legislation to protect local watersheds from mining, such as a proposed strip mine in a creek west of nearby O'Brien. 34 of the 35 locals who attended the council meeting, were there to propose a letter of support for the congressional Bill, as suggested by local business owners who agree with a need for anti-mining legislation because of the potential for contamination of drinking water. John is quoted in the Daily Courier, the local newspaper, as saying,

"We are supposed to represent the people of our community and when all but one (who show up at the meeting) support this, we need to listen to them. There was a lot of good testimony. People are very concerned with the quality of our city's drinking water." He added that past councils might have taken a more conservative stance on the issue, "Times are changing. What can I say?" The letter was signed by the mayor and the three other city councillors who were at the meeting. It says, "We also support the proposed five year mineral withdrawal" and goes on to say "This is a botanical hotspot, with the highest concentration of rare plants and a source for clean water to our community."



## 'Unfailing enthusiasm', a quirky take on life ...and a passion for sundials!



**MAURICE JOHN KENN** (Lecturer & Senior Lecturer, Civ Eng 1954-83)

Maurice Kenn will have been known to many alumni, from his role as a lecturer and senior lecturer in Civil Engineering. He also joined the Old Centralians (now CGCA) in the early 1970s, and was a life member of the Association.

Maurice was born in Harlow, Essex, on February 21, 1926 and, after attending Colchester Royal Grammar School, graduated in Civil Engineering at Kings College London. He then studied in Canada, where he obtained an MSc (Hydraulics) from Toronto University.

Maurice gained experience with the London Metropolitan Water Board, Toronto City Water and the Ontario Hydro-Electric Power Commission. From 1952 onwards, he gave specialist advice to Water and River Authorities, Hydro-electric Boards, contractors, consultants and lawyers.

In 1958, Maurice married

Rosemary and settled down in West Wickham in Kent, in a house that became their home for about 50 years, and where they brought up their two sons, Alan and Robert.

Maurice held various academic appointments in hydraulics at the University of Toronto and at Kings College London, before moving to Imperial College in the 1960s.

At Imperial, Maurice served for 21 years as a senior lecturer, spending his last 4½ years as Acting Head of Hydraulics. Paul Minton has written that, 'During the period we were without a professor of hydraulics, Maurice led the section with great skill... (he) never lost sight of the fact that, as teachers of civil engineering, we were part of and responsible to the profession.' Another colleague at Imperial, Chris Head, wrote: 'We shared many happy hours having interesting discussions on a wide range of engineering and other subjects (e.g. sundials!) ... I shall always remember Maurice for his unfailing enthusiasm.'

Maurice's personal research topics included: cavitation; cavitation erosion of concrete; air entrainment; air regulation of siphonic water flows; and applications of dynamic similarity to large-scale flow phenomena. He wrote papers on these and other topics, and lectured widely. In 1982, he shared the Institution of Civil Engineers' Halcrow Premium with A D Garrod, in recognition of their paper entitled 'Cavitation Damage and the Tarbela tunnel collapse'.

At various times, Maurice served as an Institution of Civil Engineers' examiner, and as a member of the Water Engineering Group Board, the Hydraulics and Public Health Engineering Board, the British Section Committee of the International Commission on Large Dams, and the Watt Committee on Small-scale Hydro. He also served on various other technical advisory panels for other associations. Maurice held a particular expertise in resolving unusual problems concerned with air and water flows, and gained experience over 40 years in field and laboratory aspects of water supply, pumping, hydro-electric power generation, model study analysis, ship mooring, ship anchoring and allied topics. After taking early retirement from Imperial in 1983, he was able to contribute to a number of legal cases as an expert witness.

Maurice had a very dry sense of humour and a slightly quirky take on life. Away from work, he had a great interest in, and love of, scientific instruments, especially sundials about which he wrote an informative article for Imperial College Engineer. His sons have written of their father's delight in using a 19th Century sextant on family trips: taking readings from the sun and the horizon, and then drawing lines all over their road maps to determine their precise location. As his son, Alan, explained, 'Sat-nav's didn't exist when we were growing up ... but who needs them

when you have at least two sextants stowed in the boot!'

Maurice also had a love of cars. When he moved to Canada for four years, in the mid-50's, it was with a certain amount of pride that he sent home a photo of his new car: a 1930's Buick with four doors, long running boards and a V8 engine. Returning to England, Maurice bought a car built in the year he was born! This was an open-top two-seater Alvis sports car with a streamlined tail and only one door, on the passenger side; the driver couldn't have a door because the exhaust-pipe ran along the whole outside length of the bodywork just below where his elbow rested on the door-frame!

He also had a great love of the sea, enjoying sailing in the Scottish Hebrides, taking seaside camping holidays, or simply sketching a sea view.

In 2007, Maurice and Rosemary moved to Brisbane, Australia, where they were able to spend much time with their two sons and their families.

Maurice died on April 1, 2015. His sons said of him: "He taught us: how to treat everyone with respect regardless of their social standing or status; how to question things and not just accept things on face-value, nor accept the status-quo; and how to always be honest and speak your mind when things need to be said." As Paul Minton concluded, "We have lost a good friend, a supportive colleague and a true engineer".

### An engineering life in southern Africa

**JOHN ARTHUR WALTERS** (Civil Eng 1941-44)

John was born on October 6, 1924, in Wickford, Essex.

After attending Stowe School, he moved to City & Guilds, where he graduated in Civil Engineering in June 1944 and became a life member of CGCA.

During his time at Imperial, John served in the Home Guard and, on graduating, entered the Royal Navy. He was demobilised in 1947 and moved to Rhodesia and the Rhodesian Railways, where he remained until 1949, having spent some months in Mozambique, gaining experience.

Subsequent to this, he worked for the Salisbury Municipality, and then for his father-in-law's contracting business, before moving on to Rhodesian Iron & Steel Works in the midlands of Rhodesia.

Finally, John returned to Salisbury (now Harare, Zimbabwe) to work with the Grain Marketing Board as Project Engineer. In this position, he was in charge of the construction of grain silos and cotton granaries in an attempt to counteract the impact of sanctions which were imposed in 1965.

John took early retirement in 1981, and he and Rosemary moved to George in the Garden Route of South Africa. No 'retirement' as such took place, as he continued with philately and woodworking.

John's 90th birthday, in October 2014, was celebrated with his local family, as well as family members from the UK.

Sadly, John's health deteriorated, and he passed away on November 16, 2014, leaving Rosemary, his wife of 65 years, a son, five grandchildren and two great-grandchildren.

### A Proud Old Centralian, with a love of railways

**GEOFFREY COPE** (Civil Eng 1943-45)

Geoffrey Hulme Cope was born on August 8, 1926.

A proud alumnus of Imperial College, he was a member of the City & Guilds College Association for well over 60 years and not only took every opportunity to be seen wearing his Old Centralians tie, but also missed very few of the alumni – now CGCA – Annual Meetings.

Geoffrey spent most of his career as an engineer with British Rail. He became a Member of the Institution of Civil Engineers in 1956, and a Fellow in 1981. He was also a member of the Chartered Institute of Transport (now the Chartered Institute of Logistics and Transport), and of the Permanent Way Institution (the Institution for Rail Infrastructure Engineers). He was the editor of the Permanent Way Institution's 6th edition of 'British

Railway Track: Design Construction and Maintenance', published in 1993. Geoffrey joined the British section of the Ingenieurs et Scientifiques de France (IESF) in June, 1996, and was a regular attendee at IESF functions, almost always with his wife, Irene. Following Irene's death two years ago, Geoffrey's final attendance at an IESF event was in September, 2014, accompanied to the event, in Aix-en-Provence, by his son, Malcolm.

Geoffrey was also a Vice President of the Bluebell Railway Preservation Society, a representative of which described Geoffrey as: "a real gentleman and a highly regarded and much respected civil engineer... always willing to share his knowledge, to encourage others and to provide advice. He was definitely old school and had a no-nonsense approach, but there was never any malice".

Geoffrey died after a short illness, on September 26, 2015, aged 89.

## ‘Fascinating and complex jobs’

MELVILLE WALL (DIC Chem Eng 1951-52)

Melville Arthur Gayton Wall was born on January 24, 1924, in Newport, Monmouthshire. After attending Newport High School for Boys, Melville studied for the joint course in Mechanical Engineering at University College and Cardiff Tech, graduating in 1944 with an external London degree, the award ceremony for which was not held until June 1992, at the Royal Festival Hall.

Shortly after graduating, Melville joined the Royal Naval Volunteer Reserve as a Midshipman (E), receiving a rigorous engineering training at Chatham Dockyard, before serving as a Sub-Lieutenant (E) in HMS Marne and Leander. He was de-mobbed in late 1946, but not before HMS Leander was involved in the Corfu Channel Incident, in which two British destroyers were severely damaged by underwater mines. The older he became, the more Melville was struck by the good fortune of his having survived this.

On leaving the Navy, he began his engineering apprenticeship with Babcock and Wilcox, in Scotland. This involved postings to other parts of the UK besides the Glasgow area, including Ipswich and Deptford power stations, Prestwich, and Central London (Calder Hall project). Melville then joined ICI at Northwich for a brief period. In the summer of 1950, he embarked on the major part of his career by joining Monsanto Chemicals, back home in Newport. A year's post-graduate study of Chemical Engineering at Imperial College followed, before he returned to Newport to develop his experience. In 34 years with Monsanto, Melville worked on projects in Fawley, Ludwigshafen, Dundonald, Coleraine, Swindon, Echternach (Luxembourg), Brussels, Antwerp and Louvain-la-Neuve, to name but a few. During the few years of President Kennedy's tenure in the White House, Melville made two

lengthy visits to Monsanto divisions in the eastern states. For his family, this meant interesting things brought home in a tightly-packed suitcase, or help with Physics prep coming over the phone from Dundonald, as he was away so often (in one year, he was away for 42 weeks out of 52). For Melville, it meant a fascinating and complex job as a project manager for the building and running of plants for the manufacture of plastics and agri-chemicals. In 1963, he was appointed Chief Engineer at a new subsidiary of Monsanto in Croydon, Surrey. However, before the family had even been able to move from South Wales to Purley, a new job in Central London awaited him. Having seen the Monsanto Corporate Engineering Department grow from a few men in London, working on drawing boards propped on tea chests before the new offices could be properly and adequately furnished,



Melville watched it gradually reduce as times changed. He continued working with Monsanto until his retirement in 1984, and thereafter applied his intelligence and acuity to undertakings even as old age, and finally illness, were catching up with him. Melville died in hospital on December 29, 2014, at the age of 90. He is survived by Rita, whom he married in July 1950, and by two sons and two daughters.



**Chem Eng postgrads 1951-52, Melville 4th from the left, second row from the back**

## A life well lived

BRIAN SPENCER SOAN (Mech Eng 1946-1948)



Brian Soan followed his passion for engineering steadfastly throughout his life. Born on October 11, 1925, Brian spent his childhood years in Streatham, South London, and gained a place at Dulwich College. However in 1938, with the outbreak of war imminent, his family moved to Holmbury St Mary and his education continued at Dorking County School in Surrey. In 1941, at the age of 16, Brian started an apprenticeship with Vickers Armstrong Aircraft Factory in Weybridge, where he worked on the Wellington Bomber and the production of other aircraft.

In 1946, Brian was awarded a Vickers scholarship to Imperial College where he read Mechanical Engineering. After graduating, in 1948, he worked at Vickers Armstrong as an Aircraft Stress Analyst and Instrumentation Engineer, working on aircraft and missile design and development. During this time, at a Royal Aeronautical Society Dance, he met the young lady who would become the love of his life, Joan. They were soon married and less than a year later, in 1952, they moved out to Australia with Vickers Armstrong, where Brian was Deputy Chief Trials Engineer at the Woomera Test Range near Adelaide in Southern Australia. Using small 'gun' cameras, Brian was in charge of testing the trajectory of both rockets and missiles above the Australian desert.

With the closure of funding for the programme, Brian returned to England in 1955 and joined Bristol Aircraft Limited as an Assistant Designer. In 1959 Bristol Aircraft became part of British Aircraft Corporation and, anticipating this, Brian joined W.S. Atkins Group Consultants (WSAGC), where he stayed until 1983. He was engaged as the Head of Process Planning in the R & D division where he worked

on a number of novel aerodynamic problems including the Drax Power Station chimney, tallest in the UK.

In 1964, Brian transferred to Atkins Planning, the management consultancy division of WSAGC, where he managed numerous studies in a wide spread of industries, mostly overseas: iron and steelwork developments took him to Brazil, Mexico, Germany, Norway, Denmark and Sweden, working for both governments and corporations; the Public Transport Commission of NSW brought him back to Australia; the EC commissioned studies for R & D programmes on wind energy in the UK; for the Marine Technology Support Unit, Brian managed offshore underwater studies; for BP, solid fuel demand by the steel industry; for London Transport and the Department of Energy, engineering management appraisals. In 1964/5, he was the inventor named on 6 patent specifications for improvements to rotatable vessels, travelling cranes and gasholders. He was appointed a Technical Director at WSAGC in 1977.

In 1983, Brian left WSAGC to establish his own consultancy practice, and became closely associated with Wind Energy developments for the Department of Energy and the EEC, in particular the resolution of defects in wind turbines.

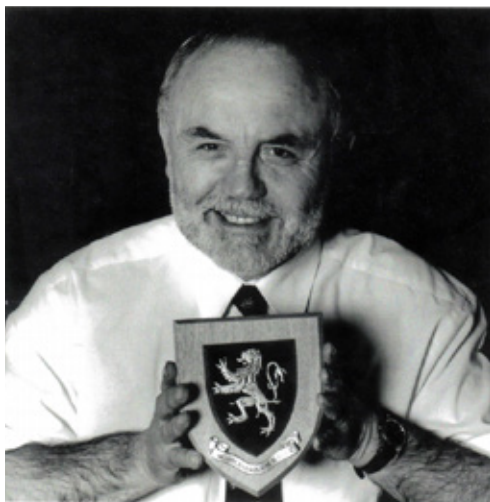
Brian was a member of The Royal Aeronautical Society and of the Institute of Management Consultants, a Fellow of the Institution of Mechanical Engineers and an Associate of the City and Guilds of London Institute. He was a life member of the Old Centralians (now CGCA).

Brian officially retired in 1989. In his retirement, he embraced the computer age. He amused himself with crosswords, sudoku, and wordplay – he was always the master of the pun. He was an inventive and practical family man who passed on his love of problem-solving to his four daughters.

In 2011, Brian and Joan celebrated their Diamond wedding anniversary. Blessed with 8 grandchildren, he lived to see his first great-grandson come into this world. He held a strong Christian belief throughout his adult life and helped many others on their journey of faith. After a long and busy life, Brian died peacefully at home, surrounded by his family, on April 16, 2015, at the age of 89. A much loved husband and best friend to his wife, Joan, a wonderful father to Rosemary, Hazel, Mary and Lucinda, a special grandfather and great-grandfather, he is very much missed.



# 'Work hard in life, but enjoy every minute of it'



MIKE 'SNAGGER' TURNER (Mining 1961-65)

Mike Turner, affectionately known as 'Snagger', passed away in May after a long battle with Alzheimer's. Aside from his love of family and travel, Mike will be best remembered by contemporaries as a lethal, hard-tackling wing forward who captained IC Rugby in 1964-65.

Brought up in Billingham, Mike was a product of Grangefield GS in Stockton. Initially, he applied to study Geology at Loughborough University, no doubt lured by its sporting reputation, but having missed an A level exam, due to appendicitis, he had to repeat his last school year and instead applied to do mining at the RSM. Loughborough's loss was Imperial's gain.

Mike quickly established his reputation at IC on the rugby field with his unremitting physical commitment, and also represented London University.

Mike spent four years at RSM, graduating in mining and then completing a DIC in Mining Geology. Whist at RSM, he met Angela (nee Taylor), a Metallurgy graduate and, after marrying in 1966, they enjoyed a long and happy marriage of over 48 years.

Following college, Mike commenced working for Hovering Gravels and was subsequently quarry manager at Hoveringham. During this time, he played rugby for Nottingham, captaining the 1st XV and also played for Notts/Lincs/ Derby.

In 1969, Mike and Angela joined Roan Selection Trust on the Zambian Copperbelt. They spent three years enjoying the sporting life and travelling, including climbing Mount Kilimanjaro. Mike again excelled at rugby and represented the Zambian national side. He captained Chibuluma which included seven IC alumni in the team. To the concentrator metallurgists at

Chambishi mine he was known as 'Megaton Turner' as a pastime of the miners when blasting in the pit seemed to be who could land a rock the furthest, hopefully onto the metallurgical offices roof! In Zambia, Mike suffered a serious neck injury which allegedly brought his rugby career to an end, and which required a cervical fusion operation in Harare.

The first of Mike and Angela's children, David (also an IC graduate), was born in June 1972 in Kitwe on the Copperbelt.

After returning to the UK in 1972, Mike studied for an MSc in Industrial Management at Loughborough University and then returned to the quarrying industry, culminating in a position of Regional Production Manager for Steetley, before its takeover by Redland in 1992.

During this time, Anne (1974), Katie (1976) and Ian (1980) were born.

Following Steetley's takeover, Mike worked as an independent Safety Consultant, acting as an advisor to a diverse number of companies before retiring in 2004. During these years, he remained active in rugby, coaching Middlesbrough, and he also became a Yorkshire referee, where his philosophy of "be reasonable, see it my way" must have bemused a few teams.

Mike was diagnosed with Alzheimer's in 2007 which ultimately resulted in his going into Victoria House Care Home, in 2014.

Much can be said to celebrate Mike Turner but in September, at a service to celebrate Mike's life, his old friend from school, Imperial and life, Bill Davison, summed it up best: "Mike was a good man – a true, traditional Englishman, both a great family man and a great sportsman. A leader, both on and off the field."

An abiding memory of those who played with or against him was his rendering, after a few pints, of the 'The Lambton Worm' which confused Londoners, Zambians, Afrikaaners and many more. 'Sung' in his best north-eastern accent "Whist lads haad yor gobs" was delivered with gusto.

By all who worked with or for him, Mike was recognised as a good man-manager, who maintained a strong

respect for all. He and Angela made friends easily and maintained those friendships over many years. His college year had regular reunions in different parts of the world over a fifty year period.

Mike's tenacity on the sporting front was matched by a modesty and humility off it. Apart from his love of family, sport and travel, he had a thirst for knowledge and developed a keen interest in philosophy, an absorbing subject around which he read widely. He went on to pass an A level in religious studies as a mature student as part of his interest in a better understanding of life. His own philosophy was to work hard in life, but enjoy every minute of it.

Following his diagnosis with Alzheimer's, devastating to all, he continued to live life to the fullest possible and was able to attend all of his children's weddings and meet all ten of his grandchildren. He remained very active until the last twelve months of his life.

His latter years were comforted by his rock, Angela, who demonstrated an immense strength and dignity in oft difficult times.

A true family man, minesman, Chap, sportsman and gentleman, Mike 'Snagger' Turner will be sadly missed by all, family and friends.



**A Duke W Sheppard R Aston R Chappell P Hammerton P Metcalf M Davies  
J O'Reilly D Howell M Turner(Capt) Prof Sparkes(Pres) C Molam(V-Capt) M Riley I Wiesner  
D G Phillips L Mills W Davison P R Ray**

# A long, successful and very active life in 'The Unknown Industry'

ROGERS EVERT KNIGHT (Elec Eng 1934-37, Mech Eng 1937-38)

Rogers Knight, who died on March 29, 2015 at the age of 99, was a life member of CGCA and was its President in 1974-75. In 1965, Rogers became a founder member of the Old Centralians Trust, continuing for almost half a century, and was its Chairman for 15 years 1980-1995.

Born in Hammersmith on December 6, 1915, to an American father and Scottish mother, Rogers attended St Paul's School then studied Electrical Engineering at City & Guilds College, switching to graduate in Mechanical Engineering in 1938. An enthusiastic member of the Artillery Battery, College Rugby and Tug-of-War teams, he was a great friend of John Garland (Mech Eng 1932-35) a fellow car club devotee. The first 'Boanerges' was a 1909 Rover 8 but it was too young to qualify for the London to Brighton Run so, in 1934, John Garland purchased the 1902 James & Browne Car that became the City & Guilds College mascot, and with Rogers as co-driver did the annual London to Brighton run. At CGCA Annual Dinners Rogers would vividly describe the trials and tribulations to 'Bo' Drivers three quarters of a century on, emphasising the 'modern' luxury of a trailer for the return journey!

In 1936, Rogers received a £100 legacy from his grandmother, and to his thrifty father's dismay, purchased a second-hand 3-litre Red Label 4-seater open tourer Bentley. He said of this time, "I was one of the students who were lucky enough to own their own car. So I used to drive to college, and I if could not park, within 50 feet of the main College entrance, I felt very peaked indeed!"

Upon graduation, Rogers spent some time on the shop floor at Darwin's Steel in Sheffield. His father, William E Knight, an importing agent for a variety of US engineering products, then despatched him to America for work secondments to: Republic Steel, in Chicago, Baltimore and Youngstown; Bethlehem Steel; Bastion Blessing; the Chain Belt Company, Milwaukee; and the National Vulcanized Fibre Company, Wilmington.

Upon the outbreak of War in 1939, and as a former Imperial College Officer Cadet, Rogers reported for duty to the Embassy. He expected to return to Britain but, to his surprise, he was posted to what became the British Supply Mission working in Washington and New York. There he was part of



a small team tasked with locating, procuring, purchasing and shipping essential war materials to war-torn Britain. Rogers spent much time in the New York docks, ensuring the size of steel coils were not too large to be handled by UK ports – US factories rolled in 10-ton coils. The team's 5 years of frenetic activity resulted in over 500 million tons of specialist steel products being shipped to Blighty, and it was Rogers' quiet boast that they 'Never lost a ton, except by enemy action'. During this time, someone in Whitehall decided that

compressed air filters regulators and lubricators in the UK at Shipston-on-Stour, becoming Technical Director of CA Norgren Limited and working between London and Warwickshire. Traditional factories often featured the MD's office overlooking the factory gates. Curiosity as to 'Who's driving that Bentley?' often resulted in Rogers being shown straight to the MD, rather than having to battle his way through the Purchasing Department!

At Rogers' instigation, C A Norgren Limited created a Research & Development Department, and



he would look better in uniform and so Rogers was gazetted as a Captain in the Royal Engineers

Upon discharge, in 1946, Rogers returned to London with his New York-born wife, Virginia – a Mayflower descendant through her Cobb/Brewster forebears. They made their home in a mews off Eaton Square, with a garage sufficiently sized for his Bentley. Rogers then took over the organisation of his father's manufacturing agency business, William E Knight Limited.

Rogers secured the UK import agency for C A Norgren Company of Denver Colorado, and arranged for the manufacture of Norgren

funds were raised for the British Compressed Air Society to sponsor research into the elimination of lubricating oil from compressed air, both at Imperial College [Tettmar's 1964 Thesis] and at the Fluid Power Centre at Bath University, where Rogers was Visiting Lecturer on 'Compressed Air Processing & Distribution'. His name was on the patent for the Micro-Fog Lubricator, leading to greater efficiency in the art of Tribology. In time he came to be recognised as a worldwide authority on the lubrication of steel mill bearings, where constant motion, weight and immense heat can create havoc. He worked

on applications as diverse as the lubrication of one-metre bearings in an aluminium mill, to the 2.4 metre/min chains of drying ovens operating at 250°C, for Kellogg's Cornflakes. The technology also led to vast energy savings for industry; in one case a 5-stand cold mill in India was converted from hydro-dynamically lubricated sleeve bearings to Micro-Fog, a power saving of 15 million megajoules a year. At the opposite end of the size spectrum, Micro-Fog technology also benefited dentistry, where spindle speeds increased from 10,000 to 250,000 rpm and (almost) painless drilling (these in turn have been replaced by air bearings requiring no lubrication). Rogers often asserted that Compressed Air was 'The Unknown Industry', but one "without which no other modern industry could exist".

Norgren UK R&D – with their Denver counterpart – created the Norgren Olympian Modular system, which facilitated rapid replacement of faulty units. Later, by use of a 'tandem yoke', air supply could be switched instantly – eliminating downtime completely and saving industry millions. One example was the Goonhilly Downs communications aerials, the maintenance for which cost £50K per hour but which could be reduced to just nine hours a year. [Ref: 'Compressed Air for Unconventional Applications', R E Knight & S G Collins 1981] The 1974 Design Council Award, presented to Rogers by HRH Prince Philip, was but one of many accolades that the Olympian innovation received.

North Sea oil platforms used waste sour gas for power generation. But sulphur mercaptans within this fuel corroded the regulators, necessitating replacement every six weeks. Norgren UK designed a regulator machined from a solid block of stainless steel, with neoprene O-rings, which lasted six months. BP purchased 3,000 of these upon seeing the prototype.

Convinced of the need for sensible standardisation, Rogers was involved with a kaleidoscopic list of organisations: BSI, ISO, SRC, BFA, BRIMEC, IMechE, etc. He served as President of both CETOP the European Oil Hydraulic & Pneumatic Association (of which he was a founding member), and of the British Compressed Air Society, during 1972-74.

Working with the CBI, Rogers was an early proponent of sensible metrication to save double stocking by British Industry. He led a drive to preserve the 'bar' (14.5psi) as



the safest unit of pressure – this was graphically illustrated in a paper presented at the Institute of Mechanical Engineers 'S.I. Units: The dangers of the Killer-Pascal'. [R E Knight & S G Collins]

In conjunction with the BCAS and Imperial College, Rogers instigated the fast-tracked standard BS 6005 for polycarbonate bowls, to protect UK industry from inferior imports. His BSI and ISO committee work covered graphical symbols, vocabulary, nominal pressures, pipe connectors and air dryer efficiency, to mention but a few.

In 1990, Rogers was instrumental in establishing a British Compressed Air Society working party on British industry recommendations and standards for the use of compressed air for general industrial, medical and emergency purposes. In



conjunction with Professor Robert Schroter of Imperial's Department of Bioengineering, this evolved into the European Standard BS EN 12021 (1999), which is the abiding Standard to which almost all use of breathable compressed air must comply.

Until well into his 90s, Rogers continued to represent the British Industry view on pressure systems legislation, filtration requirements, S.I. units et al. Sadly this work was eventually curtailed by his increasing deafness. His written contributions continued, however, acting as a consultant for Domnick Hunter Filters until his 95th year, and thereafter still assisting BCAS on a pro bono basis. In the words of their Technical Officer, Greg Bordiak, "He continued to hurl down fire and brimstone upon any sloppily-drawn standards".

Rogers was elected a Fellow of the City & Guilds of London Institute in 1980, and awarded the Joseph Bramah Medal by the Institute of Mechanical Engineers in 1987 for his services to the Fluid Power Industry. In 1965, he was a Founder Member of the 'Old Centralians' Trust' which

has provided financial help to many hundreds of students at Imperial over nearly 50 years. He was Chairman for 15 years until 1995 when, at the age of 80, he felt it was time to pass on the mantle.

Widowed in 1996, Rogers was able to take summer and Christmas breaks in Devon with his PA (since 1970) Susan, and husband Tony Collins, turning his skills to repairing paddock gates and their lawn tractor! At his London mews home he continued as a consummate host to many fortunate people who enjoyed the delights of his superb table and his cellar, preceded of course – for those of good stamina – by his fiery 'Old Fashions' (triple bourbon and bitters on ice)!

Until close to his 99th birthday, bereft of his Bentleys and later Lancia Beta, he would explore the

Pimlico Farmers' Market aboard his Breeze Mobility scooter, seeking out eclectic produce to intrigue and delight his guests. He survived numerous set-backs – saved from a bedroom fire by house-guest Sharon Keenan, he bore without complaint broken bones and the ministrations of District Nurses. On the 4th February 2015, emerging from a hip replacement under general anaesthetic at the age of 99, and asked what he would like to eat, his response was: "Like? Well I would like a dozen oysters and steak tartar, but I doubt very much that I'll get it!" Rogers responded well to physiotherapy, and was hopeful of returning home, but sadly was felled by a chest infection, and died eight weeks later, on March 29, 2015.

Rogers and Virginia had no children but he leaves a niece Ginny (Virginia) Roberts, and her husband Howard. Rogers is also remembered fondly by his friends of over four decades, Susan Collins – who prepared his obituary – and her husband, Tony.

## A true gentleman, of strong faith and courage

REV. THOMAS RUSSELL HAWTHORN (Elec Eng 1938-39, 45-48)

Tom (also sometimes known as 'Rusty') was born on December 16, 1918. He was the eldest of three children, but sadly lost touch with his younger sisters when their parents' marriage broke up; the girls were adopted, never to see each other again, and Tom remained with his father, who was mining tin in Bolivia, where Tom's playmates included local Quechua children.

Tom was fluent in Spanish by the time he was sent – unaccompanied – to England to attend school in Watchet, Somerset. He later went on to study electrical engineering at City & Guilds College, his time there being interrupted by WWII.

Tom became a pilot in the RAF, flying Hurricanes, and was a prisoner of war for three years, in camps in Germany and Poland, but though he was decorated for his war service, he rarely spoke of his experiences. Amazingly, seventy years later, when Tom visited RAF Coningsby, in 2012, he was again able to sit in the cockpit of a Hurricane, one of the WWII Memorial Flight.

Resuming his studies after the war, Tom graduated in 1948 and married his first wife, Enid. He subsequently worked in many locations around the world, and was involved in Venezuela with the lighting of Lake Maracaibo.

At the age of 64, Tom was ordained as a deacon and priest

in Mexico, and, after a short time serving the Church there, he retired to East Anglia.

He served as a very dedicated assistant chaplain at HM Prison Blundeston, where his fluency in Spanish helped him to establish very good relationships with some of the inmates. Tom's last 30 years were spent in Lowestoft, where he was kept busy conducting services in the many churches in the area. With his second wife, Valerie, he threw himself into social and church life in Suffolk, and was awarded the MBE in 1991, 'For services to the Community in Lowestoft'.

He was never reunited with the sisters from whom he had been separated, and it was only after the death of one of his sisters that it was discovered that, for seven years until she died in 1991, they had lived only a few miles apart.

Tom was very much involved with military organisations, serving as a chaplain to various bodies, most notably the Royal British Legion. The clergy of Lowestoft were quite content to leave the parade and memorial services in Tom's hands.

Tom died on December 15, 2014, one day short of his 96th birthday, leaving Valerie, to whom he was married for 40 years, a son and daughter, nine grandchildren and great-grandchildren.

He was, one might say, a true gentleman of strong faith and courage.

## Former President of CGCU

PETER HENRY STOKES (Mech Eng 1938-39, 1940-43)

Peter was born on May 24, 1918 and studied Mechanical Engineering at Imperial. He was president of the City & Guilds College Union in 1942-43 and was subsequently a member of CGCA for over seventy years.

Peter worked for most of his

career with the Simon Group, including Simon Engineering Ltd and Simon Carves (Stockport).

The beloved father of Fiona, Judy, James and Iain, and a much loved grandfather and great-grandfather, Peter died peacefully on April 19, 2012, after a short illness, at the age of 93.

## NOTICES IN BRIEF

DUDLEY CHOWN (Mech Eng 1961-64)

Dudley worked with John Brown (later Kvaerner John Brown) in London.

He died on February 2, 2014, at the age of 70.

CLAYTON RAYNER WILFRED (STEVE) STEPHENS (Civil Eng 1951-52)

Born on November 16, 1932, Steve studied for a DIC in Civil Engineering at City & Guilds between 1951 & 1952. He was a member of CGCA for more than 45 years and worked for Tarmac for much of his career.

Steve died on August 27, 2014, at the age of 81.



