



Imperial ENGINEER



USE OF SIMULATION IN CAR DESIGN
TECHNOLOGY AND ECOLOGY
ALUMNI ENGAGEMENT
HUGH KENDRICK
ePUBLISHING
A CAPPELLA
NEW DEAN

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

ISSUE 27 *AUTUMN 2017*

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Front Cover photo:
This image of Earth was taken by a NASA camera on the Deep Space Climate Observatory (DSCOVR) satellite. The image, taken July 6 2015 from a vantage point one million miles from Earth, was one of the first taken by NASA's Earth Polychromatic Imaging Camera (EPIC).

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URLs at the end of items indicate more details online.

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STORY IDEAS FOR THE NEXT ISSUE BY FEBRUARY 9 2018

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I must start my President's update in this edition of Imperial Engineer by telling you that this will be my last update as your President. I have recently taken on a new responsibility having been asked by the UK Government to lead an independent review into Building standards and Fire Safety Regulations in High Rise Buildings. The review has been set up in the wake of the terrible tragedy which occurred at Grenfell Tower in West London in June but will be forward-looking, seeking to improve the standards or protection for residents in all high rise buildings throughout the country. The timing of the review is tight and will inevitably take up a lot of my time. I have therefore decided that I must step down from my role as President of CGCA to concentrate on this important piece of work.

For the most part I have enjoyed the last few years when I have been part of CGCA's Exec committee and President for just over a year. Why only for the most part? Because the organisation is facing some very serious challenges and progress in resolving them has been by no means as fast as I would have liked to see. The challenges are that:

- our membership is falling in numbers and seriously skewed to those who left College 35 or more years ago;
- we are struggling to understand how to become relevant and attractive to young graduates who leave Imperial's Faculty of Engineering today;
- we need to create an Association which is complementary to the work of the College, the Faculty and the Departments in Alumni engagement.

We now have some important foundations in place and it will be for my successor(s) to deliver on the rest of the programme we have started:

- We have staff and student representatives identified in every department.
- We have taken the decision to provide a small amount of funding to year reps from each graduating year of each department for the first 5 years after graduation to enable them to maintain contact with their year group.
- We are now funding departmental events in several departments, notably Chem Eng and Mech Eng.
- We have joined with and sponsored a number of events with CGCU including a very well attended Women in Engineering event.
- We have engaged in a working group with the Faculty and RSMA to talk about how we set up an Alumni Association fit for the future.

Building on these foundations and creating a vibrant active Alumni Association is the task which lies ahead.

I remain convinced that we will only achieve this when we have more, younger people actively engaged in the Association. College and the Faculty have changed enormously since many of us were there as students. That is why the College remains a world class University and every department attracts the very best students because they continue to adapt and change. That's why the onus is on us as an Association to move with these changes not simply holding on to our fond memories of how it was "in our day".

Change has not just affected College and the Faculty but impacts all of us in many different ways. For CGCA one of the issues which needs to be addressed in the next 6-9 months is going to be how we all adapt to the new legislation on data protection (General Data Protection Regulation) which comes into force in May 2018. This is a direct acting European regulation passed in April 2016 which becomes enforceable after the 2 year transition period. None of us would argue with the aims of the legislation – to give citizens better control over their personal data and protect their privacy – but as ever, legislation is a blunt instrument and has many consequences. In the case of CGCA we are still trying to understand what it will mean in terms of our ability to continue to contact members and inform them about events. At the very least the Association is going to have to write out to all of its members and ask your permission to continue to send you mail and e-mails. Without a positive response from you we will no longer be able to make contact. You will quickly recognise that this represents a big risk to our existing membership base but it also means that we need to work very closely with College and the Faculty behind the scenes on establishing new and robust data sharing agreements. We have to have a workable system but we also rely on the strong support we get from the Faculty and that may mean that we have to change our ways of working to suit future arrangements – so please watch this space and look out for further CGCA communication about GDPR (starting with page 6 of this issue).

I will continue to stay connected with CGCA (or whatever it may be called in the future) and will look forward to seeing some of you at future events. In the meantime, I would like to close by saying it has been a pleasure and a privilege to be CGCA President. Thank you.



**Judith
Hackitt**

PRESIDENTS REPORT



**Tim
Cotton**

The period between the spring and autumn issues of Imperial ENGINEER is always a quiet one in terms of RSMA and RSMU activities. Due to work commitments the RSMA committee was unable to field a representative at the Imperial Alumni Fair in early May but our colleagues in the CGCA were able to hold the fort for those three RSM Alumni that did attend the event. The 2017 Annual General Meeting of the Association was held on the 29th June, followed by the final year Bar-B-Q, which was again well attended by the students plus a few stalwart alumni. See the report on page 4 for an update and few photographs.

The 133rd annual dinner will be held on Friday 24th November at the Rembrandt Hotel in Knightsbridge. Last year was an excellent event with nearly 100 guests and it is hoped that as many members as possible will attend this year. The dinner remains the most significant event in the Association's calendar. In this publication there is a flyer that contains the booking form and a group e-mail will also be sent out to all members telling them how to book.

Following the success of the last three years' events, in December the committee will again give a presentation to the students on the history, aims and membership of the RSMA in order to get students to join the RSMA whilst studying. The committee continues to maintain a very active relationship with the RSMU and for the 2018/19 academic year the new RSMU representatives are Rob Tomkies and Avni Patel, respectively President and Hon Sec. The challenge going forward is to better embrace the Materials Department students and seek a staff representative on the Committee. The involvement with ESE remains strong and the Committee is looking to further the links in ESE and Materials by engaging with the key societies within them such as De La Beche, MatSoc and GeoPhysicsSoc.

2018 is set to be a challenging year for the RSMA as the UK Privacy laws are changing and are becoming very proscriptive on how associations may, or may not, contact their members. This impacts the College as a whole and

we will be working with College's Development Department in the Faculty of Engineering and College Alumni Relations team in managing the transition to these new privacy laws. The Committee has a good working relationship with these two departments and it hoped that the membership will see minimal interruption.

Lastly on the fund raising activity front, the 100 Club is slowly growing and I would encourage you, if you are able, to sign up and support the RSMA via the 100 Club or by a one-off donation. Your support is truly appreciated. I hope you find this issue informative, the RSMA Essay Competition winning entry (page 12) is worth a read and I look forward to seeing some of you in the RSM and /or at an RSMA event in the near future.

RSMA AGM and Final Year BBQ – June 29th 2017

The 2017 AGM started after the RSMA Trust meeting, and after the previous meeting's minutes were approved Professor Rees Rawlings started proceedings with an update on the Trust's activities. A highlight of the Trust report was the announcement of the Annual Awards for the RSMA. The Peter Harding Memorial Award was given to Dr Lorraine Craig for her tremendous efforts in student development and support at the RSM. Danny Hill was awarded the Professor Rees Rawlings Award for his efforts as the RSMA Honorary Treasurer for the past four years and Sebastian Gonzato was named as the winner of the RSMA Annual Essay Prize. The meeting continued with the usual reports being given from the President and Treasurer of the RSMA which outlined the work of the Association over the last year. In summary the Association remains financially strong and is continuing to support the students and staff of the RSM. The key challenges facing the Association are the increasing

workloads to prepare for the changes in UK Privacy Law and the terrible service that the Association is receiving from our bankers, HSBC. Both of these will add significantly to the administrative burden but it is pleasing to note that the Association receives good support from the College's Development Department in the Faculty of Engineering and College Alumni Relations team. The meeting approved the election of officers and committee for 2017/18 which included a new committee member Harry Fisher. The association is also looking to add more committee members from the staff and student bodies of the RSM. By a show of hands, the members present unanimously voted in the 2017/18 Trust Board and with very little other business to attend to, the meeting was closed and the Final Year BBQ began. The draft minutes of the AGM, including the full President and Treasurers reports will be posted on the RSMA website in due course for all members to review.

The British summer was kind, take that as it *didn't* rain, and the evening was a great success with students, members and guests all enjoying the food and the company.

The event also allowed the RSMU to make the final RSM awards and to recognise those students who had contributed to the social life and wellbeing of the RSMU.

Once again, great thanks are due to alumnus Eddie Gadd who donated two pins of his finest Ramsgate Brewery Ale for the function. These were very well received by the members and guests and complemented the food supplied by the team at 58 Princes Gate. Go to www.ramsgatebrewery.co.uk to find a stockist near you, or visit the brewery and shop, you will not be disappointed with the products.



Photo courtesy Evelyn Mason

A succession of Presidents (L to R)

Ben Warnick RSMU 2014/15, Noah Hawkins RSMU 2016/17, Tim Cotton current RSMA President and RSMU 1991/92, Sam Argyle RSMU 2015/16, and Rob Tomkies RSMU 2017/18

Election of officers and committee for 2017/18

- | | |
|------------------------|--|
| President: | Tim Cotton |
| Senior Vice-President: | Position unfilled |
| Junior Vice-President | Eleanor Jay |
| Past-President: | John O'Reilly |
| Hon. Secretary: | Hannah Bungey |
| Hon. Treasurer: | David Bishop |
| VP International | John Sykes |
| Membership Secretary | Coen Louwarts |
| Members: | Lorraine Craig
John Monhemius
Rees Rawlings
Robert Tomkies (President RSMU)
Avni Patel (Hon Sec RSMU)
Paul Holmes
Daniel Hill
Celia Hayes
Harry Fisher |
| Overseas: | Giles Baynham (Canada)
Leah Glass (Australia) |

Trust Board

- Board Members:**
 Prof. Rees Rawlings (Chairman)
 John O'Reilly
 Fiona Cassidy
 Coen Louwarts
 David Bishop
 Tim Cotton

- Trustees:**
 Prof. John Monhemius
 David Bishop
 Hannah Bungey
 Robert Tomkies (President RSM Union)
 Glynne Lloyd Davies (Hon Secretary)



Photo Courtesy Tim Cotton

New Committee member Harry Fisher trying Gadd's Beer



Photo courtesy Evelyn Mason

And the awards go to – (L to R) Rosie Blann, Madeline Hann, David Whittaker and Anna Caklais

Alumni.
We want your news!
 (Contact details on page 2)

CGCA 2017 AGM and President's Evening Dinner

The CGCA AGM was held at 17:30 on Monday 12th June 2017 in the Queen's Tower Rooms in the Sheffield Building at Imperial.

Following approval of the minutes of last year's AGM, President Dame Judith Hackitt presented a review of the past year. In summary she said:

- CGCA have to modernise. Membership is falling and the average age is getting higher. This is the mid point of Judith's presidency and we have not achieved as much as she wished.
- Departmental Contacts are now in place.
- CGCA Departmental reps are in place except for Computing and Bioengineering.
- Several Departmental events have been sponsored by CGCA.
- CGCU events have been funded.
- CGCA agreed to buy PCs for CGCU
- The Union Honour Shields are being restored and a place to display them is fixed.
- Thanks to Peter Chase and Nigel Cresswell for their admin support.
- DPA registration is complete and processes are being put into place.
- We have good relationships with the Faculty and Alumni Dept.
- Letters sent out requesting email addresses / contact details from those for whom we have no email address.
- Access to membership data is still an issue, waiting on Imperial's decision on a new system.
- GDPR in 2018 will be a challenge. We need a positive opt-in to contact members by email about events, etc. If members fail to respond we must assume they have opted out so we may lose contact with them.
- Imperial ENGINEER has gone from strength to strength, thanks to Peter and Alison Buck.
- Imperial ENGINEER represents a great example of RSMA and CGCA working together.
- We are looking to work with CGCU on a regular newsletter to students in the next academic year.
- Thanks to Nic, Jess and Nicola from the Alumni dept and to Dean Jeff Magee for support throughout the year.
- The Annual Dinner was a great success, thanks go to Colin Kerr.
- The Decade Reunion was rebranded the 5 + 10 Year Reunion and worked well. Thanks to Peter Chase.
- Dick Kitney will become Senior Vice President and Atula Abeysekera will be Vice President. Thanks to David Nethercot for succession work.
- The OC Trust continues to thrive in supporting students for

conference travel, expeditions, awards and hardship help. Thanks to Chris Lumb and his team.

- However Chris Lumb is standing down as CGCA Membership Secretary.

- Thanks to the Committee for their support.

Peter Chase presented the accounts. The key points were:

- We have spent more on student events and facilities than in previous years.
- Operating accounts are OK.
- We have saved OC Trust money by paying for some of their events.
- RSMA paid a larger proportion of Imperial ENGINEER due to the change in relative number of members receiving a printed copy.
- The mail shot for email addresses increased expenses.
- We had a bank charges refund.
- Investments rose from £157K to £177K.
- OC trust funds stand at £2.8M.

Peter Chase proposed a vote to reappoint the auditors, which was carried.

Nigel Cresswell presented a proposal for a new level of membership to be known as Affiliates. After a brief debate the proposal was approved.

The Committee was elected as proposed. The list of departments awarding ACGI is unchanged. The meeting was closed at 18:25.

Dame Judith then led a discussion on the future structure of Alumni organisations for the Faculty of Engineering.

There followed a brief General Committee meeting to confirm the Trust Fund Board and other General Committee posts. It was suggested that in future Executive Committee and General Committee meetings should be merged for efficiency and convenience.

Attendees then enjoyed supper.



Photo: Peter Buck

CGCA President, Dame Judith Hackitt presented a review of the year

Executive Committee for 2017/18

President	Prof. Richard Kitney
Senior Vice President	Vacant
Vice President	Atula Abesekera (Civ '80)
Immediate Past President	Roger Venables (Civ '66)
Honorary Secretary	Nigel Cresswell (Civ '71)
Honorary Treasurer	Peter Chase (Comp '82)
Editor, IE	Peter Buck (Comp '79)
Young Members Secretary	Tim Munday (Civ '11)
Events Programme Coordinator	Charles Parry (Mech '81)

General Committee for 2017/18

Annual Dinner Organiser	Colin Kerr (Civ '88)
Decade Reunion Organiser	Peter Chase (Comp '82)

Departmental representatives:

Aeronautics	Tim Munday (Civ '11) <i>vacant</i>
Bioengineering	<i>vacant</i>
Chemical	<i>vacant</i>
Civil & Environmental	Peter Lynch (Chem '73) Judith Hackitt (Chem '72) Atula Abeysekera (Civ '80) Colin Kerr (Civ '88)
Computing	<i>vacant</i>
Design Engineering	<i>vacant</i>
Electrical & Electronic	Jineesha Mehta (Civ '11) <i>vacant</i>
Mechanical	Chris Baker-Brian (Elec '06) <i>vacant</i> Charles Parry (Mech '81) <i>vacant</i>
Overseas	
Australia (Melbourne)	Dave Bishop (Elec '61)
Australia (Sydney)	James Kehoe (Mech '58)
Hong Kong	Leslie Swann (Civ '68)
Malaysia	Cheah It-Tee (Mech '73)
South Africa	Richard Gundersen (Elec '73)

CGCU

President	Claudia Caravello
Hon Sec	Thomas Bower
V-P (Finance & Societies)	Andrew Hill
V-P (Activities)	Edmund "Ross" Unwin
Alumni officer	Andrei Pogan

OC Trust Fund Board for 2017/18

Trustees

The Consul of the Faculty of Engineering	Prof. Marek Sergot (ex officio)
The Hon Secretary, CGCA	Mr N Cresswell (ex officio)
The Hon Treasurer, CGCA	Mr P Chase (ex officio)
Nominated by the Board	Mr C Lumb (chairman)
Nominated by the Board	Mr J B Spooner

Ordinary members

Mr J Collins
Mr J Fok
Mr C J Kerr
Mr D J C Law
Mr D Lehmann
Mr Tim Munday
Prof. R C Schroter
(one vacancy)

By invitation

President, CGCA	Prof. Richard Kitney
President, CGCU	Claudia Caravello
CGCU Alumni Officer	Andrei Pogan

Data Protection, Privacy and your CGCA membership

I hope you've seen the **urgent notice** on the address sheet of this issue of Imperial ENGINEER? No? Well please go and retrieve it right away! There is a request on the back that it is very important you respond to – or we may never be able to contact you by email again.

So, what's this all about and why is it urgent now? It's about these three pieces of legislation:

- The existing UK Data Protection Act, DPA, 1998
- The Privacy for Electronic Communications Regulations, PECR, 2016
- The General Data Protection Regulations, GDPR, which come into force across Europe in May, 2018

The urgency comes from GDPR when it comes into force next May. Once in force, CGCA will be very restricted in sending you any electronic communication unless we have a positive consent from you on record.

Even if you don't read any more of this article, please look at the reverse of the address sheet and respond to the two 'Issues' described in the way most convenient to you. You may complete the form on the back of the address sheet and post it back to us, or follow the instructions to respond by email.

Issue 1

When the DPA came into force in 1998, CGCA, like many membership clubs in the UK, did not react completely to the new regulations. We should have told every member how we handled their personal data in our membership system and given you the chance to say you did not consent to that. Issue 1 on the sheet is giving every member the chance to give their consent now, hence bringing CGCA into line with the existing regulations. Before responding you should read the 'CGCA Data Protection and Privacy Statements' which are printed in the flyers in the IE packaging or can be downloaded at <http://www.cgca.org.uk/annualmembership/Annualmembership.html>

If you give your consent to Issue 1 then all continues as is.

If you do not respond to this Issue and do not cancel your membership by contacting us or cancelling your subscription payment instruction then you will remain a member.

If you respond by saying you do not want your data handled in the way described in the Statements this will effectively end your membership of CGCA.

Please respond to Issue 1 now.

Issue 2

PECR is currently a UK law. The concern here is with electronic marketing. If CGCA want to send you an electronic communication that contains any form of marketing then we need to have your consent. At present that consent can be assumed in a number of situations, e.g. you are a member of CGCA, so of course you want to know when the Annual Dinner, AGM, and other events are going to happen! At present CGCA can send you an email newsletter covering such topics.

When GDPR comes into force (May, 2018) there is an interaction between GDPR and PECR that gives rise to Issue 2. GDPR will replace DPA, 1998. It generally makes data protection much stricter and introduces the concept of positive consent across all regulations to do with personal data.

Hence, from May, CGCA cannot assume you want to receive electronic marketing unless we have a positive statement or action from you saying you want to receive such communications. If you do not respond we must assume you do not consent even if you wish to remain a member.

I have checked with the Information Commissioner's Office (ICO) who have the responsibility to enact all the above legislation, and the term 'marketing' includes:

- Details of the Annual Dinner, AGM, etc.
- Details of a joint CGCA / CGCU event
- Details of CGCA regalia
- And even an article setting out the aims of CGCA!

This is why it is important you respond to Issue 2. If you do not give consent or just don't respond we will not be able to send you email newsletters telling you about forthcoming events and this may impair your enjoyment of your membership. So please respond to Issue 2 now and enable us to know your preferences for electronic communications from CGCA.

For future members, both issues are handled in the application process.

Thank you for reading this, and please respond to us!

Nigel

Nigel Cresswell
CGCA Hon Sec and Data Controller

New CGCA President

Effective from the start of October, 2017, **Professor Richard Kitney** will become President of CGCA. This follows **Dame Judith Hackitt** standing down due to pressure of newly gained commitments. Richard was elected Senior Vice President in June 2017, so takes on the role a year earlier than expected. CGCA thank Judith for her vision and motivation in her year in office and thank Richard for stepping into the role.

Richard Ian Kitney OBE, FREng, FRSE, DSc (Eng), FCGI is Professor of Biomedical Systems Engineering, Chairman of the Institute of Systems and Synthetic Biology, and Co-Director of the EPSRC National Centre for Synthetic Biology and Innovation. He was Founding Head of the Department of Bioengineering and Dean of the Faculty of Engineering.

Recognised as a leading research worker in the field of synthetic biology, with Professor Paul Freemont he has been responsible for developing the Imperial College Hub for Synthetic Biology, one of the leading international centres in the field. In 2013, they were successful in winning the national competition to establish the UK national industrial translation centre for synthetic biology – SynbiCITE.

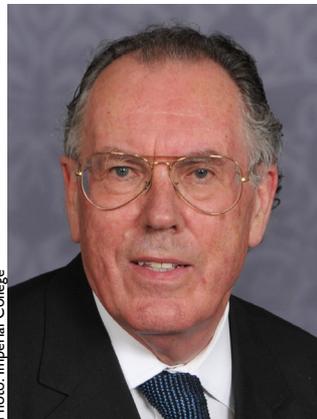


Photo: Imperial College

He has published over 300 papers in the fields of synthetic biology, mathematical modelling, biomedical information systems, and medical imaging and has worked extensively in and with industry.

In June 2001, Professor Kitney was awarded an OBE in the Queen's Birthday Honours List for services to IT in Biomedicine.

Kitney was made a Fellow of the World Technology Network in 1999 for his innovative work in the fields of health and medicine. He was made an Academician of the International Academy of BioMedical Engineering in September 2003. In 2006 he was made an Honorary Fellow of both The Royal College of Physicians and The Royal College of Surgeons.

IABSE Honorary Membership awarded



Photo: Imperial College

The International Association for Bridge and Structural Engineering (IABSE) has awarded Honorary Membership to Emeritus Professor **David Nethercot**.

The award is presented to David in high appreciation of his outstanding and dedicated services to the Association.

David, who was Head of the Department of Civil and Environmental Engineering at Imperial for 12 years, and is a Past President of CGCA, has 50 years' experience of teaching, research and specialist advisory work on major projects, principally in the field of steel construction. He is the author of more than 400 research papers as well as textbooks and design guides

and has addressed conferences in some 50 countries worldwide.

He has been one of the pillars of the worldwide structural engineering community for years, including within IABSE where his leadership and example has been an inspiration to many. David joined IABSE in 1986.

He was awarded a DSc degree in 1993 and elected to the Royal Academy of Engineering in the same year. David is a Past President of the Institution of Structural Engineers and a former Council Member of the Royal Academy of Engineering. In 2006 he was awarded an OBE for services to Structural Engineering.

bit.ly/IE27-Nethercot

CGCU win Sparkes Cup

This item is reprinted from the CGCU magazine The BOLT with permission.

The Sparkes Cup is a friendly 10-a-side rugby tournament between the CGCU, RCSU and RSM that takes place annually in Rosslyn Park Stadium during the summer term. Emphasis is put on participation, and individuals who may never have played rugby before are encouraged to sign up to meet new friends from all departments. Free food, transport and drink are supplied throughout to all supporters and players, and as it occurs after the majority of our exams, there's no excuse not to come down and join in!

Blood, sweat and champagne went into the tournament, where the CGCU fought like warriors before emerging victorious. Below is the team's take on the event that ended the CGCU on a high for the year!

"The men of CGCU were awake at early dawn to watch the British and Irish Lions play New Zealand, in the arid climate of the 'Famous 3 Kings' public house. We looked on with glumness as Owen Farrell's turnstile defence brought with it a heavy defeat. With this saddening loss at the forefront of our minds, we set out to demonstrate that Warren Gatland had left the prime British talent at home.

Stepping off the luxurious (free) coach, we entered Rosslyn Park Stadium where this mighty exhibition would take place. A large group of fans had gathered in the stands, awaiting the entrance of their favourite engineering rugby stars.

Our first match was against RCSU, a team filled to the brim with receding hairlines and short man syndrome. The terrifying prospect of a 99kg fly half sent shivers down the spine of the lightweight CGCU squad, but the lack of quality ball from the budding RCSU Finance Officer caused his effectiveness to be greatly reduced. Josh Pope ran with his usual will-o'-the-wisp style, gliding through the defence on the back of a handsomely delivered switch play. Despite the initial apprehension, CGCU came away with a convincing win.

Our second challenge came from the ramshackle squadron of the RSM, most of whom had opted to spare themselves from our talent by running away on 'fieldtrips'. The grapevine rapidly delivered news of a quicksilver hockey player who sought to cause us grief on our fringes, since our winger Ifan Dafydd's pace is like his relationship with his dentist – not what it used to be. James Field, imbued with the power of his Shark Tooth necklace, performed a sumptuous chip and chase which left the Miners in disarray. Meanwhile, Jamie Couchman thought God had been overgenerous by affording him two shoulders, and attempted to give one back via the medium of dislocation. A quick pop back into place and we were off again! After a long fight, the CGCU emerged victorious.

With RCSU winning their match with RSM, they achieved a rematch with our men in the final. Previous joviality was put aside, as the scientists sought vengeance for their earlier embarrassment at our hands. However, with their talented scrumhalf placed under intense psychological bombardment, they could not put significant phase play together. Jorn Voegtli pumped his legs and drove into enemy territory, carrying several of the opposition over the line with him to score. With this seemingly the last straw for RCSU, they unveiled their greatest asset, a triplet of meaty alumni. Fresh legs and ready to play, these giants headed onto the pitch. Despite these gravitationally-challenged charlatans, our men drew on their mettle to put their heads where it hurt and came away with the Sparkes Cup in hand.

With good spirit all round, the teams joined the supporters and headed to a nearby venue, where free drink and barbequed delights awaited us. Festivities continued long into the night, celebrating a great day of sport, as well as the handover to the new Captain of CGCU Rugby."

Harry Brady
CGCU Rugby Captain



The victorious CGCU team

Photo: City & Guilds RFC

Imperial College students do the double at cybersecurity competitions

It's been a good six months for Imperial College students in cybersecurity, with winners in both the Inter-ACE 2017 and the C2C 2017 competitions.

Madalina Sas, from the Inter-ACE winning team, and **Rodrigo Vieira Steiner**, from the C2C winning team, were asked about the competitions:

Madalina said: "The Inter-ACE is a cybersecurity competition open to students studying at an Academic Centre of Excellence in Cyber Security Research.

"The competition had two challenges. The first was a capture-the-flag where teams competed to attack, control and defend as many hosts as possible on a network. The second was a forensics challenge where various puzzles had to be solved, to find flags on the hard-drive of a Windows machine and inside a PCAP file.

"We decided to split the team, with some of the group focusing on taking over machines whilst others tried to solve as many forensics challenges as possible. I believe the main reason we won was that we had a good diversity of skills on our team, which allowed us to come at the challenges from different angles. This is important in real world cybersecurity as well."

Rodrigo Vieira Steiner said: "The C2C is a joint UK-US cybersecurity competition that was started two years ago between MIT and Cambridge University. It was launched by Barack Obama and David Cameron to help foster collaboration in cybersecurity.

"This year's main event was a three-day capture-the-flag hackathon. Teams had to find cybersecurity vulnerabilities in several servers, hack into them, and then plant a 'flag' which is a unique team identifier. Once you planted a flag you had to defend it by fixing the server vulnerabilities, preventing other teams from supplanting it. So you need both attacking and defending skills.

"Points were awarded for the number of flags at the end, but you'd also get points for fixing vulnerabilities and solving side challenges. This year, the teams were mixed in terms of the universities and individual abilities, which was decided in a qualifying round of online challenges. I was on a team with people from MIT, Carnegie Mellon, Cambridge and Oxford.

"We realised that speed was crucial for the capture-the-flag challenge; the earlier you could find the servers, the more likely they were to still be vulnerable. So we decided to focus on the attacking and defending, and left the side challenges to later on.

"It's a lot of fun taking part, and a great opportunity to meet new people with similar interests. I'd highly recommend it to anyone interested in cybersecurity. One of the main benefits is that you get hands-on experience of cybersecurity from an attacker's and defender's perspective. It's difficult to get this experience legally! You learn a lot from this and from your team mates.

"Finally, the prizes are a welcome bonus! Our team came 1st and won £9,000."

bit.ly/IE27-CyberComp



Students.
We want your news too!

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Two Imperial researchers win double awards



Photos: Imperial College



It's been a good year for **Dr Camille Petit**. She has added to a string of successes with two awards: a Silver Medal award from the Institute of Materials, Minerals and Mining (IOM3); and an AIChE 35 Under 35 Award, from the American Institute for Chemical Engineers.

The IOM3 Silver Medal award is typically given to an early career researcher who has made an outstanding contribution within the materials, minerals or mining sectors. The award was presented at an awards ceremony in July.

Dr Petit said: "It's always a pleasant feeling when your work is recognised by your peers. This award is a great testimony of my group's research efforts."

The AIChE 35 Under 35 Award was created to promote the achievements of young professionals working in all areas of chemical engineering, and to acknowledge those who have made significant contributions to their field.

The awards ceremony is being held at the 2017 AIChE Annual Meeting in Minneapolis.

Dr Petit said: "I feel extremely honoured to receive this award. I see it as a testimony to the great work of researchers at Imperial and the strong academic support from both the College and the Department of Chemical Engineering. I share this success with my entire research group and all my mentors."

A senior lecturer in the Department of Chemical Engineering, Dr Petit currently leads a research group whose focus is on developing multifunctional nanomaterials as a platform for addressing environmental, water and energy sustainability challenges.

She has made significant contributions to the fields of materials by designing and investigating new nanostructures for various separation and catalytic applications, and actively promotes research in this area through outreach and editorial activities.

bit.ly/IE27-Petit-Medal
bit.ly/IE27-Petit-35

A good year too, for **Dr Ruth Misener**, from the Department of Computing, who was awarded the Sir George Macfarlane Medal, as the overall winner of the RAEng Engineers Trust Young Engineer of the Year competition, and also received an AIChE 35 Under 35 Award.

The RAEng Engineers Trust Young Engineer of the Year awards are presented to early career researchers whose achievements are recognised as outstanding, having a major impact in their respective fields.

Dr Misener is a chemical engineer by training but now focuses on developing innovative approaches to process systems engineering and biomedical engineering in the Department of Computing.

Her research interests are diverse. She has optimised a bioreactor developed at Imperial for growing healthy red blood cells, an approach that could provide a new way for creating rare blood type supplies for transfusions in patients.

She has also developed in-depth mathematical models that map the progress in tissue of Chronic Lymphocytic Leukemia. Her work could have implications for disease management.

Her ANTIGONE software is regarded as one of the best mixed-integer nonlinear optimisation codes currently available

Dr Misener has also found ways to optimise industrial processes in the petrochemical sector, making them more efficient and sustainable.

Professor Daniel Rueckert, Head of the Department of Computing at Imperial, said: "Ruth's research integrates algorithm development and mathematical optimisation to solve real-world problems in biomedical engineering and process systems engineering. The department is really proud to have outstanding young engineers such as her. Well done on a much-deserved accolade."

bit.ly/IE27-Misener

IEEE award for contributions to bioelectronics



Photo: Imperial College

Dr Pantelis Georgiou, from the Centre for Bio-Inspired Technology, Circuits and Systems group, has been awarded the 2017 IEEE Sensors Council Technical Achievement Award in the area of Sensor Systems or Networks (early career).

Dr Georgiou was given this award for his significant contributions to bioelectronics through the development of the Bio-inspired Artificial Pancreas and innovations in Ion-Sensitive Field Effect Transistors for rapid diagnostics. He says, "We are at the forefront of revolutionising diabetes management and creating novel diagnostic technology which will have great impact on human health. It's a great honour to receive this award and I'm thrilled my group has been recognised by the IEEE sensors community."

The award is being presented at the IEEE Sensors 2017 Conference in Glasgow.

Dr Georgiou's team have developed the world's first Bio-inspired Artificial Pancreas (BiAP) developed for the treatment of diabetes. The BiAP is a closed-loop system that replicates the functionality of the biological

pancreas to deliver real-time glucose control. It uses an algorithm which replicates the sub-cellular behaviour of the beta cells of the pancreas to release insulin in a physiological manner and is the first of its kind to be implemented in a miniature low-power silicon microchip and integrated into a small, handheld device. His team has successfully validated the BiAP in adult participants with type 1 diabetes, acquiring over 1000 hours of clinical data with the system. Clinical trials were conducted at the NIHR/Wellcome Trust Imperial Clinical Research Facility, Hammersmith Hospital. The results to date have proven the safety and efficacy of the BiAP and they are now moving forward to conduct ambulatory trials on type 1 diabetic subjects in their home environment which will commence at the end of 2017.

Dr. Georgiou has also been recognised for pioneering several techniques that enable the reliable use of solid-state chemical sensors called Ion-Sensitive Field Effect Transistors (ISFETs), using CMOS micro-technology, in a fully integrated sensing system enabling development of low-cost, highly scalable and completely integrated Lab-on-Chip systems.

His team is currently designing next generation ISFET arrays to be used in a diagnostic system for rapid detection of infectious diseases, in developing countries in 2018, for rapid screening of bacterial, viral and fungal infections.

bit.ly/IE27-Georgiou

Prototype technology for unearthing mines

Peat soils are combustible and prone to smouldering fires. Engineers at Imperial have developed prototype technology that uses controlled burning to reveal landmines buried in such soils.

The O-Revealer technology consists of an electric power source and a heating coil which is inserted into the top layer of peat. Switched on, it slowly heats the peat to 500° C, igniting a controlled, flameless combustion process that strips the upper layer of soil, revealing the landmines and so making their disposal easier.

Addressing environmental concerns, the team say that their method would be carefully controlled in the field; the fires would be very small. Their impact would also be minimised by choosing at what time of the year they burn the peat.

Led by **Dr Guillermo Rein** from the Department of Mechanical Engineering, the researchers have successfully tested the device in the lab. Using dummy devices replicating two of the most common types of landmines, burying them in peat and using a fan to simulate wind conditions which affect the intensity and direction of a smouldering fire, they showed how they could partially unearth the buried landmines.

The areas most likely to benefit from O-Revealer technology include the Falkland Islands, Vietnam, Burma, Laos, Uganda, Zimbabwe and former Yugoslavia.

Worldwide, blast injuries caused by landmines currently exceed 26,000 people per year.

Dr Rein predicts that the O-Revealer is around five years from being used in the field.

bit.ly/IE27-Landmines

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Prince William sees impact of Heads Together campaign at Imperial's Data Science Institute

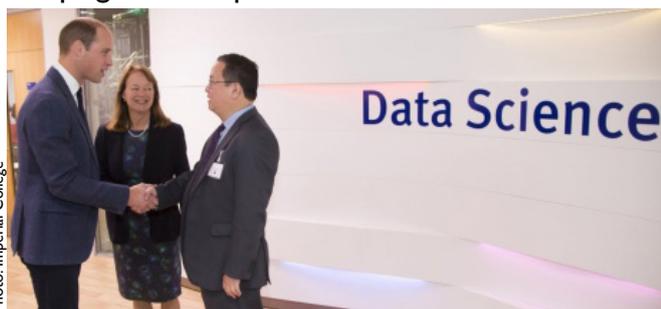


Photo: Imperial College

Professors Alice Gast and Yike Guo greet Prince William

In early October, Prince William, The Duke of Cambridge, visited the College's Data Science Institute (DSI) to see the impact of the Heads Together Campaign displayed in Imperial's pioneering data visualisation facility, the Data Observatory (DO) – the largest of its kind in Europe.

Heads Together is a mental health initiative spearheaded by The Duke and Duchess of Cambridge and Prince Harry. It aims to tackle the stigma associated with mental health and inspire people to talk more openly about mental wellbeing.

For the past two months, Imperial experts from the DSI and the Department of Mathematics, along with representatives from Heads Together, have been analysing YouGov data on emerging trends in attitudes to mental health.

The team of Imperial researchers who analysed the data included Professor Yike Guo, Dr Xian Yang and Dr David Birch from the DSI. Ms Sarah Jones, a research postgraduate from the Institute for Global Health Innovation at Imperial and an advisor to the Royal Foundation, also assisted, along with Professor Michael Crawford, from the Division of Brain Sciences, and Dr Reza Drikvandi, from the Department of Mathematics. Around 14,000 responses from 6 surveys were analysed by the team.

Following a warm welcome from Professor Alice Gast, President of Imperial, and Sir Keith Mills, President of the Royal Foundation, Prince William visited the DO.

Professor Alice Gast said: "It was an honour to welcome Prince William to Imperial and to collaborate with the Royal Foundation to produce this important evidence for the Heads Together campaign. Imperial excels at multidisciplinary research and our mathematicians, computer scientists, data scientists and public health experts identified and presented key trends using the forefront analysis and visualisation technology in our Data Science Institute's Data Observatory."

The DO's 64 screens and 130 million pixels of surround vision provided an interactive backdrop for the presentation, which showed the progress of the campaign since its launch last year. As part of the data visualisations, Ms Jones talked about the changing trends in the nation's behaviour and attitudes around mental health.

Opened in November 2015, the DSI's DO provides an opportunity for academics and industry to visualise data in a way that uncovers new insights and promotes the communication of complex data sets and analysis in an immersive and multi-dimensional environment.

bit.ly/IE27-HeadsTogether

Imperial College and technology firm, ABB, exploring new potential for collaboration

Energy Futures Lab is working with ABB to develop a power systems demonstrator facility at Imperial.

Imperial has signed a letter of understanding with ABB, the world's largest builder of electricity grids, to develop a rich portfolio of research activities to understand the complexities of integrated energy systems. The collaboration will explore the potential of building a new power systems demonstrator facility at Imperial College for research and teaching purposes.

Energy supply systems are undergoing a radical transformation.

As the energy system evolves, demonstration models are key to exploring these key components and interactions at various scales, from building to national level.

"We are building on an already strong partnership with ABB spanning over 15 years," says Professor Nick Jennings, Vice-Provost (Research) at Imperial, "And I am very pleased to see our partnership expanding further. The unique facility and other activities will enable highly realistic technology testing for the electricity sector."

bit.ly/IE27-EnergyLab

Indian village gets electricity thanks to PhD student

Clementine Chambon, a final-year PhD student in the Department of Chemical Engineering, celebrated the successful installation of an eight-kilowatt mini solar grid in the village of Sarvantara, which is located in the state of Uttar Pradesh in northern India, connecting 100 homes to a mini solar energy grid.

Clementine helped to set up the mini-solar grid via her social enterprise start-up company called Oorja. The company provides affordable and reliable power to rural communities in India that are currently not connected to the country's national energy grid network. The company also aims to provide a stable source of electricity to villages that currently receive a very poor and erratic supply of electricity.

The mini solar grid provides around 1,000 people with energy for affordable lighting, phone charging and fans to cool homes.

The renewable energy generated will also power pumps to provide irrigation services to farmers, providing significant cost savings compared to diesel powered pumps, which is what most rural villages like Sarvantara rely on.

Forty of the 100 households powered by the system will be fitted with smart meters to enable remote monitoring of energy generation and consumption in real-time. The data will help Oorja to analyse the performance of the system and improve the services they provide.

Oorja has also partnered with the Grantham Institute - Climate Change and Environment. A Grantham team led by Professor Jenny Nelson will also have real-time access to the smart meters and they will use the data to analyse the effectiveness of the system and extrapolate information about its potential impact on the environment, if scaled up.

Clementine said: "After months of preparation, we are delighted to see the smiles on the faces of our happy

customers, to hear their reports of how electricity is allowing their children to study longer, and their hopes that a computer centre will be opened in the school so that students can learn how to use a computer."

Clementine added: "Demand for electricity is high, especially for pumping water for irrigation... Villagers are particularly keen to sign up to receive energy from our system for affordable irrigation services. They are very relieved that an alternative to expensive diesel pumps will be available... Community members are excited that electricity has finally arrived in their village. However, there has been a feeling that this has been long overdue as the government has been promising its arrival for many years, which older members in the village can attest to. I am really glad that a small start-up can step in and fill a void in the energy market in India. This gives us a sense of optimism that our business model is working," added Clementine.

Oorja was founded in 2015 by Clementine and Amit Saraogi who is a social entrepreneur. The two joined forces to use clean energy as a catalyst for local economic growth. Their objective is to use renewable energy technologies to maximise the social and economic benefit for communities while reducing their reliance on kerosene and diesel generators, lessening the impact on the climate by reducing emissions.

The next stage will see Clementine and Amit pilot a hybrid mini-grid that will generate electricity from solar energy and biomass. This could provide a bigger supply of electricity to power small enterprises, such as grain mills, sewing cooperatives and water purification stations. The Oorja team then plan to raise more funding to enable them to roll out dozens more mini-grids to other villages in 2018.

bit.ly/IE27-Chambon
bit.ly/IE27-Oorja



Photo: Imperial College

Clementine Chambon with her business partner Amit Saraogi

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Robotic vision expert and fluid mechanic academic recognised as new RA Eng Fellows



Professor Andrew Davison



Professor Spencer Sherwin

Photos: Imperial College

In September, Imperial celebrated the election of two more of its academics to the Fellowship of the Royal Academy of Engineering (RA Eng): Professor Andrew Davison, from the Department of Computing, and Professor Spencer Sherwin, from the Department of Aeronautics.

Professor James Stirling, Provost of Imperial, said:

“My sincere congratulations to our new Fellows. It is hard to underestimate the pivotal role engineering and applied sciences play in our daily lives. From the smart phones that we use every day to the medical devices that underpin our healthcare and the technology that propels astronauts into space, engineering both makes our modern world function smoothly and has the potential to significantly improve our quality of life. This honour recognises the extraordinary work of Andrew and Spencer who have spent their careers at the forefront of their fields and whose work is really making a difference. It is a proud moment for our community at Imperial.”

Professor Davison leads the £5 million Dyson Robotics Lab at Imperial, along with Dr Stefan Leutenegger. Professor Davison and his team are leaders in the field of real-time 3D computer vision. His technology enables robots to negotiate complex home environments and is having a major impact on the robotics industry.

Professor Davison has worked for over ten years with Dyson to design the core simultaneous localisation and mapping (SLAM) algorithms that are at the heart of the company's first robotic product, the Dyson 360 Eye. The SLAM technology enables the robotic vacuum to visualise and make sense of the environment in which it is operating.

Professor Davison said:

“It is a great honour to be

recognised alongside engineers from many different disciplines. I'd like to use this role to push forward the profile of robotics and computer vision in the UK, and to help and mentor younger engineers in our discipline as we continue to build this important technology.

Professor Sherwin is the McLaren Racing/Royal Academy of Engineering Research Chair in the Department of Aeronautics.

He is a world leading expert in the development and application of advanced modelling methods known as ‘spectral/hp element methods’ which his team has made widely available through the open source package, Nektar++. These methods enable researchers to more accurately simulate fluid dynamics.

Nektar++ is being applied to a range of problems in unsteady fluid dynamics, including understanding the role of blood flow in arterial diseases such as atherosclerosis. Professor Sherwin's work is modelling water flow past bluff bodies such as bridges and offshore oil platforms, as well as improving the design of Formula One cars.

Professor Sherwin said:

“I am delighted to receive this significant honour both for myself and the team which has supported me for so many years. Our technology has a range of potential applications and we are excited about continuing to make it more widely available to help explore new research fields.”

Becoming a Fellow of The Royal Academy of Engineering is one of the highest honours that an engineer can receive in the UK. It recognises outstanding and continuing contributions to the profession.

The new elections take the number of Imperial Fellows of the RA Eng to 86.

bit.ly/IE27-FRAEng

Imperial engineer inspires the next generation of women in STEM



Photo: Imperial College

Dr Yolanda Sanchez-Vicente is a Research Fellow in the Department of Chemical Engineering whose research is primarily focused on carbon capture and storage processes.

She studied Chemical Engineering in Spain, and completed her PhD at the University Complutense of Madrid. Always interested in research, she then undertook a junior fellowship and applied for a research fellowship position at Imperial.

She currently works within the QCCSRC (Qatar Carbonates and Carbon Storage Research Centre).

Dr Sanchez-Vicente also mentors secondary school students as a STEM Ambassador for CREST.

She says:

“I received an e-mail about the CREST mentoring scheme, and was keen to participate. The aim of the programme is to introduce young people to the world of research, and to guide them in developing their own projects and ideas.

“I wanted to be involved in this project for a number of reasons, namely because I am passionate about research, but also because I have had really positive experiences of mentoring in the past. When I started out as a postdoc here at Imperial, I helped to supervise a secondary school student who came to work in our group for six months, which was great. At this age, students have a natural enthusiasm and passion for learning, which is really wonderful to see. It's a very rewarding thing to be a part of.

“I think you need to do whatever you can to broaden the horizons of students at this age, and to help them see where a science education could take them.

“I think diversifying engineering is really important, because different kinds of people can contribute to research in different ways. I currently have two female masters students working with me who are brilliant. I think it's really important to encourage women at this stage

to carry on with their research so that we can make the most of the skills that they have. However, much earlier on in education, I think a lot of young women and girls don't even consider a career in engineering as an option, because they don't think they are capable.

“That's why I think it was really important for the girls I was working with as part of the mentoring scheme to have a positive experience of seeing a project through from start to finish. I think it has the potential to inspire them to go further.

“For all women, but particularly teenage girls, there is a lot of pressure to be perfect. They hold themselves to very high standards, and are often quick to think that they are not good enough in certain subjects at school – such as maths or science – even if they enjoy studying them. This will then influence the choices they make later on in life.

“I also think that more needs to be done by lecturers to encourage female students to stay on, because they generally don't have as much confidence in their work as male students, even if they are attaining better grades.

“When I started out in my career, I had plenty of female colleagues. Now, at my current level, I've found that there aren't so many. A lot of my peers started their PhD at the same time as me, but didn't continue down the research path because of the nature of the work – postdoc positions are almost always fixed-term, or require you to relocate. This is a very off-putting prospect if you want to have a family. However, there are always ways of balancing your family and your career. In fact, there are plenty of women here at Imperial right now who are doing just that.”

Dr Sanchez-Vicente concluded:

“At the end of the day, if this is what you feel that you should be doing with your life, then you should do it.”

bit.ly/IE27-Sanchez-Vicente

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Robotics expert combines design and wearable technology at Design Museum event



Photo: Imperial College

At the Design Museum's 'The Future of Health' event, in September, one of Imperial's leading robotics experts spoke about the future of wearable tech and its implications for health.

Professor Guang-Zhong Yang, of the Department of Computing, is Director and co-founder of the Hamlyn Centre for Robotic Surgery at Imperial. The Centre aims to improve health worldwide by using Imperial's research strengths and expertise in safe, effective and accessible technologies.

In collaboration with Imperial's Centre for Continuing Professional Development, the event brought together designers, scientists, and artists to explore how wearable

technology can help improve our lives.

Speaking before his presentation, Professor Yang said: "Smart technology is evolving at an incredible pace, and beginning to transform the way we diagnose, treat and rehabilitate patients. My talk and Dr Lo's demonstration will give insights into how wearable devices are changing our relationship with our bodies, as well as the ever evolving role of wearable technology in healthcare. The interactive demos will show off our exciting technology, followed by more talks from other world-renowned experts in the field.

"Our part will focus on the invention of the ear-worn Activity Recognition (e-AR) sensor, a small, wearable device that clips behind the ear like a hearing aid to measure the way a person walks or runs, otherwise known as gait. e-AR provides instant feedback and instructions via smartphone app or smart watch, and is used in surgical rehabilitation – for example, to measure and give feedback on walking and balance after knee surgery – and in athletic training.

"Patients rehabilitating from operations that affect walking, such as in knee or hip replacements, can use e-AR for rehabilitation. It

measures posture, stride length, step frequency, acceleration, and shock waves travelling through the body while the patient walks around the house or street.

"I use robotics, sensing and imaging in medical diagnostics, surgery and rehabilitation. I've been involved in inventing robots that help surgeons in theatre and intricate micro-surgical robots for complex procedures during operations.

"The Hamlyn Centre embodies the combined principals of engineering and design, and is one reason Imperial plays a leading role in wearable tech today. The upcoming event at the Design Museum is tribute to this exciting combination."

In explaining how the focus of his work has changed in recent years, Professor Yang said: "Machinery, engineering and robotics have already transformed many areas of our lives. However, only in the past decade have we begun to consider comfort and appearance as an integral part of developing these technologies. Now, the design aspect of innovation is at the forefront of my work alongside improving health, both of which contribute to improving human lives.

"The focus of any engineering venture has always been to create

technology to improve our lives. However at some point engineers realised the potential of their work and strived not just to make wearable technology, but also to create something that's a pleasure to use and wear.

"It's no longer enough to have just new gadgets; they must also be smart, compact, convenient and attractive. This is where the design aspect comes in.

"The e-AR is the embodiment of what we at the Hamlyn Centre work towards every day. Bringing together the designer, the engineer and a design critic, we will share the design and engineering story behind e-AR, before going on to explore how e-AR and others like it are set to transform the world we live in."

bit.ly/IE27-Museum



Photo: Imperial College

Imperial Festival shares the wonder and reveals dates for 2018

Inspired crowds and widespread College pride are highlighted in a report on Imperial Festival 2017 published in September.

Feedback from attendees, exhibitors and volunteers on the flagship public event was presented and the date of the next Festival announced as 27-29 April, 2018.

Imperial Festival is the College's largest annual showcase. For one long weekend its doors are thrown open as students, researchers and a range of other staff leave their labs, lecture theatres and libraries to discuss, engage, perform, create and debate with thousands of visitors.

The Festival's sixth incarnation in May this year welcomed about 20,000 family members, school pupils, alumni, local residents and other members of the public onto campus to enjoy interactive stands, workshops, tours, talks and performances on everything from flying robots to the future of food.

Evaluation has been critical to the development and growth of the Festival. This year more than 500 people gave their thoughts and suggestions to help provide a fuller picture of why they valued the event,

and how it could be improved going forward.

The vast majority described their Festival experience positively with 93.9% selecting 'Excellent' or 'Good' when asked for an overall rating (an increase from 90% in 2016). The response was even more positive among under 12s, with 96.7% either liking or loving the Festival.

"Absolutely loved the atmosphere and all the staff and students were incredibly willing to talk about their passions which inspired future generations," said one visitor.

This year almost half of attendees had no connection to Imperial at all, and for around half of those the Festival represented their first ever visit to the College.

Nearly 90% of visitors said they would come again and the Festival increased 88% of visitors' understanding of work carried out at Imperial.

The evaluation also raised areas for improvement for next year's Festival. Responders of all ages commented on overcrowding and the length of queues, while a number of parents asked for more guidance to find content suitable for younger

attendees.

The Festival is only possible because of the time, effort and enthusiasm shown by more than a thousand members of staff who dedicate their weekend to entertain, engage and educate the crowds. As a result, the Festival team place great emphasis on listening to the views of contributing Imperial academics, students and staff members, and were pleased to see a similarly positive picture emerged from their interviews

More than 92% of the academic presenters and exhibitors taking part in the Festival described it as a rewarding and motivating experience with a range of benefits. Nearly seventy-three per cent described it as enhancing transferable skills, while a similar number (73.8%) reported that it strengthened connections with Imperial colleagues. Nearly sixty-nine per cent stated that Imperial Festival raised the external profile of their work.

"I was really proud of Imperial, and of being part of Imperial, over the festival weekend – made me see what an open and exciting place it

can be, filled with enthusiastic and brilliant scientists who are keen to share what they do with the wider community," said one academic staff member.

For volunteers, 87.8% of respondents rated their overall experience as good or excellent. Almost all reported that participating in Imperial Festival 2017 had positive impacts on their feelings about Imperial College, with increased pride and a greater sense of community being emphasised.

One undergraduate, helping out during the weekend, said:

"I wanted to give back to Imperial and help make the festival successful."

bit.ly/IE27-ImpFest



Photo: Imperial College

Technology and ecology

Sebastian Gonzato, a final year undergraduate in Chem. Eng., is the winner of this year's RSMA Essay Prize with his assessment of the relationship between technology and ecology, which is clearly not cut and dried.

We live, undoubtedly, in fortunate times. The last three centuries have seen humanity break free from the shackles of misery, superstition and irrationality, thus embracing the scientific way of thinking that has allowed us to learn an unprecedented amount about the world around us. Technology, the application of science to everyday problems, has enabled many of us to live largely free from hunger or even the prospect of it, allowing us to pursue more leisurely activities.

This has come at a cost; while we may not worry about dying from treatable diseases, the prospect of catastrophic damage to our environment, whether by climate change, plastic pollution or the myriad of other man-made problems, is very real. It is perhaps natural then that our relationship to technology is fraught. Faced with these looming disasters, we are tempted to turn our back on the tool that has both liberated and condemned us. To save us from this fate, we are faced with a choice: should we change our way of life or place our trust in the technology that has got us where we are now?

Ecological movements today can broadly be split into those that aim to protect our environment by changing human behaviour, and those that aim to mitigate the damage done by our lifestyles through engineering and technology. Many are those who fervently believe we must change the way we live, and indeed our very nature, in order to solve our ecological woes. Opposed to them are people who see human nature as something to be overcome: we will keep consuming and by consequence polluting, and so to save our habitat we need to come up with technological solutions that minimise or even reverse our impact on the earth while allowing for business as usual.

These opposing views have a long history. The view of human nature as changeable dates back to the Enlightenment and the French revolution, the thinkers of this period believing that changing our behaviour and prejudices was in fact necessary for progress. Over time, this has come to be associated with left-leaning political movements, and this is true of green politicians who are often labelled as watermelons: green on the outside, red on the inside. Green politicians may not use the lexicon of revolution, but that is essentially what is being asked of us when we are told to divest from fossil fuels, invest in green energy and most importantly to consume responsibly. The revolution we are asked to carry out is one that aims to change our behaviour and relationship to the environment we live in.

Opposing this call to revolution is the conservative movement, which was born as we



Photo: NASA

know it today in Great Britain with Edmund Burke. Conservatism does not oppose change or progress, but demands that change happen within the framework of our society. The name is particularly revealing: the purpose of conservatism is to preserve our society, culture, institutions and our environment for future generations.

The difference between these two positions is subtle, but important. While those of the left might see oil companies as enemies that need to be overcome in order to achieve ecological justice, conservatives accept that these companies exist for a reason. They might then be inclined to work with them in order to conserve and improve our environment for their children.

Perhaps the greatest experiment of our times to change human nature was communism. The quest to abolish the notion of private property and even the ability to think in terms other than as a collective, led to the preventable deaths of millions, whether in Stalin's gulags or Mao's cultural revolution. There are few now who honestly believe that this is an agreeable form of government, but the idea that radical change in human behaviour is possible lives on. That radical change often means a rejection of capitalism for the green movement. In the words of Rudolf Bahro, founding member and theoretician of Germany's green movement: *"The capitalist mode of production is markedly self-destructive, outwardly murderous and inwardly suicidal."*

The fact that socialist and communist states were heavy polluters is sometimes forgotten by those that decry the destruction wreaked

by consumerism. The examples are numerous: the Chernobyl disaster immediately springs to mind, but that is just the most notable incident. More telling was the contrast between East and West Germany: in the former, many rivers and lakes were too polluted to be used anymore with entire forests decaying because of this.

The conservative philosopher Roger Scruton argues that these are not simply isolated or anachronistic cases. By putting property in common, we are absolved of responsibility for taking care of it, and this applies to the environment as well. This is the well known free rider problem, for which examples bound. To use a previous example, when Germany was reunited, water usage in East Germany dropped dramatically because up until then water had been free.

Despite this, the modern green movement appears to have conflated unbridled capitalism and the endless stream of new technologies it produces with pollution and ecological disasters. This ignores the fact that in most cases technology has actually led to reductions in pollution. Factories during the early industrial revolution were polluting on a scale that is difficult to fathom. An 1839 lawsuit against soda works in England (which eventually led to the first air pollution laws to be passed in 1863) alleged that *"... the gas from these manufactories is of such a deleterious nature as to blight everything within its influence, and is alike baneful to health and property... Cattle and poultry droop and pine away."*

Modern processes to produce soda ash do not cause anything like this damage.

Similarly, cars pollute considerably less than they did 3 decades ago due to catalytic converters and desulfurized fuels. What has changed however is the scale of industry, which has turned local ecological problems into global ones.

The natural response to this is to point out that technological progress was the cause of these problems in the first place. There is a tendency to see this progress (often written in quotation marks) as a sin that has led us away from nature, and hence we need to redeem ourselves by renouncing our obsession with economic growth. There is no going back though: we long left the Garden of Eden and we must now find our own way in this world. To then deny ourselves the tools we have developed to save our environment (and, lest we forget, ourselves) is somewhat perverse.

Nonetheless, blindly placing our trust in our own ingenuity is similarly stupid. Take the classic example that is used to showcase our ability to solve ecological problems, depletion of the ozone layer. The 1989 Montreal Protocol, which led to the phasing out of chloro-fluorocarbons (CFCs), is frequently held up as a model on how to solve ecological problems. What is never mentioned is how close we came to completely depleting the ozone layer. When receiving the Nobel Prize for Chemistry in 1995 for his research on ozone depletion, Paul Crutzen noted that bromofluorocarbons, which are “almost a hundred times more dangerous for ozone than chlorine”, were originally considered as refrigerants instead of CFCs: “Noting that nobody had given any thought to the atmospheric consequences of the release of Cl or Br before 1974, I can only conclude that mankind has been extremely lucky.”

Relying on technology to solve ecological problems can also be incapacitating however, because it is actually much more effective to change human behaviour than to develop technology to compensate for our destructive lifestyles. In his book *Sustainable Energy Without The Hot Air*, the late Sir David Mackay sets about constructing an approximate energy balance for the United Kingdom. What is striking about this endeavour is how easy it is to add to our energy consumption in comparison to how difficult it is to add renewable sources of energy. For example, devoting three quarters of the United Kingdom to biomass production wouldn't be able to cover the energy required if everyone took a transatlantic flight once a year.

A more technical example may shed more light on the matter. Buildings globally account for almost 40% of total end use of energy. Unsurprisingly these is therefore interest in employing sophisticated controllers in buildings in order to regulate temperature while minimising energy consumption and therefore emissions. These model predictive controllers (MPC) control systems by trying to achieve some objective while satisfying constraints and obeying the systems dynamics. The building is the system, the objective is to minimise energy consumption while the constraints are to keep the temperature at a

bearable level.

Optimising a building's energy consumption in this way would appear to be a good idea, but there is a better way of doing it. It is very easy to change the constraints of the problem by allowing for colder temperatures; for every degree you turn your thermostat down, you decrease the heat loss by about a tenth while the savings in heating power are even greater. Changing the dynamics of the system is also possible through better insulation, but it is admittedly more difficult. Lowering your thermostat is much more effective, but it would require the (perhaps insurmountable) lifestyle change of wearing a sweater indoors. An MPC controller requires no lifestyle change, while still allowing you to feel warm and fuzzy about 'saving the planet'.

There is also the risk that the fruits of science actually distance us from the harm we cause, when they should in fact allow us to take ownership of the solutions to our problems. At the very least, they shouldn't add an additional ecological burden to our daily activities, or merely shift the problem further down the supply chain.

Hydrogen fuelled cars are a good example of this last case. The product of hydrogen combustion is just water, which at first glance would seem desirable: no carbon dioxide emissions, not to mention equally harmful nitrous and sulfur oxide pollutants. However, hydrogen is predominantly obtained through steam reformation of hydrocarbons, which does produce carbon dioxide. The other principal way of producing hydrogen is through electrolysis which doesn't produce emissions (assuming the electricity supplied comes from a clean source), but this is up to 3 times as energy-consuming as steam reformation. This is a typical case of a technology that allows the user to feel good while doing very little (if anything) towards solving our ecological woes.

I have painted a typically dualistic picture of this problem. Certainly in this day and age we should however be wary of such simplistic representations. Indeed, ecological movements and attitudes are as diverse as the people who support them, be they rural conservatives from England's countryside, angry hipsters in New York or climate refugees in Southern Bangladesh. The solutions (if they indeed exist) to our ecological woes are similarly not black or white.

This fact is not lost on most people who identify as green, and hence the arguments laid



Ruins of a kindergarten in Pripyat following the Chernobyl disaster

out in this essay have largely been attacking a straw man. Green parties around the world recognise the importance of different strategies. This is why they favour investing in renewable sources of energy, as well as attempting to reduce our energy consumption, encouraging people to recycle, reuse and generally take care of the environment they live in.

Nonetheless, this pragmatism does not go far enough, and ecological movements are not short on their share of sacred cows. Wind and solar power are seen as the be all and end all in the energy mix despite the problems posed by intermittency, while research into other technology is stifled for fear of unintended consequences to the environment. At the 2015 Imperial Climate Conference, the UK Green Party's Deputy Leader Amelia Womack was asked about the Green Party's stance on nuclear fusion, a process that could potentially provide far more energy than nuclear energy with potentially less waste products. Despite not having heard of nuclear fusion before, Womack's response was to simply dismiss it.

Changing our behaviour or trusting in science to come up with solutions is not a question of either/or. The technologies we use are merely tools, and they are only as useful as the people who wield them. To place the blame on our current problems squarely on them misses this crucial point, and denies us the use of some of our greatest achievements. Knowing when and how to use these tools is the challenge we now face, and it is one that we must all rise to.



Sebastian Gonzato is finishing his 4th Year of Chemical Engineering at Imperial and is Station Manager of ICRadio. While he is at his happiest solving technical problems, his keen interest in the humanities makes him reflect often on the impact technology has on our society. If his essay seems quite confused, it is because he was trying to sound more intelligent than he is, while being in two minds about most of what he was saying. If he is unsure about what he wants to do in the future, he does know that he wants to become more involved with the pressing environmental and social challenges of our times, and to get more opportunities to write in the third person.

IMechE Simulation and Modelling Conference 2017

Three members of the Imperial Racing Green Shell Eco-Marathon team were able to attend this conference in Birmingham in September, thanks to financial support from the OC Trust. They each told us about their experience at the conference and why it was helpful to them personally and for the team. This article is compiled from their individual replies.

Laura Cattaneo, Hasan Amin and Oisin Shaw were representing the team that are aiming to compete in the Shell Eco-Marathon (SEM) in London in 2018, which pitches ultra-efficiency vehicles developed by student racing teams against each other. They are competing in the hydrogen fuel cell concept class, which seeks solely to minimise fuel consumption while completing a given course.

In this article, they will try to highlight the most important concepts of the Simulation and Modelling 2017 Conference, held by the Institution of Mechanical Engineers on the 12-13 September at the National Motorcycle Museum, in Birmingham. The two-day event was divided into talks on different topics and included two panel discussions per day. This article is structured in sequence by the presentations attended in chronological order, with comments and observations from Laura, Hasan and Oisin.

Our reasons for attending

Preceding the conference, an outline of the learning outcomes and participation impact was produced, highlighting the specific areas of interest as members of the student-led Imperial Racing Green SEM team:

- **Learning outcomes:** Learn to develop modelling and optimisation techniques. Hear about the latest projects in design, development and testing across the different engineering sectors. Engage with leading manufacturing companies including Jaguar and Land Rover, Rolls Royce and Lamborghini.
- **Areas of interest include:**
 - Optimisation and integration of simulation and modelling across engineering disciplines.
 - Simulation in design and innovation.
 - Full vehicle body modelling.
 - Simulation for powertrain development and testing.
 - Testing and Validation.
- **Enhancement to personal development:** Familiarise with the latest breakthroughs in manufacturing, structural analysis, powertrain engineering and systems and control, allowing the development of a clear team vision. Build up confidence around the topic which can further enhance team performance.
- **Participation benefit and impact:** Get an insight into design processes of leading manufacturing companies, possibly inspiring new changes in the current vehicle and aiding their implementation, focusing in particular on dynamic modelling and simulation for the 2018 competition. Benefits include broadening of knowledge in the area and skill development.



Hasan Amin, Laura Cattaneo, Oisin Shaw at the IMechE Conference in Birmingham

Photo: Hasan Amin

Day One, 12 September

Simulation in Design and Innovation

Simulation and modelling for cost reduction at design stage; Steve Fletcher, Global CoE Director – CAE, Tata Technologies

Steve Fletcher's talk highlighted the relationship between accuracy and cost technology and methods of optimisation of a vehicle, by reduction of weight through early stages of the design and architecture. He said they saw a 10% reduction in weight increasing fuel economy by 10%. Optimisation was summarised in the following formula:

$$\text{Right performance} + \text{Right Price} = \text{Right Material} + \text{Right Amount} + \text{Right Place}$$

In other words, choices of materials to optimise vehicle weight were made by considering the performance required at a price point and looking at the amount and sourcing required for the material. The performance of material is found by setting targets and optimising the space topology (defining primary load paths with e.g. OptiStruct).

His talk presented the increasing confidence in simulation software and its advantages in design, however it highlighted also the disadvantages of simulation versus physical testing and prototypes, such as reduction of physical contact on products, loss of control of tolerances and difficulty when leading with fatigue and rupture.

An interesting point was made comparing stochastic modelling to determinism. Effort must be made to move away from single shot runs. Nominal truths do not necessarily exist and should not be expected: instead, model a family of analyses to understand where design sits within a normal distribution.

External Airflow Simulation in Automotive Engineering Development: Current Practice, Future Prospects; Adrian Gaylard, Technical Specialist for Aerodynamics, Jaguar and Land Rover

The entirety of the design process of a product was explained and divided into the main areas of Concept, Design, Perfection and Preparation of Production. A graph of high/low probability against time showed the relationship between cost responsibility, degree of freedom for decision, real product knowledge and ideal production knowledge. As time goes by, cost responsibility and product knowledge (both real and ideal) increase, however freedom for decision decreases. It was shown that the real product knowledge could be achieved thanks to simulation techniques. Adrian Gaylard emphasised the use of simulation to generate more knowledge, earlier. The automotive industry has a significant drive via time-based competition, with a single day delay potentially costing \$1M.

This was one of the particularly interesting presentations. Adrian Gaylard outlined how the Jaguar XE model saloon had been completely designed using computational fluid dynamics (CFD), as opposed to the traditional method of using CFD for first approximations, and a wind tunnel for validation and final design. It was particularly interesting hearing the details of how particular physical phenomena had to be introduced to the model, for example bonnet flutter or surface fouling.

One of the reasons this talk was so interesting was that wind tunnel testing is far beyond the resources of our race team in the foreseeable future, but we have an existing

Aero design and CFD team, and could potentially afford time on a computing cluster. This will undoubtedly be instrumental in the formation of long term plans by the team. We need to look at aerodynamics and cooling flows. At 70 mph, 70% of resistance is drag; at 40-50 mph, aerodynamic losses are equal to all other losses combined. Aerodynamic loads are also induced, pulling panels like doors and windows outwards. Effort needs to be made by Imperial Racing Green to avoid this, although our operating speeds are usually under 30 mph.

Adrian noted that, in the development of the Jaguar F-Type, more effort was put into lift management than drag management. Aerodynamic efficiency must also be balanced with brake cooling, perhaps by including actuating brake doors. Active grill shutters are also opened when engine load requires it.

The Industrialisation of High-Order Flux Reconstruction Methods; Andrei Cimpoeru, CFD Engineer, The Centre for Modelling and Simulation, CFMS

This talk focused mainly on demonstrating the benefit in using High-Order Discretisation for CFD applications and considering high fidelity CFD and High Performance Computing (HPC) solutions. The topic was very technical but not applicable for the SEM car projects.

PANEL – Does the specification fit the need?

The panel discussion focused mainly on the challenges facing software users in industry – addressing the different requirements of a product at application stage – and questioned

the limits of understanding between industry, academia and software providers.

Simulation for Powertrain Design

This session of two presentations was run at the same time as Systems and Control across Transport. Since it presented more value and application to the team, it was decided to attend the Powertrain session.

Simulation and Testing of Complex Engine Boosting Systems; Richard Burke, Senior Lecturer, University of Bath

Engines are more efficient at high loads. Boosting challenges include

- Mechanical Pressure limit
- Mechanical Temperature limit
- Turbocharger limit (Compressor operating limit)

Hence, with a complex boosting system, the lecturer highlighted the need to rely on simulation to aid system design, which can however cause problems with model interfaces. It was also pointed out the correlation of cost and complexity to realism, and the difficulty in reproducing it in simulation. The current modelling solutions allow one to “study the interaction to create simple models to integrate with other models”. These are offered by current software such as Matlab, Simulink, C code, Ricardo Wave and GT Power. Future visions will incorporate High Order models, which would be parameterised to Low Order models to allow a Control Optimisation. Finally, turbocharging is the key enabler of fuel reduction, and future systems will require complex design and energy management.

This was another particularly informative talk, presenting the use of “Hardware in Loop” (HIL) systems, in which complex boundary limits or components are simulated by combining real time simulations and hardware. The example used by Dr. Burke was the complex turbulence conditions produced by a turbocharger. For the ultra-efficiency vehicle, the fuel cell is by far the most expensive component in the system, but is not overly complex to model. Using HIL, it would be possible to incrementally test the system, and iterate the design, validating during the process. Dr. Burke also discussed using HIL models to more quickly map the operating limits of a system, which is vital for a powertrain.

Whole Machine Simulation for Off-Road vehicle Drivetrain Design; Igor Strashny, Engineering Manager, High Efficiency Machine Research, Caterpillar UK

The talk focused on system modelling not related to racing vehicles.

Simulation for Engine Development

Volcan: a Simulation tool for Iterative Calculation of Engine Thermal Boundary Conditions; Tom Deighan, Principal Engineer, Ricardo UK

Volcan is an analytical tool developed to provide improved accuracy of component temperatures with a physical basis. The calculation is based on physical models and semi-empirical correlations, hence is predictive and allows detailed design parameters. The database methods are quick and simple and



Photo: Laura Cattaneo

The conference was held in the National Motorcycle Museum in Birmingham



Photo: Imperial College

Imperial Racing Green's Shell Eco-Marathon (SEM) team currently competes in the Prototype Hydrogen class of Shell Eco-Marathon. For the 2016/17 they entered the car ICHV01. The car is a hydrogen fuel cell/supercapacitor hybrid vehicle: Fuel cell – H-200 Horizon stack, 200W nominal output; Supercapacitor bank – 18 x 100F capacitors, total 5.5kJ of energy; Motor – Maxon RE 50 24V 200W; Chain drive.

they use limited input data. In summary, Volcan:

- Is predictive
- Has quick run-time
- Boundary Conditions by iteration can be performed quickly
- Captures all engine heat paths in detail
- Can be used to model heat transfer temperature changes in pistons, rings, grooves etc.

Simulation SABRE: Designing and Modelling a novel Aerospace Engine as an SME; James Barth, Lead Aerodynamicist, Reaction Engines Ltd

SABRE uses advanced heat exchangers to double the speed of current jet engine technology and reduce fuel consumption. Heat exchanger technology was presented, such as Microchannels. The software used for the combustion modelling is CFD++.

Development and Testing

Left Shift Product Development with Virtual Reality; Paul Dainty, Business Development Manager for Virtual Reality and Ground Transportation Account Manager, ESI UK Ltd

Virtual Reality is here applied to engineering; the new platform IC.IDO allows global VR realtime co-operation, facilitating design conception and development.

Bloodhound SCC: the role of Simulation and Modelling in Development and Testing; Mark Chapman, Chief Engineer, Bloodhound SCC

The whole project of Bloodhound is entirely reliant on simulation. "All models are wrong – some are useful" (George Box)

PANEL – Democratization and Usability

The Panel discussion highlighted the importance of how simulation should not replace an engineer's work, but should be used as a tool to make the engineers achieve their work. The session focused on overcoming the challenges in simulation and modelling adoption across the engineering disciplines and on improving software usability for different engineering functions. With an improvement in software availability, engineers and CAE expert will be able to work better together for

improved democratisation.

**Day Two, 13 September
Optimisation, Integration and Validation
Integration of Systems and Software for Seamless Workflows; Akin Keskin, Chief of Virtual Engine Design System, Rolls Royce plc**

Akin Keskin's talk looked at how to manage simulation systems to create the best results. It focused mainly on connectivity between different simulation and modelling systems, challenges arising from incompatible systems and requirements for future simulation and modelling software in design, validation and manufacturing processes. Understanding initial goals and requirements is essential to increase the usefulness of simulations. It highlighted the trade-off needed between product design challenges, with the following analyses for aircraft engines, which have parallels to our racing car:

- Performance: given as specific fuel consumption, fuel consumed per unit thrust. Mainly driven by aerodynamics. Run different CFD solvers for different parts of engine accordingly.
- Weight: hit weight target, keep an eye on weight constantly throughout development. Increase confidence level and accuracy through the design process.
- Cost (material, operating etc.): achieve targets to avoid negative effects on other parts of the product.
- Life: products need to go into service and hit targets, number of take off/landings (cycles) for aeronautical industry.
- Product Service: products will need regular maintenance – Rolls Royce sell engines with a 'total care' contract.
- Manufacturability: focus on efficiency and cost reductions.

How can we design faster and ensure quality with a lower workforce? It can be achieved through standardisation of design tools, by reducing waste and improving design capability, and by ensuring a better link between design and manufacturing, assembly, test and service. Lead time can be reduced by using more simulation capability, by creating cross-functional and multi-skilled teams and by introducing Agile development and surgical teams. For the near term future, design

processes would include globally distributed integrated product teams, standardisation of individual simulation tools with clear interfaces, standardisation of design rules, use of central storage and computer capacity. For the long term future, design processes would include intelligent design systems – Simulation as a service (SaaS), artificial intelligence, fully probabilistic. Current and future challenges include:

- Simulation verification and validation
- Digitalisation and connectivity
- Data storage and search
- Large data analytics
- Cybersecurity
- Supply Chain integration

Rolls Royce use a matrix structure with functions (e.g. aerodynamics) against projects (e.g. a specific engine). Use of this sort of planning would greatly benefit Imperial Racing Green by more effectively categorising projects to ensure their goals are sensible, and to better realise them.

Accelerated Optimisation and Validation for High Performance Brake Design; Chris Hebert, Engineering Director, D2H Aero

The talk focused on the importance of brake design in a vehicle's design process. The coefficient of friction of a pad brake depends on the temperature, pressure, rise time and speed. This is difficult to model computationally as the coefficient of friction for disc brakes varies even at the same temperature and the same combination of materials. The design considerations include aerodynamics, weight reduction, durability, component selection, reduced cost and better performance.

This was one of the most useful talks as it looked at how to consider performance with racing circuits. Models should be made of existing or new race circuits. The following analyses can then be made: Brake thermal model – physical model, lumped parameter models; Transient solution for conduction, convection and radiation; Physical testing for correlation.

One of the best insights granted was mentioning hardware and driver in the loop technology. Digital twins are being created to run in parallel with races, to simulate when to change brakes in race in real time. The ability to perform analyses in real time will be a driving

focus of Imperial Racing Green this year, and we shall attempt to implement telemetry and information transmission systems.

Confidence in Optimality for Complex Electrified Powertrains through Synthesis and Selection; Jonathan Wheals, Chief Engineer – Innovation, Ricardo UK

Identifying the best combination of elements for electrified driveline during the selection process for the automotive industry is extremely important. The talk particularly focused on an approach to tackling complexity arising from Hybridisation. The V-cycle selection method is proposed. An examination process of the products was divided into phase 1 (Failure to meet a constraint), phase 2 (Objective Merit ranking) and phase 3 (Optimisation). This process allows design solutions to be quickly filtered and reduced.

An option to iterate and redesign our passive hybrid transmission (which utilises a hydrogen fuel cell with supercapacitors) would be with synthesis and selection, as explored in this talk.

Synthesis occurs with a computer generation of all hardware candidates (potentially millions of topologies to combine a set of given nodes). Selection is then made by ranking according to highest scoring attributes (previously set), and assessing against constraints and objectives. This sometimes leads to counterintuitive but higher performance solutions.

PANEL – Ensuring Rigorous Simulated Testing in Conjunction with Physical Testing

The Panel discussion focused on understanding the complementary relationship between simulation and physical testing and the crucial importance of the latter, especially with incoming new regulations even if more expensive and difficult to perform. The limitations of simulation in a test environment were discussed and it was concluded that best practice and lessons learnt come from past case studies.

Simulation for Powertrain Validation and Analysis

An Integrated Approach in Thermofluid Dynamic Simulation of High Performance Electric Vehicles; Roberto Della Ratta Rinaldi, Senior CFD Engineer, Williams Advanced Engineering

The four types of powertrain configuration are Petrol, Diesel, Hybrid and Fuel Cell. The talk also showed how the battery and chassis can be designed holistically to produce a system that works together and allows seamless integration, while optimising battery architecture. The integrated EV Simulation would have then to take into account the range (A/C), the mass, the resistance (rolling and drag), the charging (ambient), the cost and the performance (drive cycles, ambient). It was also highlighted how battery cell performance is dependent on temperature and presents thermal challenges (optimal range 20-35 degrees). Cooling options were presented:

- air cooling (lighter, low cost, simple)
- liquid cooling (high performance, low

“As a recent graduate, soon to be starting a research based postgraduate course at Imperial, having the opportunity to attend this conference was invaluable. As with almost all experimental research projects, my postgraduate project has a modelling phase prior to the design of the test rig. This informs the required variables and parameters of the test rig, and it is therefore important that the modelling has the correct scope and focus. My role as a postgraduate advisor for Imperial Racing Green (specifically the Ultra-efficiency team) will benefit from the knowledge gained from this conference.”

– Oisín Shaw

- thermal resistance)
 - refrigerant cooling (dielectric, light)
- Battery ageing was also analysed, and was divided into calendar ageing and cycle ageing, the capacity loss being dependent on storage, climate, driving cycle, utilisation mode etc. Finally the new Williams FW EVX was presented. This electric racing car includes a battery pack, an efficient powertrain, a cooling system to maximise efficiency and reduce drag and a lightweight structure.

Minimising Risk through Integration Fast High Fidelity Modelling Tools; James Towers, MBSE Consultant, EnginSoft UK Ltd

The talk highlighted how nowadays everything is model-based system engineering, however structure and interfaces are not enough for the description of the required part. EnginSoft allows fast, high-fidelity and multi-domain modelling.

Streamlining the Manufacturing Process Simulation and Concept Development: how and why to Build up Trust in the early Stages of a Project; Riccardo Parenti, Head of Concept Development, Lamborghini

The talk focused on the design stages necessary for product development and the challenges which need to be faced, such as ensuring quality at the lower cost.

Stress and Structural Analysis Dynamics and Tribology in Efficiency and NVH; Stephanos Theodossiades, Professor of Non-Linear Dynamics, Loughborough University

This session focused on complex dynamics systems and case studies, not particularly useful for the team.

Structural Simulation in Preliminary

Engine Design; Adele Nasti, Structural Design System Lead, Virtual Engine Design Systems, Rolls Royce plc

Again, the presentation highlighted the Design Framework (Conceptual design, Preliminary design, Detailed design - Systems, sub-systems, components) and the need of multi-skilled engineers.

Best Practice PANEL – Developing Best Practice across the Engineering Industries

The Panel discussion focused on cross-industry learning for simulation and modelling, and that knowledge sharing is critical for engineering development and future, engaging with engineers for better understanding and usage of physical and digital resources. The session also focused on the future of Computer Aided Engineering and how to further the use of virtual manufacturing to improve industrial outcomes. This includes modelling, simulation, calibration, validation, sensitivity analysis, uncertainty, dissemination, and understanding future applications. The panel also discussed the limit on how much best practice can be shared and on how much it is wanted to remain private.

Conclusions

- In conclusion, simulation can:
- reduce cost
 - improve confidence
 - support innovation
- Increased stochastic approaches can improve simulation. Engineers need to develop knowledge among other disciplines but also not live in a virtual world, as simulation needs only to be used as a tool.

The conference was incredibly interesting and valuable for the team. A good insight of leading manufacturers showed the current technologies in the automotive sector which will be useful for the future development of the car. Some vital points were highlighted of which we would otherwise not have been aware, and this should increase the performance of our car and the success of future team members. It was also a great insight into how industry approaches research and development, and how the balance of simulation and testing is struck. Although some presentations were somewhat specific to the CFD area and for this reason not very applicable to the SEM vehicle (at least not yet), it was overall a great experience and we are all very grateful to the OC Trust for letting us be able to attend.

Laura Cattaneo is a third year MEng Mechanical Engineering student.

Hasan Amin is a third year MEng Mechanical Engineering student.

Oisín Shaw (Mech Eng 2013-17) was SEM team principal for the 2016-17 season and is now postgraduate advisor.

A Cappella at Imperial

After rave reviews of *The Techtonics* a cappella group when they performed at the CGCA annual dinner in March (as reported in IE26), we thought it would be interesting to find out more about them. In the process they told us about the Imperial A Cappella Society which is one of the largest university a cappella societies in the UK, with five well-established groups.



The Techtonics

The Techtonics group was founded in the summer of 2008 by Christian Carter and Ed Brightman, who jointly lamented the lack of quality contemporary a cappella at Imperial College and decided to start an all-male group. Their aim was to combine funky grooves with funky socks with a repertoire ranging from 70s rock classics to dubstep bass drops.

The Techtonics performed their first gig at 'ArtsFest' (an annual celebration of arts at Imperial) in February 2009. They went on to perform at their first full concert in December 2009 in the Imperial College Christmas concert, which has since become an annual fixture for the group.

In February 2010, The Techtonics competed in their first competition, The Voice Festival UK (VFUK), and won the award for Outstanding Arrangement, awarded to Christian Carter for the arrangement *Come Undone*. In August 2010, the group performed for the first time at the Edinburgh Fringe festival. Their first international tour was to Croatia in August 2011.

In February 2012 at The Voice Festival they won the awards for Outstanding Performance for *Earthquake* and Outstanding Soloist for David Verhoeven. 2012 also saw their first US East Coast tour in September just after releasing their debut studio album *Groundbreaker*.

They won more awards at The Voice Festival in March 2013, with Outstanding Soloist for David Maguire and Outstanding Vocal Percussion for Max Hunter. That was swiftly followed in April by the award for "Best Male Collegiate Song" for *Earthquake* at CARA



Photo: Joe Martinez

Winning the ICCA World Championship Finals in New York 2016

(Contemporary A cappella Recording Awards) in Boston, MA, USA. In September they returned to the US for another East Coast tour.

In March 2014 they reached the national final of the Voice Festival, winning the award for Outstanding Soloist for Peter Noden. In September they returned to the US for a tour of California, their first on the West Coast.

In January 2015 they released their first single, *Let Her Go*, from their second studio album *Clockwork*. The album was released in October and was promoted on their Clockwork Tour of North America in September.

In 2015, the International Championship of Collegiate A Cappella (ICCA) began hosting annual live competition rounds in the UK. Imperial College A Cappella Society hosted the semi-finals in 2015 and 2016. The

Techtonics competed both times. In 2016, the group placed first in the UK, and went on to win the ICCA world championships in New York.

The following summer, the group performed for a second time at the Edinburgh Fringe festival with their show *Don't Push the Button*, which was awarded 5 star reviews.

From March - April 2017 the group went on tour to Hong Kong to perform as a part of the Hong Kong International A Cappella Festival.

In April 2017, the group recorded a cover of *Bang Bang* (Jessie J, Ariana Grande and Nicki Minaj song), arranged by Kyle Alexander Hogan, former member of the University of Rochester YellowJackets, for the UK TV series *Tonight at the London Palladium*, which aired on 19 April 2017.

Having toured both coasts of America, they plan to head back to the States again. Whether they're performing on Broadway or busking on Portobello road on Saturday mornings, the characteristic energy of the group will have you walking away with a smile on your face.

bit.ly/IE27-Techtonics
bit.ly/IE27-TechtonicsICCA2016
bit.ly/IE27-TechtonicsBicycle



Photo: Hong Kong International A Cappella Festival (HKIAF)

At the Hong Kong International A Cappella Festival in 2017



Photo: Amici Photography

Busking on Portobello Road on Saturday mornings

A Cappella Society

The Techtonics were ineligible to become a society of the Imperial College Union (ICU), because it was too small and single gender. This led to members of the group in November 2010 starting the Imperial College A Cappella Society, of which The Techtonics would be part, with the wider aim of making the activity of a cappella open to all ICU members and to encourage other groups to form. It belongs to the Arts and Entertainments Board of ICU. Apart from The Techtonics there are now 4 other main groups:



Photo: Marc Emmanuelli



The Imperielles

Imperial's first all-female group was founded in 2011 and have flung themselves onto the UK a cappella scene with intriguing mash-ups and a whole new level of sass. As close friends on and off the stage they have been laughing and harmonising ever since. With a hugely successful Comic Relief video and their very own music video, Imperielles are always looking for new and innovative ways to perform a range of popular music.

bit.ly/IE27-Imperielles

bit.ly/IE27-ImperiellesRedNose



Photo: The Imperielles



The Scopes

Founded in 2011, The Scopes are Imperial's premier mixed contemporary a cappella group, singing a wide repertoire from jazz standards to Bruno Mars. They can often be found busking at Portobello Road Market on Saturdays, and have also been active in international a cappella competitions, including the UK ICCA. As a group which regularly releases singles on Spotify and SoundCloud, the Scopes aims to bring their own brand of fun and madness to the a cappella world!

bit.ly/IE27-ScopesVideo

bit.ly/IE27-Scopes



Photo: The Scopes



Take Note

Take Note is one of Imperial's newer a cappella groups, having started in 2013. It's a close-knit all-girls group which specialises in Barbershop music, as well as modern music with fun Barbershop twists. Take Note brings even more variety to Imperial's spectacular a cappella community with this jazzy genre, aiming to entertain with a sound different to contemporary a cappella, providing students with a wider range of music.

bit.ly/IE27-TakeNote



Photo: Marc Emmanuelli



Surscery

Surscery is Imperial's newest group, having been formed only in 2014, but claim to have the most interesting vibe! Combining aspects of Western music, and Hindi music, Surscery sing a fusion of genres, creating an engaging and exciting performance.

Having performed at East Meets West, and soon to be expanding into the a cappella concerts and more competitive venues, Surscery is full of enthusiasm and flare.

bit.ly/IE27-Surscery

bit.ly/IE27-SursceryVideo



Photo: Marc Emmanuelli

Self-ePublishing (not to be confused with Selfie-publishing)

An introduction by Imperial ENGINEER's Editor, Peter Buck (Computing 1976-79)

When I'm not having to do some consultancy to pay the bills, the work that I most enjoy – even more than editing Imperial ENGINEER – is helping Alison to run an independent science fiction and fantasy publisher. This seems to be a subject which quickly attracts attention in conversations at alumni reunions etc., and it is obvious that many engineers feel they have (at least) one book inside them waiting to get out. For most of us, it is incredibly difficult to find an agent or a big five publisher (unless you're a celebrity with a guaranteed audience for your salacious memoirs). So self-publishing has become very popular; indeed quite a few of the authors that we publish started by self-publishing their books.

Whereas even ten years ago self-publishing would have been regarded as tantamount to vanity publishing, it is now seen as evidence of the democratisation of publishing. Either way, it is now both very popular and very easy. In some ways it is too easy, enabling people with neither literary skills nor any aesthetic or qualitative proficiency to upload a poorly written and badly formatted document and have it uncritically published as an eBook! In many ways, far from democratising, self-publishing has highlighted the value of publishers as a form of quality assurance.

As engineers (especially those of us who consult), we find a large part of our professional life is spent writing, and most of us have written far more words than many accomplished authors – there is an oft-repeated maxim that a writer needs to have written at least a million words before they have learnt their craft. I'm sure that most of us have written well over that number of words fairly early on in our careers!

So, if you have a yen to write something more exciting than a technical report or management recommendation, whether it's a thriller, fantasy or even just your salacious memoirs, my intention in this article is to give you some pointers as to how you should go about it. When you have published your masterpiece, let us know so we can review it in IE and pass on the good news (hopefully) to your fellow alumni.

First, some background

It is (as I've already said) very easy to publish almost anything as an eBook. You might want to enjoy the feel of a real book, the smell of the fresh ink and newly cut paper, and the weight of a tome in your hands, but printing brings lots of costs with it (production, storage, distribution, shipping etc.) By comparison, once you've produced an eBook, it costs no more to sell one copy than a thousand copies. There are dedicated online retailers for eBooks (Kindle, iTunes, Kobo, Nook, Google Play, etc.) many of them operating globally, and they are generally very keen to sell your book at no cost to you. So let's start with a bit of book history and the current state of eBooks.

In the beginning was the word...

...which was typeset in hot metal and printed manually by Johannes Gutenberg. Actually China and Roman Egypt had been printing centuries before Johannes came along, although they used wooden blocks. The earliest known example of printing is probably the still-indecipherable Minoan Phaistos disc from the Bronze Age (before 1000 BC).

But let's skip forward to the 20th century when Desktop Publishing started, thanks to Apple's LaserWriter coupled with Postscript and word-processing software on a Mac. Having cracked production, the advent of easy network communications and cheap storage technology meant that the distribution of documents in a digital format became more common. However, you still needed a computer with the right software to read the document. The commercialisation of the internet, especially the Web, acted as a catalyst and then the arrival of mobile technologies made the sci-fi trope of an electronic book seem achievable. At this point a few 'interesting' things happened.

A number of companies started to produce display technologies that could be used somewhat like an electronic version of paper – write some text to the display then remove the power and the text remains visible. As contrast improved and resolution increased it became feasible to use this in a mass-market device that could store the text of a book and display it, on demand, one page at a time. A variety of devices were launched, although they all suffered from a dearth of books to read on them. Each one used a proprietary format for its text to enable it to include a modicum of formatting – but mostly they took the view that a book just consists of a sequence of words and all the effort that the author and publisher put into the design and layout of the book was unimportant frippery. It was hardly surprising, therefore, that the major publishers were unconvinced that it was worthwhile publishing electronic editions of titles that were selling perfectly well as paper copies – especially as it would require the production of a separate version in each of the multiple formats in order to be readable on all of the different devices.

One of these formats was developed by a French company called Mobipocket which was subsequently bought by Amazon and became the basis of the initial Kindle device. Amazon realised that the early pioneers had suffered from a lack of suitable books, but the major publishers were still not particularly interested so, along with the introduction of the Kindle, they launched a free service to enable authors to bypass publishers and publish their books directly in an electronic edition available for the Kindle. Known as Digital Text Platform, it subsequently became what is today known as Kindle Direct Publishing (KDP). With the huge retail presence of Amazon, the Kindle was able to kick-start the market for electronic books and the big publishers finally started to

take notice.

Meanwhile a trade association for digital publishers developed an open standard for electronic books, called EPUB, which is based on XML, XHTML and CSS – technologies used for displaying information on the web. This has subsequently been adopted by most of the major manufacturers of eBook readers, including Apple, Kobo, and Nook, as well as by many apps on tablets and smartphones. In fact the only notable exception is Amazon – so now the multiplicity of formats has more or less come down to two.

Why should you care about any of this? There is still a distinction between the format(s) used by Amazon – who subsequently developed a more feature-rich format called Kindle Format 8 (KF8), based on HTML5 and CSS, and then upgraded it to version 10 (KFX), which their more recent devices can support – and most other devices and apps which use EPUB. If you wish to publish your book on any platform other than Kindle you will need to produce an EPUB format version. However, if you also want to publish on the Kindle you can upload the EPUB version and KDP will automatically convert it into Amazon's own formats (although there are some limitations).

Some other things to worry about

An Act for the Encouragement of Learning...

...so starts the Statute of Anne from 1710 which introduced copyright and formalised legal deposit to the Royal Library (now the British Library). Before I go any further I must make it clear that I Am Not A Lawyer :-)

In many countries, any book that is published needs to have one (or more) copies deposited with a legal deposit agency. In the UK there are six legal deposit libraries; a copy of every UK print publication must be given to the British Library, and to the other five libraries if they request it within a year of publication. Since April 2013 there is an equivalent entitlement on the legal deposit libraries to collect UK-published electronic publications, but at the moment no mechanisms are in place for self-publishing authors to deposit their publications.

Does this affect you? At the moment, not if you only publish your book as an eBook. If you produce a printed edition then you will need to deposit a copy with the British Library.

Copyright is an area that many people don't fully understand, even though it is intrinsically very simple. If a piece of work is created, as soon as it is 'fixed', that is written or recorded on some physical medium, its author is

automatically entitled to all copyrights in the work until the author disclaims them or the copyright expires – this was enshrined in the 1886 Berne Convention which ensured recognition of copyrights between nations. Under the Berne Convention, copyright must be automatic, prohibiting any requirement of formal registration. Most nations were signatories, although the US refused to sign as they insisted on registration of copyright and mandatory copyright notices. Just over a hundred years later, in 1989, the US became one of the last developed nations to sign the Berne Convention. Thus, if you are an author you automatically have copyright in your work once it is created – unless the work was made by an employee in the course of their employment, in which case the copyright is owned by the employer. In the case of commissioned works the ownership of copyright would normally be established in the contract between the commissioner and the contractor.

The rights granted to a copyright owner fall into two categories; economic rights and moral rights. The economic rights are what allow authors to make money from their work – they have the right to control reproduction, sale, rental, broadcast and adaptation of their work, and can take action to prevent or claim compensation for infringement. The economic rights can be sold or licensed (which is what authors will generally do in the contract with their publisher). Moral rights protect non-economic interests of the creator of a work – in the UK there are three recognised moral rights: the right to be identified as author of the work (“the right of paternity”), which needs to be asserted by the author; the right to object to derogatory treatment (“the right of integrity”); the right to object to false attribution.

In the UK, copyright protection for an original literary work lasts for the life of the author plus 70 years from the end of the year in which the author dies – if there are joint authors then it is determined by the date of death of the last surviving author. Once the copyright has expired, the work is considered to be in the public domain and use of it will not infringe copyright. For example, John Dryden’s 1697 translation of Virgil’s *Aeneid* is in the public domain, but David West’s 1991 translation is still under copyright protection. RCS alumnus H.G. Wells died in 1946 so his *The War of the Worlds* (1898) remained in copyright until the end of 2016, while Jules Verne’s *Le Superbe Orénoque* (also 1898) is long out of copyright as he died in 1905.

Although there is no requirement to register copyright, it is a good idea to include a copyright notice with your work (using the © symbol, the name of the copyright owner and the year the work was created). This ensures that it is clear when the copyright protection started and who to approach for permission to use the work. You should also include an assertion of the right of paternity for the author.

If your work includes material from other work (for example, a quotation from a book

or poem) that is not in the public domain, you must obtain permission from the copyright holder of that work to use it. If you cannot get in touch with the author directly, the publisher will usually be able to handle your query. Make sure it is clear what you are intending to use and why – most authors/publishers will give you a free waiver for a short quotation, especially if it’s for use in a low sales volume book rather than one from a large commercial publisher! You may have heard the US term ‘fair use’ used in relation to using copyrighted material. It is similar to the UK term ‘fair dealing’ (e.g. using a limited amount of copyrighted material for non-profit educational purposes, private study or research, or for critical or satirical purposes) which only applies to non-commercial use. This, therefore, does not give you licence to use such material in a book you’re going to sell.

One doth not know how much an ill word may poison liking...

...so says Hero in *Much Ado About Nothing* when considering deliberately slandering her cousin. Libel is, of course, the written equivalent and it is the responsibility of a publisher to ensure that nothing is published which is actionable.

This is not likely to be of much concern if you’re publishing fiction, but if you’re going to be producing an eBook with essays on politics or history it would be advisable to make sure that they don’t include anything that could be considered libellous. As the publisher you will be held responsible – which is why commercial publishers will include a clause in the authors’ contract ensuring that the author indemnifies the publisher against claims including plagiarism and libel.

Now, down to the writing

Lay on, MacDuff...

Of course, the first, and most time-consuming part is actually writing your book. You already know what you want to write about, but before you start it is worth establishing some structure and a style-sheet so that you are consistent all the way through (chapter titles, standard paragraphs, quotes, etc.). You can use some tools (like Scrivener) to help you write in the form of a book, but using standard software like Microsoft Word or Apple Pages is perfectly good enough. You can use tools within these packages such as the spellchecker (set to the correct language), but I would recommend turning off the autocorrect facility as this invariably leads to unintended words being substituted, and if you’re a touch typist then you may not even notice that it has changed what you typed!

When you have finished writing it is essential to get an editor to go through it for you. However good you think you are as a writer, however careful you think you are as a typist, it is a fundamental truism that you CANNOT successfully edit and proofread your own work alone. Many self-publishing authors are tempted to get their partner/parent/best friend to do this, on the grounds that they read a lot and ‘have a good grasp of grammar’

– but this is a sure-fire route to disaster and potentially the end of a beautiful friendship (or two). There are plenty of freelance editors available (just look on the Internet) who can give you an independent and unbiased view of your text and offer constructive criticism and corrections.

If you think that this is unnecessary let me tell you about my friend Desmond (not his real name). He wrote a novel and had it ‘proofread’ by his son (because ‘he is good at grammar’) and a close friend (who ‘reads a lot and is very pedantic’). Following their handful of corrections he published it on Kindle and then sent me a copy and asked me if I’d write a review. As I read it I made notes of the errors that I found (yes, I am that annoying). In the end I sent him 27 A4 pages of notes on the errors in the book – which ranged from a character changing name halfway through, another character’s hair colour changing repeatedly with no explanation, multiple typographical errors, and a couple of (albeit minor) plot holes. He was shocked that his son and friend had missed all of these. Needless to say he re-edited the book and re-issued it in a corrected version. The moral of this story is that relatives and friends will be subjective and biased and are essentially reading it as an entertainment, whereas an editor will read through it multiple times as a professionally objective and independent reader. The job of an editor is not to change the story or affect the author’s ‘voice’ but to make sure that the text itself is clear, concise, correct, consistent and complete (the 5 Cs of editing). This can include correcting syntax errors (such as grammar, spelling, punctuation); correcting semantic errors (such as using the wrong character’s name, inconsistent spelling of a name, or anachronisms); improving use of language (such as poor sentence structure or phrasal ambiguity); trimming unnecessary text (such as repetition); ensuring plot elements are not missing. They can also help with issues such as formatting consistency and layout suggestions.

Once you have the text edited (and if possible, separately proofread – most professional publishers will have proofreaders who check the manuscript after it has been edited, but it is essential that they haven’t been involved in the editing so they come to the text fresh) you will need to ensure that it is consistently formatted. If you set up and used a style-sheet at the outset this will be easy. Remember that books are generally not A4, so lay out your text so that it will look good on a typical book-sized page. One of the most useful components of a text, but frequently overlooked, is white space – i.e. the gaps between and around words, sentences and paragraphs. They give a shape to the text and contribute to the rhythm and timing when it is read.

So you have your book written – how do you turn it into an eBook? You can sign up to Amazon’s KDP and just upload your Word file. However if you want a good ‘product’ you’re better off doing the conversion yourself. But that’s a whole other article...

Meet Hugh Kendrick (Mech Eng 1958-61)

What was the career trajectory that led a mechanical engineer from City & Guilds to be elected a Fellow of the American Physical Society cited for innovations in nuclear materials safeguards and nuclear non-proliferation (as reported in the Spring issue of Imperial ENGINEER)?

Hugh Kendrick's studies at City & Guilds were funded by an apprenticeship with Vickers-Armstrongs (Aircraft) Limited's (VA) South Marston Works where he helped build twin-engined Scimitar fighters for the Royal Navy. Hugh has had a life-long interest in aviation and fulfilled a childhood dream when he learned to fly in the University of London Air Squadron, part of the Royal Air Force Volunteer Reserve. He planned for his National Service to be in the RAF and contemplated a career in either the RAF or commercial aviation.

His interest, however, was piqued by the prospect of nuclear engineering when Professor Peter Grant initiated a graduate course at Imperial. Kendrick obtained leave from VA to spend a summer at the Atomic Energy Research Establishment (AERA) Harwell, to which VA later became a contractor when the Scimitar programme ended.

Besides flying, Kendrick's outside activities focussed on rugby which he played regularly for City & Guilds and occasionally for IC as well.

Contemplating new career choices, Hugh sought permission from VA for an MBA at Harvard, but was firmly told that "engineers should be on tap not on top!" So he applied for the Master's programs in nuclear engineering at both the Massachusetts Institute of Technology (MIT) and the California Institute of Technology (Caltech). Caltech offered him a Teaching Assistantship and he completed an MS there within a year. While there was no rugby at Caltech, there were enough ex-pats from the UK and other Commonwealth countries to sport a cricket team which Hugh joined. Another member of the team was Richard Wade, and their two families have remained friends ever since. Richard and Hugh even ended up working together in the same company, namely Science Applications International Corp. (SAIC).

Hugh remembers that he and his best (and life-long) friend at Imperial, Brian Launder, sailed together on the Queen Mary to New York in the summer of 1961, he to go to Caltech and Brian to MIT. In those days, First Class passengers, about 1/3 of the passenger total, commanded almost all the space on the QM, so he and Brian used to steal through the dog kennels between two of the QM's funnels into the First Class area in the evening to watch films and play ping-pong. Even though dressed in their Sunday-best suits, they stuck out like sore thumbs and were soon asked to go back where they belonged!

At the end of his year at Caltech, Hugh sailed home on the Queen Elizabeth to be reunited with his fiancée and love of his life, Wendy, who was training at St. George's Hospital to be a nurse. At his mother's suggestion, they



Wendy and Hugh in the Shetlands

holidayed together in the huts of the Fell and Rock Climbing Club, to which Hugh still belongs, in the English Lake District where his mother had been born. Within a year, they were – and still are, 54 years later – married.

When his apprenticeship was drawing to an end, Hugh was told that he would be paid on an age scale by VA at South Marston. When he expressed surprise because he now had a Master's degree, he was told "that education is the key to the door." Fortunately, he was able to transfer to a more compatible environment at Vickers Research (VR), where he helped design, build and test L-, S-, and X-band electron linear accelerators. Unfortunately, Kendrick learned he was to return to VA South Marston at the end of that year because VR was to be disbanded.

By now disillusioned with the old world attitudes prevalent in industry at the time in England and already attracted by the vitality he had seen in his time in the USA, he decided to apply to graduate schools in the US to conduct a PhD program. An experimentalist by nature, Hugh had obtained a recommended list of nuclear engineering schools before leaving Caltech. Tellingly, powerful multi-megawatt research reactors were already in operation at universities in the US by 1957, whereas IC's much less powerful kilowatt reactor was not commissioned until 1965 or later. Offered a lucrative fellowship by the University of Michigan (U-M), he and his by-now-6 month-pregnant wife, Wendy, emigrated in August 1963.

Kendrick's research was in solid state physics (condensed matter physics as it is now called). He worked during the summers for the Ford Motor Company's Scientific Laboratory and his two mentors there, Sam Werner and Tony Arrott, and he conducted a program of magnetic neutron scattering experiments on the 2 MW reactor donated to U-M by Ford. Together, they discovered the first-order magnetic phase change in chromium. It

seemed that Hugh worked almost 24 hours a day 7 days a week to finish his doctorate but found time to play for U-M's rugby team. By the time he graduated, he and Wendy had 2 children, Stuart and Amanda, but his rugby career had ended with a serious ankle injury during a tournament in Chicago.

His first job in 1968 was in the Linear Accelerator Division of Gulf General Atomic (GGA) in San Diego, California. Kendrick and his family drove across country and camped in as many National Parks as they could on the way. At GGA, Kendrick's research in measuring neutron and gamma ray spectra from concrete slabs bombarded by high energy neutrons was related to radiation environments in Minuteman missile (ICBM) silos. He was also involved in developing and applying non-destructive assay measurements of the uranium-thorium fuels for GGA's High Temperature Gas Reactor (HTGR). The measurements were for the Quality Control (QC) and nuclear materials safeguards of the fuel for the 300 MW HTGR at Fort St. Vrain in Colorado.

Leaving GGA, Kendrick went to work for a new start-up SAI which later became SAIC, and which he helped build to be a \$5+ billion all employee-owned company with more than 40,000 employees and offices world-wide when he retired in 2001.

Kendrick soon moved to the Washington DC offices of SAI and conducted research and analysis programs to assess environmental impacts, safeguards and security, risk and safety evaluations as well as the economics primarily of nuclear power reactors and associated nuclear fuel cycle facilities.

He became progressively more interested in nuclear safeguards and the risks of nuclear proliferation particularly associated with the nuclear fuel cycle. Analogous to probabilistic safety assessment of nuclear power, he pioneered the application of probabilistic approaches to safeguards. He worked for most of the US Government Agencies in these fields including the Atomic Energy Commission (AEC) and its National Laboratories, the AEC's Nuclear Regulatory Office (later the Nuclear Regulatory Commission), The Energy Research and Development Administration (ERDA) which became the Department of Energy (DOE), the Environmental Protection Agency (EPA), the Bureau of Radiological Health (BRH), the National Science Foundation (NSF), the Office of Technology Assessment (OTA), and the Department of Defense (DOD).

As an engineer, Hugh always liked the challenge of solving difficult problems, and came to realise that nuclear non- and counter-proliferation presented the most challenging and important problems which he ever faced.

He became involved with SAIC's work in nuclear weapons, particularly warhead security and the potential use of tactical nuclear weapons to counter the Soviet threats in Europe. He was struck by the fact that doves and hawks in the arms control arena had similar assessments of the risks of nuclear proliferation arising from the civilian nuclear fuel cycle.

Wanting to devote himself to these problems, Kendrick left SAIC in 1977 to work in ERDA and DOE for 4 years. He developed ways to assess the risks from, or resistance to, proliferation from different nuclear fuel cycles. Assessing the risks from materials involved in civilian nuclear facilities led to the finding that there is "no non-weapons usable plutonium." He studied the ways nation-states developed or tried to develop nuclear weapons capabilities e.g. Taiwan, South Korea, India, Pakistan, South Africa, Brazil, Argentina, Iraq, Iran. Earlier, he had been involved in helping Argentina to develop plutonium recycling capabilities that could have been diverted to weapons purposes. Eventually, he was responsible for producing a 10 volume report based on research programs involving 35 different government and commercial entities assessing many different fuel cycle concepts. He personally authored 2 volumes that dealt with proliferation resistance and ways to counter the risks of proliferation of nuclear weapons from civilian nuclear fuel cycle facilities by terrorists or nation-states. In addition, he led the proliferation resistance methodology that the US applied during the International Nuclear Fuel Cycle Evaluation (INFCE) program. Kendrick believes it was this body of work that resulted in his election to be a Fellow of the American Physical Society.

In 1981, Kendrick retired from DOE as the Director of Plans and Analysis in the Office of Nuclear Reactor Research in order to return to SAIC where he held various staff positions. As Vice President of Marketing, he developed a new commercial electric utility business which involved novel real-time safety parameter display systems that grew out of SAIC's work in ballistic missile tracking for DOD. As Director of SAIC's Internal Research and Development program, he managed a portfolio of 20-30 research projects annually chosen by a committee he chaired which included experts from academia as well as SAIC researchers. As Deputy Chief Operating Officer, he directed company-wide cost control activities and monitored business and performance from the top-level Sector down through Group and Division levels. He developed a suite of management and project training programs, and, as a founding member of the Employee Ethics Committee, he developed and delivered the mandatory company-wide ethics training program.

During his time at the DOE he had turned to running as a relaxation and competed in road races at distances from 10K to marathons eventually running about 10 of them including New York, London, the Marine Corps in Washington DC, and finally, Big Sur in California. Eventually, his body insisted that

a big clumsy fellow should stop such activity and broke down!

To replace running, he and Wendy took up trekking in mountains, the bigger the better. Travel, to see wild animals and wild places, is an enduring passion. They trekked in the Himalayas in Nepal, Tibet, Bhutan, and India, and in the Karakoram of Pakistan; across the Alps in France, Switzerland and Austria; the Pyrenees from Bilbao to Barcelona; and the Torres del Paine in Argentine and Chilean Patagonia. They climbed Mount Kilimanjaro. They visited the Galapagos and have safaried in Africa perhaps 20 times, and visited more than 100 countries, and Antarctica.

Kendrick was frequently called upon to chair or be a member of risk management (so-called "Red") teams conducting oversight reviews and making recommended remedial actions. At SAIC, these teams were always made up of technical experts who were leaders in their fields as well as business experts, and stressed the technical quality of the work reviewed as well as a full spectrum of the risks involved. The teams might assemble on a one time basis or be constituted periodically. For example, NASA asked SAIC to conduct a probabilistic assessment of the Shuttle following the Challenger disaster. SAIC had an earned reputation for probabilistic safety analysis from which a team of experts was selected. They found the overall risk of catastrophic failure to be of the order of 1 in 100, clearly orders of magnitude more risky than that assumed by NASA's top management at that time. Kendrick was a member of that team which concluded that the work was technically supportable, and took the responsibility to brief appropriate members of SAIC's Board of Directors to ensure there would be no surprises when the results were provided to NASA. As another example, Kendrick chaired a team that regularly conducted safety and other risk reviews of three on-going major programs: support to DOE's program to develop, build, and license the High Level Nuclear Waste Repository at Yucca Mountain (a program he feels was summarily and groundlessly cancelled during NRC's licencing review by the Obama Administration); support to the US Army's program to demilitarize chemical weapons (Kendrick was also a member of DOD's independent review of the incinerator operations on Johnson Island that destroyed US stockpiles collected from around the world except within the US); and of SAIC's support to the National Cancer Institute's Research and Development Center at Fort Detrick which included the manufacture of ton quantities of the HIV virus and its distribution to research laboratories world-wide.

Honours and Awards.

At IC, he was awarded a First Class Honours degree, the Associateship of the City & Guilds of London Institute, and the Henrici Medal for Mathematics.

He won scholarships and fellowships throughout his academic career, and outstanding achievement awards and

certificates during his service with the Federal Government.

He is a member of the American Nuclear Society, a Fellow of the American Physical Society, a member of the American Chemical Society, the Society of Sigma XI, and a past member of the Institute of Nuclear Materials Management (INMM), and the American Association for the Advancement of Science.

He is a past member of the Nuclear Safety Committee of the National Research Council.

He is a past member of the Committee to select DOE's Ernest O. Lawrence Award.

He was a member of the Safeguards Committee of the Atomic Industrial Forum.

Publications.

When he graduated with his PhD, Kendrick had authored or co-authored at least 9 papers in refereed journals including *Physical Review Letters*, *Physical Review*, *Journal of Applied Physics*, and *Nuclear Instruments and Methods*.

Subsequently, he was a frequent contributor to journals of the American Nuclear Society including *Trans. Am. Nucl. Soc.* and INMM on various topics in radiation transport and dosimetry, nuclear materials safeguards and security, and nuclear fuels. In addition, he authored or co-authored project reports at GGA, and numerous contract-sponsored reports for many Federal Government Agencies on such topics as nuclear reactor and fuel cycle alternatives and strategies, low- and high-level waste management alternatives, environmental and economic assessments, and nuclear safeguards and nuclear proliferation.

He has been an invited author, speaker, and panelist before public, professional, industry, and academic audiences which have included: the Aspen Institute; the American Nuclear Society (including its International Executive Conferences); the American Institute of Chemical Engineers; the American Society of Mechanical Engineers; the Ditchley Foundation; the Presidential Management Interns; the Brookings Institution; the Military Operations Research Society; the University of Michigan; the University of Chicago; Georgetown University; the George Washington University; Harvard University's Center for Strategic and International Affairs; the Nineteenth International Space Congress; and the Atomic Industrial Forum. His subjects have included energy alternatives and energy policy, the prospects for nuclear energy, US nuclear energy programs, the relationship between nuclear energy and international security, and nuclear non- and counter-proliferation.

After his return to SAIC, and in retirement, Kendrick has retained his interest in nuclear non-proliferation in which the company was continuously involved. He recently attended a 2-day seminar of 24 talks on "Nuclear Weapons and Other Security Issues" back in his old stomping grounds in Washington DC. And he will attend the annual conferences of the American Nuclear Society and the American Physical Society and its Forum on Public Affairs.

Development, advancement and alumni engagement in the Faculty of Engineering

Sharp-eyed readers will have noticed in the interview with Teresa Sergot in IE25, that Nic Katona was mentioned as taking over Teresa's role for Imperial ENGINEER, and that he is now the contact name on the inside cover. You may also remember that he wrote an article in IE22 (spring 2015) about philanthropy and what he was hoping to achieve in his new role as Head of Development for the Faculty of Engineering. So we thought it would be timely to catch up with Nic, to re-introduce him to IE's readership and find out how his first three years at Imperial have been. Nic also wanted to introduce his team who will be supporting us. We met up with Nic and two of his team members Andy Cox and Andrew Mackinnon and had a long and interesting conversation. So long, in fact, that it won't all fit into one issue of IE, and so interesting that we don't want to edit any of it out! So instead, we are splitting it into two, with Part 1 in this issue and Part 2 in the next.

IE – Nic, I guess the first time you hit everyone's consciousness in Imperial ENGINEER was a couple of years ago when you wrote an article about Philanthropy and your plans for what was going to happen, as your team was just being established. So maybe we can talk a little bit about how that has gone – whether your plans have changed?

NK – At that time it was just myself in the Faculty of Engineering, so I think we were starting to talk about the opportunity of expanding the team. The Advancement Division had about 30 members at the time, and two years later I think we're into the upper 70s in terms of number of staff. The reason for the 70 is a reorganisation within College, bringing several different existing entities under the Advancement umbrella, with the idea of streamlining processes and streamlining the work, to make an organisation that was externally facing so the engagement of Alumni would be a more professional operation and the Alumni would have a more positive experience of how they're engaging with College. The Advancement operation brought together alumni relations, events and supporter engagement (stewardship of alumni and of donors). It also expanded the number of Development professionals – you know, people who are going out to have those one-on-one interactions with alumni – into the various faculties to help provide our alumni the best experience possible. So through that process I was lucky enough, and the Faculty of Engineering was lucky enough, to get a comprehensive team of five people, myself, Emma Edsall our development assistant, and three front line development professionals – Andy Cox, Andrew Mackinnon and Claire Kidd. The Faculty of Engineering has the largest alumni population, we're about 95,000 at this point. We have the largest number of departments, 10, so because of that it takes a lot of work and we needed to have more staff to facilitate that.

So two years on, I'd say we've seen marked growth, both in alumni engagement as well as philanthropy. We've seen strong growth as far as the internal relationships that we have



Photo: Imperial College

Nic Katona is Head of Development for the Faculty of Engineering. He hails from Wisconsin in the United States. He holds a BSc in Political Science and Prevention & Care of Athletic Injuries and a Masters in Political Management & Fundraising. In his spare time, he enjoys eating, running and travelling.

now with our heads of departments, with our academics etc. – that has helped to open the doors of Imperial to the alumni community and we've started welcoming alumni into the Faculty and departments more. We've taken a lot of the events that already existed, like lecture series and networking nights and started to turn them more external and say 'well, why aren't we welcoming in those who are closest to us – our engineering alumni?' We started communicating more often with our alumni through the alumni e-newsletters which go out on a quarterly basis now. Simple things like that just to inform and engage our alumni about 'here are the things that are going on at Imperial and here are the things that are going on within your department'. I think one of the crucial things that we've really worked to do over the past

two years is build on the strong relationship that Teresa had with the Associations, and work diligently to engage the Associations as strong strategic partners in building a strong and robust alumni community. And so I'm very pleased to say that the working relationship that I and my team have with the presidents and the executive committee of both Associations is strong. This wouldn't have been possible without all the dedication and work done by Teresa over many years! We certainly have moved from a time of suspicion and apprehension to one of collaboration and partnership. You know there are days where some old feelings or suspicion pops up but I think it's much better. We work to engage the Associations in conversation at the executive level as much as we can on big strategic decisions, or talk to them about how they can work together on alumni engagement opportunities. We've really worked with them to not just map 'what does it look like for Imperial over the next five years' but 'what does it look like for Imperial and the Associations over the next five, ten years', as we start coming into some rocky waters with Brexit and the new data-protection and privacy laws that are coming into play in May of 2018. The data protection and data privacy laws could significantly impact alumni relations and the Associations, so we're trying to work together to tackle these issues. We're working to hold hands and march together into an unknown and uncharted territory right now, so that both Associations can maintain the robust numbers they have. Hopefully through our work, and working together, we can increase those numbers; especially with younger generations of alumni. We need to work collaboratively to meet the goal that we share, which is a strong, engaged and robust alumni community within the Faculty of Engineering.

On all of those big strategic points, I think we've moved quite significantly over the past two years... more work has to be done, but I think we're at least on sure footing and a solid foundation now to tackle the next challenges that come about.

IE – And how do you relate to the college-wide alumni organisation?

NK – We all sit together, so the great part now is that... when I first came in, Alumni Relations were over there, and my team were over here, and we had little interaction, dare I say. Now that we're all under the same umbrella, Andy, Andrew, Emma and Claire sit downstairs on the first floor with the Alumni Relations team so there's constant engagement with one another. Alumni Relations have really embraced the strategy that we're implementing within the Faculty of Engineering – we have embraced their strategy and goals for College. We all recognise that there are some unique differences within the Faculty of Engineering that we need to take into account when planning events or thinking about how we message folks. Especially, dare I say, some of our senior alumni. We need to recognise and appreciate the Associations' heritage, traditions, strong name recognition amongst that community, and acknowledge that the Imperial brand is not something that resonates with all of our graduates – we need to acknowledge and recognise RSM and C&G when we talk to our alumni – and continue to engage with the two Associations. I'm very pleased to say that my colleagues in Alumni Relations are helping to promote and, behind the scenes, to facilitate the CGCA annual dinner and the RSMA annual dinner. We also provide some soft guidance and logistical support around the decade reunion luncheon and some other Association events. So we've worked hard to weave a strong relationship between the two of us to ensure that our alumni benefit.

IE – Many of us know Jess Adams, who attends committee meetings and is a great help at events like the Alumni Weekend. She works for Alumni Relations?

NK – Yes, Jess works in Alumni Relations and has been again, one of the key people we work with. She's gotten to know the Associations very well and has been a strong partner in supporting the Associations and fostering those positive relationships. We've become the Association 'experts' that colleagues turn to for a crash course in all things RSM and C&G. We make a good team because Jess would wear the Alumni Relations hat and I would wear the Faculty of Engineering Advancement hat and we would work together to make things happen. Don't get me wrong, Jess and I have many people working with us to make this all possible, and we would not be where we are without them, but we just became the go to folks when it was regarding the Associations. (See box, right.)

IE – And do you work with the current batch of students, to prepare them, make them aware of what's available once they leave?

NK – Yes. That is again where we work with Alumni Relations because we are very keen on building a soft 'alumni-in-training' mindset amongst the students, helping them to understand the benefits of the Imperial

alumni network; allowing alumni to engage with the students. We work with Alumni Relations to engage key student leadership, whether it be CGCU or RSMU leadership, or some of the departmental societies (Dept Socs), which is kind of a newer piece. So while the two constituent student unions remain strong, we're also seeing some of the Dept Socs really coming up and growing quite significantly. Andy can talk about the work that we've been doing with the Faculty of Engineering departmental societies.

AC – We gathered the Dept Socs at the beginning of last academic term for a pizza evening, where we talked about the role of our team and the wider Advancement Division and what it means to them now and when these guys will graduate. We also wanted to take time to understand the events that they run throughout the year. They try to do networking evenings for career opportunities or areas of interest, they undertake a load of extracurricular activities and all of these various different events are opportunities for alumni to connect back into the department and something that we will look to push forward as we continue to implement the programme. So certainly the students benefit from that style of alumni engagement a huge amount, seeing alumni who've been through the exact same experiences they have and have gone on to really interesting, really successful careers is something that we hope can benefit both the alumni community as well as the student population in many ways. We try to facilitate that with people we already have some sort of relationship with; listening to their experiences and interests and matching with opportunities to come back and talk to students. The Dept Socs are an obvious opportunity to do that.



Photo: Imperial College

Andy Cox is a Development Manager. He grew up in Kent before embarking on a law degree at Durham University. He has spent time living and working in Hong Kong, York, Manchester and now London, completing an MA in Conflict, Governance and International Development in the process. In his spare time he enjoys playing football and squash, cycling and pub quizzes.

NK – We look at it as a way to advise and help the students because... you know when a student is trying to reach out to a CEO of a company or a vice-president of Shell or something like that, they sometimes miss key pieces around professionalism or tone, or how do you get the attention of someone like that who's getting hundreds of emails a day – how do you stand out from that? We've talked to them about that, we work very diligently to make sure that we are viewed as trusted advisors to them and to our alumni. So when we're bringing something to them, we're hoping it stands out because we've heard what the alumni are interested in doing, we've matched that to something that's available, we've almost validated the event for the alumnus or alumna so that they realise that it's not going to be haphazard, it's not going to only have four students show up. They know it's something that will be well done, and because of that we're helping to bring in alumni that can guide some of these students. But also it removes some of the pressure on the student of having to go and do all the LinkedIn searches themselves, trying to send hundreds of emails and then not getting anything and wondering 'why is this happening'. In certain instances we work with the departmental societies to promote some of their events. We can advertise those events in e-newsletters that go out, so it reaches a larger number of alumni as well. It's an area in which more work can be done but we really enjoy engaging with the students! We have to tread that fine line of not encouraging them too much to do these events all the time, because at the end of the day they are students and their primary focus



Photo: Imperial College

Many alumni know Jess Adams from Alumni Relations. She came to Imperial from New Zealand in 2010 and has been an enthusiastic Alumni Engagement Officer since 2014. She has been an invaluable support for alumni at various events such as the Alumni Weekend, as well as behind the scenes with both alumni Associations. Jess has unfortunately (for us) just moved on to pursue a PhD at Birkbeck, University of London, studying the politics of participatory art.

All of us here at Imperial ENGINEER wish her well for the future, and good luck with her research. Maybe she'll tell us about it when she's got her doctorate!



Photo: Claire Kidd

Claire Kidd is a Development Manager. Claire grew up in Leeds. She completed her undergraduate studies in Global Politics at the University of Brighton before moving to the University of Sussex to study her masters in Conflict, Security and Development. In her spare time, Claire enjoys spending time with her family and friends.

should be on their academics and research and enjoying London. We never want to be viewed as using our students as a means to an end – but those that are quite keen, those that want to put in the time and effort, we're coming alongside and helping out as much as we can, and that will benefit the wider alumni community.

IE – Because the Associations are working with the departmental societies as well to try and do the same sort of thing,

NK – We've started talking with the Associations about that. When I had conversations with Judith and the CGCA executive team, that was one of the questions. CGCA has tried numerous different models – first they had professional staff they were utilising as links in each department, that were ebbing and flowing and maybe weren't working as well as they wanted – and they had a keen interest in the need to get the 'younger generations' engaged with CGCA to ensure the continuation of the organisation. We've talked about some of our efforts with the departmental societies, and we shared some of our stories, and I think the CGCA took it on board, saying, "okay, well, clearly we have engaged students who are moving into these leadership roles, how can we augment the relationships to dive deeper into the departments while still respecting our constituent student unions and still working through them?". It was this hybrid approach of continuing to work with CGCU and RSMU but dipping into these departmental societies as well, because sometimes the societies do carry a louder voice in their specific department. Additionally, they're revitalising the approach of having a dedicated staff member

in each department, which is great, and my team know these staff members which is nice – and in some instances where they couldn't find people we suggested names. It's been a really good synergy and hopefully that will pay off. At the CGCA AGM the student attendance increased significantly – that's a really positive sign!

IE – I was there and I was talking to Claudia Caravello, the new CGCU president. They're starting a new newsletter with her presidency, *The Bolt*, so she was quite keen to share some of the articles from Imperial ENGINEER, and the reverse as well, we'd get some things from them from their students to try and mix the communities up a bit more, which I hope will work quite well.

NK – That's a prime example of a challenge in working with student groups, that year on year it changes. So you're always getting new blood in, which can be a positive thing, but at the same time it loses some of that historical memory. So what we try to do is, at least in those initial meetings that we have with the departmental societies, we almost try to give them a bit of a "Don't reinvent the wheel. Let us inform you about what is in place or what is available to you already, so that you're not having to spend your first four months in office thinking 'we have to do a newsletter, we have to do this we have to do that'" – it's about softly educating the students about "Oh did you know that Imperial ENGINEER exists?", "Did you know that quarterly e-newsletters are happening?" – not to stop them, but just to make it more strategic and utilise their time more effectively. I think you're absolutely right – where there are opportunities or where there's enthusiasm, we really try to nurture that to say "yeah, great!". If you're going to suss out some stories within the student community, please do, we would love to share them, because one of the key things we try to talk about in the e-newsletters is student stories – what's happening within the student body – because our alumni are keen to hear that.

IE – That's right, we know that alumni are really very interested in stories of what's going on at College. So that's why we have the pages about faculty news, pages about student and college news, as well as the alumni news... and obituaries.

NK – Exactly. I have given all my team the Imperial ENGINEER, because it's an interesting way for us to see how information is presented differently, or in some new and really interesting ways. You guys have sussed out stories that we haven't heard about – either because of connections that you have in the department, or the connections that you have developed with alumni. People share news with you in a different way than they share with us. And it's really interesting. Andy came back after reading the last one and said there were three or four articles that he didn't know about, and it was a really interesting read. But I think that the Imperial ENGINEER provides the members

of the two Associations with something that we haven't found the best platform for yet, which is sharing news about themselves. We have yet to crack that nut, of how do we set up a system that allows alumni to write and, dare I say, brag about themselves a little bit – and what does that look like? You know, I'm very used to a 'class notes' section from my time at institutions in the US, it was just a thing that was done by decade, and people just wrote in their little update - 'John had his second child and he's been promoted to the VP of X company'. It was brief, just two or three sentences.

IE – The Triodes do that. They're Elec Eng graduates from 1973 and they have a reunion every year, and Martyn Hart sends me a copy of his 'report' and a photo. Obviously it's mostly of interest to people who know them, but it's a nice approach and I think it appeals more widely.

NK – You'd be surprised who would be interested. Alumni like knowing that they are part of an institution that has a strong alumni community. This is an example of the community coming together and we need to share this more often!

IE – I keep hoping that it's going to promote the idea to other year groups from other departments to do the same sort of thing, because it would be great – I'd be quite happy, I think everyone would, to add extra pages into Imperial ENGINEER to have more items like that.

AC – And there are other classes doing that as well, that we've heard of, not necessarily through college or in concert with college, who are just going to the pub each year, or something like that.



Photo: Imperial College

Andrew Mackinnon comes from Edinburgh, Scotland. He studied toward his degree in Politics and International Relations at Georgia State University and the University of Aberdeen whilst working in alumni relations and fundraising. He decided a move into major gift fundraising was what he wanted and was delighted to join the Faculty of Engineering Development Team at Imperial in June as a Development Officer. In his spare time, he enjoys exploring London, trying new restaurants and reading Stephen King.

IE – Sometimes we get a photo and a paragraph, sometimes we get nothing, and then sometimes, like the Triodes, we get a full article.

NK – Exactly, exactly! So that is something where I think there is room for further collaboration: alumni reunions, mentoring and other volunteering.

IE – We had an article in IE about the Alumni Mentoring Scheme when that started some time ago, and we'll follow that up with an update on volunteering. Because I think there's a natural reticence in some people. Some people are quite up front and they want to be involved, and they'll approach you straight away, but I'd have thought having met many over the years, that the majority would be a little more reticent and would assume – certainly the older ones – that they'd be out of date and so on. But then there are people like Roma Agrawal. Her employers give her a day a week to go out to schools and outreach.

NK – And a lot of them do. Surprisingly, in a lot of the financial institutions some of the benchmarks they're even rated against are 'What is your philanthropic activity, what is your community service, your engagement with the community?'. So I think we need to take advantage of those opportunities. This is an area that we are working to actively continue to grow, and I think that'll tie into the other big piece that's coming about but probably not until 2018. The launch of a new and more interactive, and more current-day, alumni portal, which will enable alumni to really engage in a true interactive community through a new online portal. It will allow alumni to do things like, say, 'Do I want to share information more broadly?', 'Do I want to join various interest groups?', 'Do I want to volunteer?' or 'What does my profile look like?'. That's at the college-wide level, not just the Faculty. We're talking with the Associations about what are the Associations' footprint within that community, so we can have members of CGCA and RSMA saying 'Yes, I'm a member', or 'I want to join the group'. It may allow the Associations to get new members because someone may say 'Oh I wasn't aware', or 'Look how easy it is for me to learn about CGCA or RSMA', they can look at it, say 'Are you a current member yes, no, and do you want to join?' and it's done. Will it work just like that? Probably not, but it is the mantra we are working with at College. We want to simplify the process and make it easier for alumni to engage. This new alumni portal is another way that we're working and talking with the Associations on the front end about their interests, and their needs, and how can we help facilitate that. I think that we've moved light-years from probably two or three years ago, when such conversations may not have occurred. Now the Associations are being key players in helping us determine how can we work together to facilitate this new portal.

IE – It's interesting that you're talking about the change over a fairly short period of time,

which sort of coincides with you being here. So is that because you've been acting as a catalyst, or was the fact that the Faculty brought you in the first sign of this change happening, or was it a bit of both?

NK – What I'll say is that College made the right strategic decision when they recognised and identified that alumni relations and alumni engagement is crucial to the continued success of Imperial. It was an area of opportunity for us to increase and better ourselves. I think they realised that the small and compact Imperial of old had evolved, and that our alumni had many different loyalties and affinities. College acknowledged that many alumni resonate strongly with their discipline and made the decision to bring in teams to embed within the faculties, to help nurture and develop those affinities and loyalties. As we continued to listen to our alumni, we recognised and strongly embraced the idea that people have a strong affinity to their home department(s). And so we needed to help augment the voice of the departments as well, and bring those forward. So I think through some of the efforts and outreach that we made, of working closely with the Dean, Heads of Departments, the academics, etc., they started to understand what we were trying to do; which is to build long-term and sustainable relationships with our alumni across the board, from the youngest member to the most senior member, engaging them in one way or another. Not every single alumna/us is going to have the opportunity to engage with my team unfortunately, just sheer bandwidth issues, but making sure that we are starting to communicate and open the doors to alumni is College's goal. Teresa did a wonderful job of nurturing the relationships with the Associations, and I think the renewed focus on Alumni Relations and Advancement within College gave me a louder voice to quickly pick up the work that she had done. And start speaking quite loudly about the importance of the Associations who have a robust and engaged alumni body already. Why would we keep them at arms length? Let's start to repair the relationship, but know at first it's not going to be easy. Early on in my tenure, I had a bit more bandwidth to take on and address some of the issues and concerns of the Associations. It also was a great opportunity where I was new and didn't have any baggage. Granted I had the baggage of being American, and I think some in the Associations were quite concerned about what that meant. You know, an American coming in and how aggressive or how bolshie was I going to be, or how was I going to try to change the Associations. But I think, hopefully, they've seen that I'm true to my word and that my team members are true to our word, that we, the Faculty and College really are focused on building a robust relationship. Sometimes that means we have frank conversations – sometimes that means we sit around a table and I call some of the



Photo: Imperial College

Emma Edsall comes from Brisbane, Australia. She completed her undergraduate and postgraduate studies in Law at Queensland University of Technology, before becoming admitted to practice as a Solicitor in Queensland. Emma decided that it was time for an adventure and moved to London where she was welcomed into the Faculty of Engineering Development Team at Imperial as Development Assistant. In her spare time, she loves to travel, watch live music and keep active.

executive board members out on some of their stuff and sometimes they do the same to me. We have gone through a bit of a catharsis, of venting, sharing, and educating – me acknowledging some of their concerns as very valid but also being able to sidestep some and say, "You know, that wasn't me and I don't want that put on me because that's not how I or College is going to operate with you". So, to go back, long-winded answer to the question, I'd say it's maybe 75% system – that College strongly endorsed outreach to the Associations, and then maybe 25% my personality and my team in helping move this forward. But we certainly wouldn't have been where we were if Teresa hadn't been such a strong partner and taken the time to validate me to the Associations. She dedicated so much time to shepherding me through this process and educating me every step of the way. I don't think I, or my team would have been successful if she hadn't laid the framework before she retired. I'm certainly indebted to her for doing that, and I think the Associations, rightfully through the awards they've given her, have recognised her strong contribution in developing our relationship with the Associations... cordial friends moving forward in this journey, together.

Part 2 of this conversation will be in the next issue of Imperial ENGINEER, covering philanthropy, the difference between UK and US alumni relationships, and some of the aspects of this year's Alumni Weekend that made it better than ever.

We'd like to especially thank Emma Edsall for her help in producing this article.

Leading electrochemical engineer is new Dean of Engineering



Photo: Imperial College

Professor Nigel Brandon has been appointed Dean of the Faculty of Engineering.

An Imperial alumnus, Professor Brandon rejoined Imperial in 1998. Becoming Professor of Sustainable Development in Energy in the Department of Earth Science and Engineering, he was the founder and Director of the Energy Futures Lab. He has served as Vice Dean (Research) in the Faculty and, most recently, as Director of Imperial's Sustainable Gas Institute. His research is focused on electrochemical power sources and his expertise is highly sought after by industry.

A Fellow of the Royal Academy of Engineering, he was awarded an OBE for services to UK-China science, for his work in developing collaborations between the UK and China in the areas of climate-change, energy, and environment.

Professor Brandon will now be responsible for providing strategic leadership, planning and coordination for the Faculty of Engineering, and for driving continuing excellence in research and education.

Professor James Stirling, Provost, said: "At a time of uncertainty and rapid change, society needs innovations in engineering more than ever. Our Faculty of Engineering is developing solutions to some of the world's most challenging problems and driving advances in energy security, climate change, clean and efficient transport and the challenges of an ageing population. It is also training the next generation of science and engineering leaders.

"Nigel has demonstrated exemplary leadership. He is the ideal person to lead the Faculty through this exciting next stage."

Professor Brandon said: "It is a tremendous privilege to be asked to lead the Faculty of Engineering. Imperial has hugely talented staff and fantastic students, and I am looking forward to us all working together to realise the opportunities ahead in both teaching and research".

bit.ly/IE27-Brandon

Singapore Deputy PM hails 40 years of alumni excellence



Photo: Imperial College

One of Imperial's most active and longest running alumni groups has celebrated four decades of success.

Singapore's Deputy Prime Minister Teo Chee Hean (MSc Comp 1977) addressed 300 alumni and friends at the 40th anniversary gala dinner of the Imperial College Alumni Association of Singapore (ICAAS).

The gala dinner took place one week after Imperial celebrated the official opening of LKCMedicine, the College's joint medical school with Nanyang Technological University (NTU) in Singapore, and was attended by the School's Dean Professor James Best.

The evening was organised by Jayson Goh (EEE 1998), President of ICAAS, and his executive committee. Mr Goh, who also serves on Imperial's Court, said: "ICAAS can continue to be the link between Imperial College and our many graduates who are pushing the innovation frontiers."

During Mr Goh's speech, the audience applauded Professor Phua Kok Khoo, the founding president of ICAAS, who initiated the group in 1977.

Attending the gala event, Prof Alice Gast, President of Imperial College, said: "Imperial and the UK enjoy a deep and special relationship with Singapore...I admire Singapore and Singaporeans.

"You are worldly yet loyal to your homeland. You are innovative yet realistic. You celebrate wisdom and age while giving young leaders a tremendous amount of responsibility. You are inspiring to us at Imperial and I believe that our excellent university is enhanced by our Singaporean students and alumni."

Deputy Prime Minister Teo Chee Hean, outlined his vision for science and innovation as new engines of economic growth, staying on for a lively Q&A session. He also took the chance to reminisce about his "very good year at Imperial College", and his pleasure at seeing some of his old classmates at the ICAAS dinner.

He spoke about Singapore's historic "shift from a labour-intensive to a skills-intensive economy, now transitioning to an innovation driven economy." The nation is "reaching a point where

we can reap some of our returns from earlier investments, including long term ones like funding PhDs at Imperial," he said.

The DPM commented on Singapore's move towards a cashless society, the potential for Internet of Things tech for public services including smart streetlights and ASEAN's prospect for growth, while underlining the importance of "people like the alumni of Imperial College [who] are comfortable with technological change."

He spoke of his "secret happiness when young people quit steady jobs at multinationals to try a startup..." something that growing numbers of Imperial's Singaporean alumni and students are doing, "..., and be willing to fail in the process."



Photo: Imperial College

Imperial has more than 400 Singaporean students: the highest proportion at any UK university. 40 current students, all members of Imperial College Singapore Society, attended the gala, including a group of musical performers.

When asked for his advice to current Imperial students, the DPM said: "There's a new world with many opportunities...When you go to a university like Imperial you learn two things: first, the specific subject you major in; the other thing you learn is how to organise your knowledge and thinking. You learn rigour and the method of how to think about the world around you.

"It's important to have a discipline of your own to structure your

thinking...but do it in your own way. You must know how to understand these things so you appreciate your own discipline and have the humility to take on other ideas outside your field."

Current and future students rubbed shoulders with alumni leaders from Hong Kong, Beijing, Shenzhen and the wider region, as well as Singapore. They were joined by Britain's High Commissioner for Singapore Scott Wightman.

Imperial's new Dean of the Faculty of Engineering Professor Nigel Brandon, who is also a visiting professor at NTU, met with alumni, including his former student in Mech Eng, Teo Eng Dih, who now serves as a senior advisor on climate change in the Prime Minister's Office.

Singapore has one of the highest concentrations of Imperial alumni per capita anywhere in the world, the College's 2,700+ alumni including the Republic's Acting President JY Pillay (Mech Eng 1956) and Business leader Koh Boon Hwee (Mech Eng 1972).

Singapore's first ever Schwarzman scholar Lejon Chua (Chem Eng 2014) also graduated from Imperial.

Many of those responsible for Singapore's dynamic national planning and infrastructure were in the audience, including alumni Siow Chong Goh (Comp 1995) and Wen Tung Chiu (MEng Chem Eng and Chem Tech 1996) who work together at Singapore's Urban Redevelopment Authority.

Several alumni looked back fondly on the opportunities – for their careers and wider lives – that Imperial and London afforded them.

Yang Yang Zhang (PhD Bio Eng 2009), now Director of Debt Capital Markets for Bank of China International, developed her interest in finance as a student, interning at Barclays in London. Originally from China, Dr Zhang stays in touch with many Chinese and Singaporean Imperial alumni via WeChat.

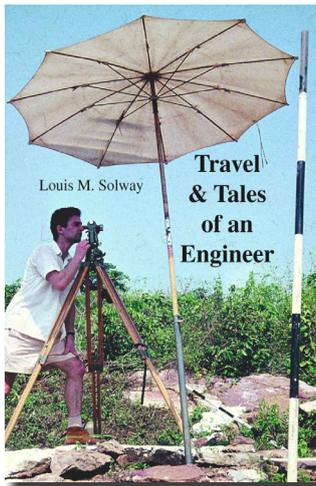
Yu Han Wong, COO of A-Smart Holdings, said his career gained from "the rigorous training of the mind" in his Mech Eng degree, "but most importantly," he added. "I met my wife at Imperial!"

bit.ly/IE27-Singapore



Photo: Imperial College

Book Review



Travel and Tales of an Engineer
by **Louis M Solway**

Cedar View Press, 2017
ISBN 978-1-54813-430-3
Kindle ISBN 977-1-84396-450-6
(Available from Amazon, Kindle, Kobo)

It's not often that one reads such a refreshingly honest biography. Adapted from material prepared for his children so that they might better appreciate exactly what their father did, this short book chronicles many aspects of Louis' career working around the world as a civil engineer engaged principally on water-related projects. As such, it provides both fascinating insights into his world – its challenges, surprises, opportunities and satisfactions, as well as telling us something of the actual engineering – and of how such a career is viewed by the central character.

For older readers there is the joy associated with looking back over a very varied, never uninteresting and always rewarding (in the true sense of the word) set of experiences; for younger readers there is that sense that similar adventures and excitement might come their way were they to opt for this sort of career. Alas it won't be the same, but 21st century opportunities will simply be different, not, providing good decisions are made, any the less satisfying.

This is an ideal book for a train journey or a relaxing afternoon in a deckchair – amusing and frank, informative and interesting – where else could you gain such insights into life in Ghana, Iran, Hungary, Libya, China, Brunei, Trinidad and Redditch?

David Nethercot
Emeritus Professor of Civil Engineering

Electrical Engineering class of '81 annual reunion

The Electrical Engineering class of 1978 to 1981 held their annual reunion on Saturday 16th September, meeting in Beit Quadrangle and afterwards for dinner in the Thai Square, South Kensington. The group have met every year since graduating in 1981. Since many of the group are now retiring and have more time, from now onwards they will meet up twice a year – in September and April.

Being 36 years since graduating, there was much to talk about. Going round the table (see photo):

Yogesh Joshi works for the BBC NEWS in Newsgathering Operations being part of a team bringing "LIVE" & packaged National & International News to our homes for BBC TV, Radio and Online.

Sunil Morzaria has spent the last 17 years as owner and Managing Director of an IT company working closely with lots of Advertising Agencies and Creative companies in London.

Trevor Hall worked at Philips for twenty-eight years after leaving University, ending up in applied research on SoCs and embedded software. On leaving Philips in 2008

he joined a High-Tech startup in Cambridge working on networked graphics processors, and survived the transition from a multinational to a roller-coaster life in a VC funded silicon and systems company, and is currently Director of Systems Engineering at DisplayLink (UK) Ltd.

Ian Tyes, after 20 years running his own computer business, studied law and qualified as a solicitor. Nearing retirement, Ian is about to emigrate to China to teach English as a foreign language.

Robert Powell works for National Grid. As Engineering Manager on the North Wales Connection Project he is responsible for connecting a new power station on Anglesey to the National Grid.

Krishna Thakrar had a number of different roles ranging from being part of the commissioning team on the JET project to developing microprocessor systems for high speed non contact inkjet printers to developing electrical and control systems on high profile projects, currently working for Bosch Rexroth Ltd.

Bernard Ashpole ran the family Engine reconditioning and Precision Engineering business for

many years until selling the business in 2016.

Marek Stuczynski is now with a US data centre products and technology company where he works as a Solutions Architect designing IT solutions.

Alan Higginson worked in the electricity distribution industry until 2012 when he took early retirement. He was quickly bored and went back to work for Wessex Water managing their central engineering services department. He will retire, permanently this time, at Easter 2018.

Roger Edwards had a 2 year spell working at an observatory in the Canary Islands. Roger returned to the UK to develop and market travel document readers, and takes delight at seeing his products in use when he enters many countries in the world. He is currently Product Manager at Gemalto responsible for the complete life cycle of their whole document reader range. He also spent a lot of time with Young Enterprise helping Year 12 students set up their own company for a year.

Anyone wanting to contact the group should email:

alan.r.higginson@btinternet.com



Clockwise in the photo are: Yogesh Joshi, Sunil Morzaria, Trevor Hall, Ian Tyes, Robert Powell, Krishna Thakrar, Bernard Ashpole, Marek Stuczynski, Alan Higginson (holding the Imperial College London teddy bear), and Roger Edwards.

If you have arranged a reunion of your classmates or contemporaries, please send us a photograph and a report. We would love to hear from you and there may be other alumni who would like to join you when you have your next reunion. See the next page for information about how the College Alumni Relations team can help.

Flat Pack Alumni Reunions

If you'd like to arrange an alumni reunion for contemporaries or classmates, the Alumni Relations Team is keen to help.

In our conversation with Nic Katona and his team (see page 24), we were pleased to discover that help with reunions is one of the things that they now offer. Nic explained:

"One of the key pieces that Alumni Relations has worked on is offering a more robust reunion opportunity for classes. The reunion classes still need to do a lot of the heavy lifting as far as the organising and all of that, but College has put together a pretty good 'how-to' kit. And they're able to send that out to everybody. 'Okay if you're interested in having a reunion, here's the things you need to think about, here's what College can provide, here's where we come alongside of you.' So it will look simple to the alumni – we hope it'll look simple to the alumni! We know there's a lot of back-end work that the alumni will never see, or maybe appreciate (you know, 'why hasn't this happened sooner'), but what we're really trying to get alumni groups to focus on is: re-unite whenever you want to. We would prefer you re-unite on Alumni Weekend, because there's a lot of stuff going on at Imperial, it's a perfect time to just come and see, it's brilliant; if we can try to get you to do it at that time, great, but if not, that's fine – and here is just a pack, we ship it out to you. For the organiser, here's how we can help, here's what we need you to do, etc. And even better if there's an additional step of 'send us a photo of your reunion, send us some blurb', and we'll share it both with Alumni Relations so they can promote it, but also start sharing it with everyone, via Imperial ENGINEER.

"The *Plan Your Own Reunion* page on the Imperial website explains that if you're interested in doing reunions you should get in touch with one of our colleagues in Alumni Relations (there's an email link on the page). My colleague collects some basic preliminary information, then sends out a physical pack of 'here's what you need to do, here's what we're able to facilitate etc.', and then if they want to come on board for the reunion activity, we work with them along the way. Then, a week before the actual event, we send them another pack which has balloons and badges and bunting and so on."

So, if you're interested in organising a class reunion, what sort of help can the Alumni Relations team provide?

- Advice about finding the best accommodation, or an expert Imperial contact to help organise your College venue or catering

requirements.

- They can let you know if your proposed reunion clashes with other important College dates or if there are other alumni events you may be able to combine with.
- When you're trying to find old friends, they can help by searching their database of 190,000 alumni. They can't give out contact details, but can provide you with the names of all the alumni for whom they have contact details – and then get in touch with them on your behalf, to gauge their level of interest, and also seek their thoughts regarding the type of event and location. Then ask them to respond to you directly.
- They can promote your reunion, such as a listing it in Imperial's online event calendar.

Plan Your Own Reunion page:
bit.ly/IE27-PlanReunion

Arranging your reunion is just one option on the *Alumni Volunteer* page of the Imperial website.

"We're starting to build up alumni volunteering opportunities, because a lot of alumni want to give back time, etc. It's something that we're mindful of, it's something that we're needing to coalesce the different entities of Imperial together, but we're starting. The Alumni Volunteer page gives some high-levels of ways to do that, such as the Alumni Mentoring Scheme, which was featured in Imperial ENGINEER when it was launched. There are the institutional opportunities that my colleagues in Alumni Relations do, across the faculties.

"There are bespoke opportunities that my team tries to offer as we get to know individuals. Finding out what their interests are, and how does that map in, and does that meet a strategic need of various departments or the faculty as a whole etc. So we're coming at it from two approaches, the folks that just want to slot into something existing and those folks who... their time may be limited, they may have a narrow focus on something, you know, they may be interested in diving really deep with us both from a time, a talent and a treasure component, then we kind of step in and say 'maybe a bespoke opportunity is appropriate, what does that look like, how can we facilitate it and move it forward?'"

If you're interested in volunteering or mentoring, check out the Alumni Volunteer page:

bit.ly/IE27-Volunteer

DIARY

Wed, 1 Nov 2017 Dept. of Mech. Eng.

Sir Hugh Ford Distinguished Lecture: *Adventures in Glass*, David Cormie, Arup
17:00-19:30, Lecture Theatre 200, City & Guilds Building, Sth Ken Campus
Open to all

Fri, 3 Nov 2017 UAE alumni

Informal barbecue in Dubai
Details and to register: bit.ly/IE27-Dubai

Sun, 5 Nov 2017 CGCU Team Bo

London-Brighton Veteran Car Rally
Starts Hyde Park at 7am, ends Madeira Drive Brighton (via A3, A24, A23)

Tues, 7 Nov 2017 Alumni reception in Paris

Hosted by President Alice P Gast
Empowering next generation brain machine interfaces, Dr Tim Constantinou (Dept of E & E Eng.)
Rewiring wounds to heal, Dr Ben Almqvist (Dept of Bioengineering)
Using healthcare data to track transmission and predict AMR infection, Dr Céire Costelloe (Dept of Medicine)
18:30-21:30, Pierre & Marie Curie University, Paris
Details: bit.ly/IE27-Paris

Tues, 7 Nov 2017 Friends of Imperial

Why we remember some things and forget others, Dr Claudia Clopath, Head of the Computational Neuroscience Laboratory, Lecturer in Bio Engineering
19:00 - details and to book:
bit.ly/IE27-Clopath

8-16 Nov 2017

I, Science An exhibition of the artworks created for Imperial College's *I, SCIENCE* magazines 2016/2017
09:00-21:00, Blyth Gallery, Level 5
Sherfield Building, Sth Ken Campus
Open to all

Wed, 15 Nov 2017 Inst. for Sec. Sci. and Tech.

2017 Vincent Briscoe Lecture: *Big Data needs Big Ideas*, Professor Bill Durodié, University of Bath
17:30-18:30, Sir Alexander Fleming Building, Sth Ken Campus
Free, please book at: bit.ly/IE27-BigData

Thurs, 16 Nov 2017 CGCA Jo'burg lunch

Baron & Quail, Woodmead, Johannesburg, SA
Contact Richard Gundersen for details
Gundersen@yebo.co.za

Mon, 20 Nov 2017 Design Engineering

Collaborating with Technology Start-ups, Graham Brett, therefore consultants
18:00-19:00, Skempton LT 201, Sth Ken Campus
Free, must book place in advance:
bit.ly/IE27-Brett

Mon, 20 Nov 2017

BCS Roger Needham lecture 2017
Many-core programming: How to go really fast without crashing, Dr Alastair Donaldson, Imperial College, London
18:00-21:30, The Royal Society, 6-9 Carlton House Terrace
bit.ly/IE27-Needham

Tues, 21 Nov 2017 Centre for Blast Injury Studies

2017 annual networking and research update event: *Care across the Continuum*, from *Point-of-injury to Recovery*
09:00-19:00, The Great Hall
Open to all, register in advance at:
bit.ly/IE27-CBIS

Tues, 21 Nov 2017 Dept. of Life Sciences

How Science Got Women Wrong, Angela Saini, Science journalist
12:30-13:30, SAF Building G16
Open to visitors, please register at:
bit.ly/IE27-Saini

Wed, 22 Nov 2017 Montreal alumni

First alumni social in Montreal
18:00, Kampai Garden, Montreal
Details: bit.ly/IE27-Montreal

Fri, 24th Nov 2017 RSM

Annual Dinner, 7pm-11pm
Rembrandt Hotel, Sth Ken.
Booking form enclosed.

Sat, 25th Nov 2017 CGCA

'5 & 10' Reunion Lunch
12:30 for 13:00, Queens Tower Room C, Sheffield Building
Booking form enclosed

Wed, 29 Nov 2017 Dept. of Civil and Env. Eng.

Research Showcase
12:30-19:00, Skempton Building
Open to all, please register at
bit.ly/IE27-CivShowcase

Tues, 5 Dec 2017 Friends of Imperial

Asteroid impact: life after death, Professor Joanna Morgan, Dept of Earth Sci. and Eng.
19:00 - Details and to book:
bit.ly/IE27-Morgan

Wed, 6 Dec 2017 Dept. of Bioengineering

Inaugural Lecture: "*Non-linear Low-power Microelectronics for and from Biology: A Log Story*", Professor Manos Drakakis
Details (tbd): bit.ly/IE-ImperialEvents

Mon, 11 Dec 2017

College Christmas Carol Concert with Imperial College Chamber Choir
18:00, Holy Trinity Church, Prince Consort Rd. Followed by drinks and mince pies. All welcome, details:
bit.ly/IE27-Carols

Wed, 13 Dec 2017 Dept. of Earth Sci. & Eng.

Inaugural Lecture: Professor Stephen Neethling
Details (tbd): bit.ly/IE-ImperialEvents

Thurs, 14 Dec 2017 Alumni reception in Dubai

18:30-21:30, The Oberoi, Al A'amal Street, Business Bay, Dubai
Details: bit.ly/IE27-ReceptionUAE

Thurs, 15 Feb 2018 CGCA Jo'burg lunch

Baron & Quail, Woodmead, Johannesburg, SA
Contact Richard Gundersen for details
Gundersen@yebo.co.za

Fri, 23 Feb 2018 CGCA

Annual Dinner
Principal speaker: Nigel Brandon OBE
FREng
18.45 Ironmongers' Hall, Barbican
Booking form enclosed

Sat-Sun, 28-29 Apr 2018

Imperial Festival / Alumni Weekend

An up-to-date calendar of events of interest to CGCA and RSM members is always available on the CGCA and RSM websites. Imperial College maintains a calendar of college events at bit.ly/IE-ImperialEvents and the Friends of Imperial regularly organise events of interest to alumni (see bit.ly/IE-FOI)

For more information follow links, or see page 2 for contact details

Bastion of traditional mining engineering training



Prof. TIM SHAW (Staff 1980-2017, Emeritus Professor of Mining Engineering at Imperial College)

Prof. Shaw was appointed to the Chair in Mining Engineering at the Royal School of Mines in 1980. Prior to that he held an academic appointment at the Virginia Polytechnic Institute. He entered the academic environment after a successful career in the South African mining industry where he reached the level of Chief Consulting Engineer with the Johannesburg Consolidated Investment Company. He had extensive experience as a technical consultant and company director and held honorary doctorates from two Central European Universities.

Tim was born into a mining family and spent part of his school days at the Consolidated Murchison gold-antimony mine in South Africa, where his father was General Manager. Tim was educated at Bishops Diocesan College in Cape Town before going on to study mining engineering at the University of the Witwatersrand, where he met his future wife Tuulike through their shared love of music. He then joined Johannesburg Consolidated Investment Co. Ltd. He was given study leave by JCI to complete an MSc in mineral exploration at McGill in Montreal, Canada.

The traditional training in JCI's underground Witwatersrand gold mines gave Tim a detailed understanding of the practical aspects of mining. This also left him not only with a wonderful ability to communicate with all levels in the hierarchical structure of the South African mining industry, but also a legacy of collateral damage to his hearing. Regardless of the proximity of rock drills and blasting operations, ear protection was not considered necessary.

Tim's rapid rise within JCI gave him eventual overall technical responsibility for their large

gold, platinum, coal and antimony operations (including Cons Murch) as Chief Consulting Engineer. It was from this elevated appointment and poised to reach the top position in JCI that he and Tuulike decided that their young family would have a brighter future outside South Africa.

Tuulike's family was originally from Estonia and the consequences of political uncertainty on their lives was perhaps a driver. This is how Tim found himself as a Professor at the Virginia Polytechnic Institute in the mid-1970s and essentially having to start a completely new career.

After the death of Robert Pryor in 1979 the Chair of Mining Engineering at the Royal School of Mines fell vacant and Imperial College were able to offer the appointment to Tim so he and his family made their next big, but last, move.

Tim went on to act as a bastion of traditional mining engineering training at Imperial College. He also served a period as Dean of the Royal School of Mines which gave him the confidence to continue to use the crest on business cards notwithstanding later official disapproval. The guidance was that only the approved Imperial College London font be used under the re-branding and re-organisation that was implemented after his retirement in 2001. He was delighted when the use of the RSM crest was subsequently reinstated and the building again became an institution not just an address.

The slow demise of the undergraduate mining engineering degree at the RSM was due to society's ambivalence towards mining, not Tim's commitment. He launched the European Mining degree with several institutions on the Continent, including in Delft and Aachen. This legacy continues as the Joint Master European Mining, Minerals and Environmental Program.

He contributed to the teaching of MSc in Metals and Energy Finance students together with College's related continuing professional development programme. He demonstrated time and again that the theoretical relationship between mining finance and technical risk I taught was simply re-visiting real scenarios that he had been involved in when with JCI. When it came to the transition from technical and financial to business leadership roles at a board level, his extensive experience as a company director brought in the importance of sound decision making in value creation. Tim could also take a complex case history and break it down into its

basic elements and then illustrate the points from a vast store of apposite anecdotes.

Right up to his last month, we were delivering team teaching to postgraduate students and he was scheduled to deliver a continuing professional development course with me in July. He provided direct support for three MSc dissertations last summer.

Tim understood the need not to rest on his laurels and always kept himself academically and professionally up to date. He attended MINExpo 2016 in Las Vegas as part of the meeting of the Society of Mining Professors of which he was a founding member. The visit to America included the usual mine visits. He was constantly updating his teaching slides and incorporating current technical developments from personal observation.

Tim's knowledge of information technology and the application of computer and operations research in the minerals industry spanned the period from his time as a young engineer with JCI (when he set up their first mainframe) through to the modern age of the Internet. He was always harvesting the very latest in audio-visual material for his teaching, putting considerable strain on the processing resources of anything but a top-of-the-range laptop. Yet he also became fascinated with the archaeology of ancient mining through working with academics at Tel Aviv University.

He secured numerous research grants in the field of dimension stone and non-explosive techniques in mining. His academic achievements were recognised by the award of two honorary doctorates.

Tuulike's death in 2009 hit Tim hard and his screen saver was a picture of her which was projected at the start of every lecture he gave. He was never maudlin about her passing though – she was simply part of his life past and present and his annual presence at Glyndebourne was a tradition he continued to observe on her behalf.

It was invaluable working with him on the many shared professional assignments we took on as he was never happier than when undertaking a site visit – the more remote and challenging the better. He was quite miffed that his family holiday in Botswana last month clashed with my request that he carry out a site visit for me – in Peru. In offering some comfort to him that the mine was at 5,000 metres and perhaps it would not be prudent for him to go up to that altitude I got a

dusty response. He pointed out that he was brought up on the Highveld and if Grasberg at 4,000 metres left him unaffected then Peruvian mines would not be a problem.

It was in Botswana that he suffered a stroke and died, in Johannesburg on 21 April, at the age of 82. A transient ischaemic attack he had had three years ago might have been a warning but if so he did not pay it much heed.

That reflected the essence of the man – a thirst and an enthusiasm for life. While I consciously attempted to capture Tim's fund of knowledge and experience in a new e-Learning course we have only just launched on EduMine, there will be no substitute for having him present in the lecture room. He will be sorely missed but his legacy will continue through the many students he taught.

Dennis Buchanan
Emeritus Professor of Mining Geology, RSM

Highly respected engineer

BARRY WOOTON STAYNES (Civ Eng 1954-55) PhD, DIC, Eur Ing, CEng, FICE, FStructE

Barry was born 18 January 1934.

He became an internationally recognised expert in the field of specialist concrete, and a highly respected Civil and Structural Engineer.

He was a modest man but his professional credentials were anything but modest – he was an enthusiast with a quiet but keenly competitive spirit.

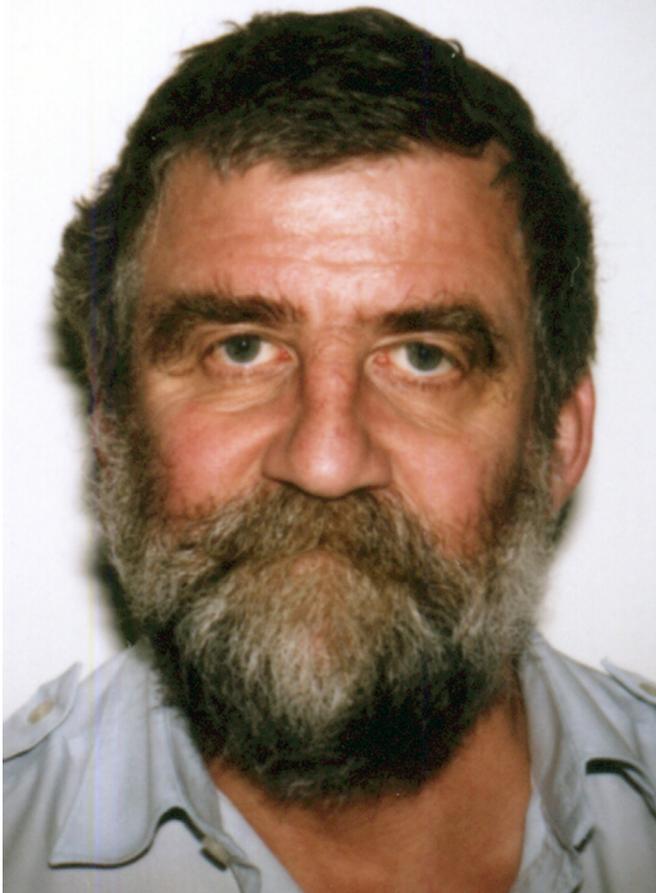
He worked in education, rising to become Director of the Civil Engineering Department at Brighton Polytechnic, where he was involved in organising international conferences on concrete, including some on the use of polymers in concrete.

In the early 1990s, Barry left education to become an independent consultant.

Barry enjoyed music, attending numerous shows, and sport – cricket, rugby and golf. He was a man who accomplished much, had the deep respect of his colleagues and friends and enjoyed life to the full.

A kind, gentle and a devoted husband, Barry died peacefully at home on 12 April, 2017, at the age of 83. He will be sadly missed by his wife, Sandra, daughters Caroline and Rachel and all who knew him.

“A colossus...and a man of integrity”



Dr. TONY FRANK MASON (Metallurgy 1965-71)

Tony was born in 1947 in Oxford. After school, he went to the Royal School of Mines, to study metallurgy.

After completing his honours degree in Engineering, he stayed on at the RSM, joining the Hydrometallurgy Research group to study for a PhD under Dr A R Burkin.

Professor John Monhemius remembers Tony from this time, first as a lecturer in the undergraduate years and later as a colleague in the Research Group. He interacted with Tony in the laboratories and daily research group morning coffee sessions, which were very social. He remembers Tony as very much an RSM man having spent 6 or 7 years at the place, during his UG and PG studies. Tony was a renowned member of the Chaps Club, which is at the heart of the RSM worldwide network.

On leaving the RSM, Tony joined Johannesburg Consolidated Investment Company (JCI) in South Africa and worked in various of their operations in South Africa and in what was then South West Africa and is now Namibia. It was here that he met Sylvia, whom he later married. The couple settled in Randfontein, South Africa.

After six years with JCI, Tony joined Mitchell Cotts International

Projects and stayed with them for seven years.

With these years of experience behind him, Tony started his own consulting company, Mineral Processors, based for 12 years in Johannesburg before he emigrated to Western Australia and set up business in Perth.

Tony had found his niche, namely dense media separation. But that did not stop him applying his depth of knowledge to other areas of mineral processing as well.

Tony's contribution to Mineral Processing and life in general is best summed up by comments made by those who knew him.

Professor Tim Napier-Munn says: "I was always impressed not only by his knowhow, but also the energy and enthusiasm with which he shared it. I'm glad I was able to have a technical exchange with him even right to the end".

Will Blair and Dave Willets say: "Tony's achievements and experience worldwide in the mineral processing field were vast. He was a colossus in his own right and we will remember him specifically as one of the last few world experts in dense media drum technology. His technical knowledge covering a range of disciplines was huge and he was a man of integrity. Tony was quite partial to the amber liquid –

particularly the German varieties!"

They summarise Tony as follows: "One of a kind...not afraid to speak his mind."

"Didn't suffer fools lightly and he met quite a few during his career – both corporate and otherwise!"

"Always tested the boundaries and was not afraid to go against the herd mentality."

"A workaholic."

"Didn't hold the view that 'clothes maketh the man' and grew the bushiest beard in WA."

"Had a lifelong partner in Sylvia."

Nic Lottering (Jr) respected Tony for intellect, humour and low tolerance of idiocy. His father always tells a story of how people flocked around Tony when he had something to say, as it was always abundantly clear that he knew what he was talking about and you could only learn from him.

"He was a true stalwart of his time and I believe a huge loss to engineering, common sense and intelligence and in fact to mankind itself".

Adam Johnston says:

"When I was fresh out of school and of little experience, he showed me how to use science and thinking to solve problems. Tony had a tonne of operating experience, but still used his calculations and broad knowledge of science to think things through before jumping in.

"Tony loved travelling, fixing mineral processing plants and drinking beer. He loved sharing his experiences and was a great teacher. If he could spend half the standard approach and get the same results he was happy. He was proud of working with his wife and supporting her with all her accomplishments."

These sentiments do justice to a true Minesman, both intellectually and as a personality.

Tony's support of RSMA activities and the Chaps Club, of which he was President during his post-graduate years, continued throughout his life. Winter Braais – the South African version of a barbecue, with a variety of animals on a spit like lamb, springbok, wild pig or ostrich fillets – held by Tony and Sylvia at their house in Kelvin, Sandton, are well remembered. Those who have spent time in South Africa, will have enjoyed the RSMA Summer Sundowner parties hosted by Tony and Sylvia.

Tony was always to be found at the bar in Kelvin House in Johannesburg and later at the Celtic Club in West Perth on Fridays, always with the Chaps Tie.

Tony and Sylvia were made for each other. They ran Mineral Processors in Perth as a great team.

His departure is a loss to the industry and many will sorely miss him.

Fond memories

HENRY JAMES SAMUEL MASON (Elec Eng 1935-37, 37-38)

Henry was born on 24 November, 1914.

He always looked back with affection on his College days, having gone up to what was then City and Guilds in September 1935.

Whilst at Imperial, he lodged with a Mrs. Greening who lived on Brixton Hill. Henry remembered:

"She provided all the meals I wanted. I stayed there during term time for the three years I was at College and cannot speak too highly of the way I was looked after. Not only did I have a bedroom, but a fire was lighted in another room where I retired each night to study. And all that for £1 7s 6d, which in modern currency is £1.37½!"

Getting to the College by public transport was complicated, so Henry soon bought a bicycle – and nearly missed one of his finals examinations when a tyre burst!

"Naturally, as the subject was engineering there was quite a lot of lab work as well as lectures and tutorial periods. Professor Fortesque lectured on electrical engineering theory. Usually a one-hour lecture was followed by a two-hour period of tutorial work where we worked on questions and called in a tutor to help when we got stuck. Lab reports had to be prepared and this was where a lot of evening time was spent."

"At the end of each year there were examinations. Unlike the present day system all the exams were done in a week, usually two a day; three hours each, one morning and one afternoon."

During his time at Imperial, Henry became involved in athletics. He also joined the College Dramatic Society, appearing as a policeman in J.B.Priestley's 'Bees on the Boat Deck'.

He recalled his graduation:

"On the 10th May, 1939, I hired a cap, hood and gown, and with hundreds of others assembled in the Albert Hall to have my degree conferred on me. Now I was H.J.S.Mason BSc,ACGI, DIC."

After graduation, Henry worked for Post Office Telephones throughout his career.

While playing tennis at Banbury, Henry met his future wife. They were married in 1943, and had two sons.

Sadly, Henry's wife died in 1990, at the age of only 72, while Henry himself lived on to the age of 101½, dying of old age at home, looking out at the garden, on a beautiful summer's day: 3 July, 2016.

Work hard, play hard – “Work is happiness”

CYRIL JEWITT (Elec Eng 1949-52)

Cyril Jewitt was born in Etherly Dene, near Bishop Auckland, on 18th August 1929, the second child of Matthew and Edith Jewitt.

Although his was not the most affluent start in life, he had good parents and a mother, determined to have the best for her children, who sent him to what she believed to be a better school than the local village school. And there, at Cockton Hill Primary, began Cyril's lifelong love of learning.

After passing his 11+, he moved on to King James Grammar School in Bishop Auckland where he threw himself into everything both academically and in sports, in particular football, which remained very important to him throughout his life. He was the living embodiment of the phrase 'work hard, play hard'.

His characteristic determination and academic ability, won him a place at Imperial College London, straight from his National Service in Hamburg. He had applied while at school but had not been accepted.

Undeterred, he applied again from Germany. On being turned down once more he wrote a "letter of protest" and received an invitation for an interview on the following Monday. Cyril managed to get compassionate leave for seven days, and arrived for the interview just 10 minutes ahead of time. His endeavours paid off; he received a letter of acceptance the very next day.

Cyril looked back on his school and higher education with pride and fondness. Not so long ago, when one of his grandchildren was considering an application to Imperial, Cyril explained to him that he would be "worked hard there". From a man whose mantra was "work is happiness" this was a commendation not a warning.

After completing his degree, Cyril joined English Electric as a graduate apprentice in Bradford, spending two years on the shop floor working on every aspect of electric and diesel locomotives. This was followed by two years in the Design Department, after which he

moved to Sales and Contracts. In addition, Cyril taught HNC students at Bradford Technical College two nights a week.

From Bradford, Cyril's career took him to GEC in Birmingham, then five more years with English Electric, during which he spent some time working overseas, mainly on the Indian sub-continent. His final move was back to the North East to work for NEI Parsons in Byker.

Cyril enjoyed a long and busy retirement with June (née Burrows) a student from King's College of Household and Social Science (KCHSS) whom he met at a Students' Union dance just behind the Royal Albert Hall.

Continuing a lifelong drive to keep both brain and body active, his post-retirement pursuits included badminton, sequence dancing, Sunderland AFC, and genealogy. Additionally, Cyril acted as a lay member of a Military Pensions Tribunal Board, a role to which he applied himself with his characteristic commitment and dedication.

Employing his highly logical brain and drawing on his engineering training, Cyril brought a forensic detail to his genealogical investigations.

In the days before the Internet and online records, he taught himself how to read and transcribe parish records and other historic documents, spending every Wednesday in Durham County Records Office. He also made many trips elsewhere in the pursuit of particular pieces of information as he strove to find every Jewitt in the county.

In time, Cyril managed to trace the family directly back to the 17th century and from here he widened the search, to make the family tree not only long but very broad.

But underpinning all of this activity was his own immediate family. Cyril was absolutely devoted to June, his four children and eight grandchildren, who greatly miss his warmth, humour, strength and support.

Cyril died on 31 May, 2016 at the age of 86.



Two careers: engineering and local government

JOHN LESLIE WILSON (CTEC 1960-65)

W J McAuley recalls:

John and I were contemporaries in Chem Eng at the debut of the Swinging Sixties. John was a solid Yorkshireman of great good nature who, like the rest of us, took studies seriously but not too much so.

The only time I recall him becoming experimental was when he got himself a perm (common now but rare then) and turning up for lectures sporting this triumph of the coiffeur's art. This prompted unseemly derision with one of our number shouting "who's taking you out tonight, John?"

Following graduation, John returned to Leeds where he married his school sweetheart, Lesley, and settled into his career. After a couple of years they moved to Ferndown in Dorset where John joined the family's motor business. He remained there for the rest of his professional life.

It was in retirement, however that his second career blossomed.

He was elected to Dorset County

Council in 2001 as a Conservative member for the Ferndown division. He served in a number of roles including chairman of the Corporate Services Overview/Policy Development Committee between 2003 and 2007. He was elected as vice-chairman of the County Council in 2005 and became chairman in 2007. He chaired the full Council and represented the authority at civic and ceremonial functions.

John was active in several other civic and social organisations. He was a member of East Dorset District Council and was previously a Ferndown Town Councillor.

In addition, he was also a member of the Dorset Fire Authority, a governor of Ferndown Upper School and an active member of the Lions Club.

John stood down as County Council chairman in April 2016 for health reasons but remained a county councillor until his death.

John died on 20 June, 2016. He is survived by his wife, Lesley and their daughter, Dianne.

From boating novice to elite rower

ANDREW (ANDY) HILL (Chem Eng 1969-72, MSc 1972-73)

Andy was born on 18 February, 1951. Raised in Sheffield, he came to Imperial in 1969 to study Chemical Engineering.

At the Freshers' Fair he joined the Boat Club as a complete novice. A natural leader, he was soon appointed crew leader in his first boat. By his third year he had progressed to the 1st VIII and Vice-Captain of the Club. Successfully passing his exams, Andy stayed on in Chemical Engineering to take a

MSc in Nuclear Science and also to become Captain of the Boat Club. At the end of his university days, he had successfully completed his studies, risen to elite status in rowing and had represented Imperial three times at Henley Royal Regatta.

His first employment was with DuPont in Northern Ireland during very troubled times there. In 1975, he returned to London to marry Shirley, whom he had met through rowing. He joined Scientific Design London and was transferred to Scientific Design New York shortly

after, where he was based for five years. Various projects led to periods living in Taiwan, Brazil, India and East Germany. He returned to the UK to work initially for Davy Ltd, then Engelhard Industries and Courtaulds.

His next position was for 12 years as MD of Atraverda, a start-up company developing new batteries, amongst other technologies. He followed that with 9 years as MD of Novacel, developing surface protection coatings.

After university, Andy continued

to row, with Kingston, Thames, Ross-on-Wye, Nottingham and finally Loughborough Boat Clubs.

It was on 17 September, 2016, following a race at Milton Keynes for Loughborough Boat Club that Andy suffered a heart attack, collapsed and passed away.

Andy was a member of Imperial College Masonic Lodge and Nottingham University Lodge for many years.

He leaves behind Shirley, his son Jonathan and daughter Jennifer who miss him greatly, as do so many.

A Life in Steel

ALAN PATRICK (Metallurgy 1948-52)

Alan Walter Patrick, was born in the Midlands, at West Bromwich on 25 March, 1927, the only son of Walter Patrick, a book binder. He had one sister, 4 years his junior.

On completing his secondary schooling at West Bromwich Grammar School, he was called up for National Service in the Army, just as the war was ending.

In 1948, Alan went to the Royal School of Mines to take the BSc Metallurgy course. He was awarded the Bessemer medal in 1952 for jointly topping (with Roy Barleggs)

the First Class Honours list of Metallurgy Graduates.

At a dance in Chelsea in the early 50's, he had met the love of his life, a very attractive, cultured and talented young woman, Rosemary Warren.

After graduation, Alan stayed in London, joining Guest Keen Nettlefold, to work in their galvanised steel division (John Lysaght Ltd), becoming a technical specialist in the application and use of galvanised iron, especially corrugated iron. GKN became part of the nationalised British Steel Corporation in 1967.

He visited the GKN subsidiary, John Lysaght Australia in the mid-60s and travelled extensively over the next twenty years promoting the use of galvanised iron, par-

ticularly in Eastern Europe, behind the Iron Curtain.

Alan returned to studying for his Masters in 1970 and later continued part-time employment as a lecturer for agencies such as Lloyds Register of Shipping on steel welding technology related to ship construction.

All his life, Alan was keen to keep fit. He used to swim a mile before work when he was in London, played badminton until he was 80 and walked to Eastham Ferry every day for as long as he was fit enough. As a true Midlander, he continued to follow the ups and downs of West Bromwich Albion.

He was an avid reader and had an extensive library. One surprising idiosyncrasy was his absolute



refusal to become computer literate. Instead, he persisted with hand written letters in an almost indecipherable scrawl.

Following his retirement, Alan and Rosemary moved to Bromborough, Merseyside in 1988. They had no family. Sadly, Rosemary passed away just 12 months ago.

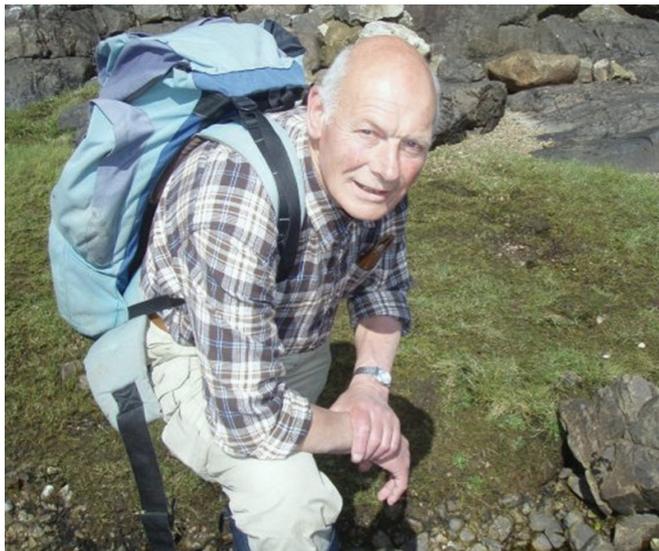
Alan died on 23 May, 2017.



Six of the twelve Metallurgy graduates of 1952, at the RSM Centennial Ball in 1951.

Standing, from left to right, are Bres Barry, Bas Pile, Roy Barleggs, Charlie Eastéal, Alan Patrick and Ron Butler

A legendary and inspirational teacher



Dr. PAUL GARRARD (Geology 1957-60, 65-68, Staff)

In the late spring of this year, Paul Garrard died at the age of 79 after a tragic fall whilst walking his pet dog.

Paul will be remembered by many staff and students as a dedicated and talented teacher who helped ensure that graduates from the Royal School of Mines are the most capable in the world. Paul's legacy is the thousands of students that he taught who have gone on to shape the world.

Paul was an RSM man through and through. Prof. Dick Selley, an ex-head of department said of him "If Paul was a stick of rock you would find the letters 'RSM' embedded in it from end to end." Paul came from a working-class background and obtained a degree from the Royal School of Mines in Geology in 1960.

He went on to spend 5 years mapping the Precambrian basement in Rhodesia for the Geological Survey – a time where he perfected the mapping skills that would become legendary amongst students.

In 1965, Paul joined Anglo American Cu mines whilst at the same time working on his PhD at the RSM.

At beginning of the 1970s, Rex Davies, the then Prof. of Mining Geology offered Paul a position as a lecturer in Mining Geology. His specific role was to run the field work programme and in particular field mapping. He was the perfect man for the job.

Paul remained at Imperial for the next 30 years as lecturer then Senior Lecturer. During this time his gift for teaching and inspiring students became legendary. His valued contribution to teaching was recognised by the College when in 1995 the 'College Teaching Award for Geology' was bestowed upon him.

Paul will be remembered by most staff and students as a kind but demanding teacher, whose expectations were high and whose feedback and help was second to none. For example, one hapless student's cross section was well

on its way to a 10/10 mark, as it matched Garrard's own master tracing; however the student marked it 'carboniferous', the lower case sin resulted in a 6/10.

Students who were lucky enough to go on the Kinlochleven fieldtrip with Paul – a trip he ran for 25 years with John Cosgrove – will still have field notebooks in which each diagram and locality is adorned by helpful advice in red ink. They will remember his patient explanations and his habit of making folds, boudins and even entire mountain belts using his over-sized hands.

One student joked, "It took 30 million years for the Alps to form, but I saw Paul make them with his hands in 30 seconds".

Paul worked students hard and never saw why a little rain, even if 'falling' horizontally, should ruin a day of geology. The students knew that the weather would only end a day's fieldwork if Paul's pipe went out. In the harshest weather, students would watch the smouldering pipe for signs of an early return home,

only to be disappointed when he would turn it upside-down. He had a clever trick of packing his pipe so tightly with tobacco that he could turn the bowl upside down and continue to smoke in the rain during fieldwork!

Paul was a gentleman geologist, with pipe and flat cap, who was apparently carved from rock.

The commitment that Paul put into his teaching came from his love for Geology and of a job done right. Paul knew that the legacy and reputation of the Royal School of Mines is not just in scientific and engineering developments, but in the quality of its graduates and their impact on the world.

Away from Geology, Paul was a huge supporter of the students of the RSM in terms of general student wellbeing and was President of the RSM Rugby club for many years.

On his retirement, 10 years ago, Paul moved to Cornwall with his wife, Shelagh. He is survived by Shelagh and their sons, Mike and Ian, and will be greatly missed.



L to R – Dick Selley, Paul Garrard, John Cosgrove, The Bouncing Czech and Chris Halls taking a break from field work in Sidmouth.

Dick Selley

Recognition for the engineering profession

DENIS GRANTHAM MAXWELL (Materials 1937-40)

Denis was born on 14 February, 1919. He studied at Imperial, becoming a member of the RSMA.

In 1941, after graduating,

Denis served as a Pilot Officer in Spitfires of the RAF's 602 Squadron. Returning from a mission over northern France on 1 May, 1942, his squadron was attacked. Denis was shot down and captured, becoming

a P.O.W. in Stalag Luft III, in Poland.

From the late 1960s, Denis was involved in the development of the South African Council for Professional Engineers, formed after the SA government signalled its

official recognition of engineering as a self-governing profession. Denis served on councils, including the Professional Advisory Committee on Mining Engineering.

He died on 16 June, 2016.

Mining in Costa Rica

MICHAEL SEAWARD (Mining Geology 1963)

Mike was a member of the Chaps Club.

He spent much of his career at Rosario Dominicana's Pueblo Viejo mine until it closed in 1991 due to falling grades and metallurgical difficulties.

Retiring to San Jose, he occasionally consulted and developed a successful wine import business.

Mike died in September, in San Jose, Costa Rica.

He is survived by his wife Margaret, daughter Elizabeth, son Michael, and their families.

An addendum

Following publication of an obituary for DAVID HART McLELLAN (Chem Eng 1943-44, Elec Eng 1944-46) in IE26, Richard Deavin (Civ Eng, 1966-69) has written to add the following:

"In the late 60s/early 70s, Major Mac was the Imperial Rowers' Henley Coach, with a number of successes. I was fortunate enough

to be coached by him when I rowed in the IC eight in 1969 and greatly appreciated his encouragement and firm discipline.

We had some success in early heats but did not make it to the final. However, in other years around that time, IC chalked up some significant results."

